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L2 Learning Effort of Students Majoring in English Language and Literature

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Abstract

The present study aimed to explore the foreign language (L2) learning effort of students studying English language and literature. The research was designed as a descriptive cross-sectional survey that was administered to a total of 150 undergraduate students. The Foreign Language Learning Effort Scale (FLLES) was used to measure the effort levels of the participants and the research data were analyzed through both parametric and nonparametric statistical tests depending on the normality of population distribution for the FLLES and its subscales. The results revealed that the students often expended effort in their studies, and the dimension of effort with the highest frequency of exertion was the *procedural effort*. As regards the effects of the learner characteristics determined for the study, the students' age and perceived English language proficiency did not result in differences in their L2 learning effort levels whereas gender and year of study influenced the frequency of the exerted effort. Female students scored higher than their male peers did, and the L2 learning effort the student expended decreased as the years of study advanced, excluding that of the seniors who scored highest in overall FLLES and the subscales. The results are discussed and recommendations are provided for further research.

Keywords: effort, foreign language learning effort, EFL

İngiliz Dili ve Edebiyatı Öğrencilerinin Yabancı Dil Öğrenme Çabası

Öz

Bu çalışma, İngiliz Dili ve Edebiyatı bölümü öğrencilerinin yabancı dil öğrenme çabalarını araştırmayı amaçlamaktadır. Betimsel tarama deseninde gerçekleştirilen araştırmaya toplam 150 lisans öğrencisi katılmıştır. Araştırmaya katılan öğrencilerin yabancı dil öğrenme çabasını ölçmek için Yabancı Dil Öğrenme Çabası Ölçeği kullanılmıştır. Araştırma verilerinin analizi ölçek ve alt ölçekler için popülasyon dağılımının normalliği göz önünde bulundurularak parametrik ve parametrik olmayan testler ile gerçekleştirilmiştir. Veriler doğrultusunda, öğrencilerin dil öğrenme çabasını sıklıkla gösterdiği ve prosedürel çabanın en yüksek düzeyde gösterilen çaba olduğu sonucuna ulaşılmıştır. Belirlenen öğrenci özelliklerinin çaba üzerindeki etkisine bakıldığında, yaş ve algılanan yabancı dil düzeyinin anlamlı bir etkisi görülmezken cinsiyet ve eğitim yılı değişkenlerine göre öğrenci cevaplarında anlamlı farklılaşma olduğu tespit edilmiştir. Kız öğrencilerin çaba düzeyi erkek öğrencilere oranla daha yüksek bulunmuş; gösterilen dil öğrenme çabasının eğitim yılı ilerledikçe düştüğü, yalnızca son sınıf öğrencilerinin tüm öğrenci grupları arasında en yüksek çaba düzeyine sahip sınıf olduğu belirlenmiştir. Sonuçlar tartışılarak öneriler sunulmuştur.

Anahtar kelimeler: çaba, yabancı dil öğrenme çabası, İngilizce öğrenimi

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INTRODUCTION

Individual effort has been identified as one of the critical factors holding strong association with learning (Carbonaro, 2005) and making substantial contribution to the attainment of academic outcomes (Arratibel & Bueno-Alastuey, 2015; Young, 2011). Students expending higher effort and persistence in classroom tasks are identified with using motivational strategies in higher frequencies (Wolters, 1999). In foreign language (L2) learning context, successful language learners are characterized with acknowledging the necessity of effort in developing effective methods and approaches to learning (Yağcıoğlu, 2015). Student effort has been affiliated with active engagement (Carbonaro, 2005; Noels et al., 2018), and it is further asserted that strategic efforts are typically employed by effective language learners to make the necessary alterations in their learning environments and to enhance their language learning autonomy (Gao, 2010). Since learning effort is evaluated as an internal and controllable construct (Carbonaro, 2005), it is advocated that it should receive higher emphasis over other motivational agencies (Yeung, 2011).

It is quite noticeable in L2 learning literature that effort has commonly been approached as an output of learner traits such as motivation and attitude (Genç & Köksal, 2021; Özer, 2020), and it has been situated as one of the fundamental components of several theories in second language acquisition (SLA) research. According to the Attribution Theory (Weiner, 1985), for instance, effort is recognized as one of the dominant causal determinants credited for past achievements and failures. The Self-Efficacy Theory of Bandura (1977), as another example, discusses the amount of effort as one of the essential indicators of self-efficacy. The learners with higher self-efficacy exert greater effort to attain their learning goals by monitoring, directing and evaluating their own learning processes with higher self-satisfaction and self-worth (Bandura, 2001). Another theoretical approach to L2 learning that highlights effort as an important factor in success is the Goal Orientation Theory. According to the theory, mastery goal orientation, which may be described as the pursuit of knowledge acquisition in order to improve and master skills (Yeung et al., 2014), is grounded on the belief that effort brings success (Ames, 1992). Finally, yet equally importantly, Gardner's (1985) theory of L2 motivation involves effort as one of the fundamental indicators of L2 learning motivation (Dörnyei & Ushioda, 2011). Within the framework of the socio-educational model, Gardner (2006) identifies effort as one of the three major components of motivation, the other two being the desire to learn L2 and the attitudes towards learning L2. It is advocated that as learners become more motivated, they expend greater effort for the attainments of their learning goals (Gardner, 2006), and in turn, as they acknowledge the positive relationship between effort and learning outcomes, learners will have long-reaching motivation (Oxford & Shearin, 1994).

Learning effort has so far been conceptually elucidated in two works. In one of these works, Carbonaro (2005, p. 28) defines effort as "the amount of time and energy that students expend in meeting the formal academic requirements established by their teacher and/or school." He conceptualizes learner effort as a multifaceted construct and determines its dimensions as rule-oriented, procedural and intellectual effort. Rule-oriented effort stands for students' complying with the basic school and classroom regulations. Procedural effort refers to students' behaviors intended to meet the requirements of a specific class determined by the teacher. Lastly, intellectual effort is displayed when students are cognitively and intellectually engaged with learning. In another work focusing on learning effort as an independent construct, Bozick and Dempsey (2010, p. 40) define it more concisely as learner behaviors where cognitive and behavioral engagement is manifest. Based on their comprehensive literature review, they contend that effort should be evaluated on two terms: degree and specificity. Based on its degree, learner effort might be procedural or substantive. Procedural effort refers to compliance behaviors, such as following rules at school, behaving in class or submitting an assignment on time. Substantive effort, on the other hand, pertains to more sophisticated student actions such as leading project assignments or arranging extra time for examination preparation. The researchers also acknowledge a third measure of effort: noncompliance. As the name suggests, noncompliance refers to the lack of effort, as in not participating in classes or failing to submit assignments on time. As regards the specificity of effort, learner behaviors are identified as task-oriented or general achievement behaviors. Task-oriented effort is observed when the learner's focus is on a specific task or problem in a particular class while general achievement effort appertains to all endeavors exerted to succeed in school or in a specific class overall (Bozick & Dempsey, 2010).

Literature Review

Student effort has almost consistently been associated with higher academic performance (Carbonaro, 2005). Despite very few contradictory results (Patron & Lopez, 2011), research has commonly pinpointed a

positive relationship between learner effort and success. For instance, Kelly (2008), who aimed to determine the relationship between learning effort, achievement and grades, confirmed the hypothesis that the substantive engagement and active effort of students produced higher student grades. Adamuti-Trache and Sweet (2013) aimed to examine the effects of academic effort on the literacy scores of Canadian science students. The students' academic achievement was positively correlated with both their academic effort and their beliefs about the contributions of effort to their achievement. Examining the relationship between individual effort besides socio-economic background and motivation and student academic achievement in EFL learning, Arratibel and Bueno-Alastuey (2015) concluded that personal effort and motivation correlated more with student achievement than socio-economic background. Lastly, scrutinizing the influence of individual study effort on L2 learning performance in a digital language learning platform, namely Duolingo, Ersoy (2021) determined that effort increased the test scores of the students in that online setting.

In addition to the above-mentioned research measuring the actual effort-success relationship, student perceptions regarding the influence of effort on performance have also been subjected to academic scrutiny. Focusing on the success and failure attributions of tertiary-level Turkish EFL students, Genç (2016) concluded that effort was among the factors to which academic achievement was attributed. It was further determined as the most influential factor attributed to underachievement.

Other studies on learning effort in EFL context have been descriptive in nature. This is exemplified in the study of Özer (2020), who conducted a descriptive survey on the L2 learning effort levels of a group of students taking vocational English course. The study results indicated that the overall L2 effort level of the students was at a moderate-to-high level, and the students displayed moderate-to-high focal effort and procedural effort, moderate substantive effort, and very little non-compliance. The female students reported greater, though not significant, effort. In another descriptive study in a Turkish context of EFL learning, Genç and Köksal (2021) studied foreign language learning effort of digital natives, i.e. a recent term used to refer to those individuals born into the digital technology era and use technology efficiently, and the effects of new media and some learner characteristics on learner effort. Their results revealed high levels of EFL learning effort in general for more than half of the digital natives and significant effects of inclination towards EFL learning, perceived academic success, and the use of media tools and social media sites on effort.

EFL learning effort has also been researched in regard to its relationship with some learner traits and beliefs. Yetkin and Ekin (2018) explored the intended effort and L2 motivation levels of Turkish EFL students and measured the predicting effect of motivational tendencies on the intended effort for L2 learning. The results suggested that the students considered intended effort as the most significant factor in learning English language. Furthermore, the intended effort was mostly predicted by the L2 learning experiences, the ought-to L2 self (an L2 self-image intended to meet the expectations of the outer world) and the ideal L2 self (an idealized self-image competent in the target language with integrative intentions), respectively. Özer and Başarır (2020) examined the correlation between L2 learning effort, self-efficacy and perceived success of EFL learners and the mediator role of effort in self-efficacy and perceived success relationship. Their analysis results indicated that a significant correlation existed between all three constructs and that the L2 learning effort partly mediated the effect of self-efficacy on perceived success.

There still exists a paucity of scholarly work addressing learner effort theoretically in its own right (Bozick & Dempsey, 2010) and as obvious from the literature reviewed above, published empirical research available to date on learner effort in the context of EFL learning is insufficient despite its evidenced association with academic achievement. This paper examines a specific group of EFL learners, more specifically the English philology students, with the purpose of determining their learning effort levels besides the effects of some learner characteristics on learning effort. The study is significant as it aims to add to the limited body of work on L2 learning effort and inform the scope of further theoretical and empirical research as well as practice in EFL classrooms in English-major departments by providing a descriptive account of the subject. The study sought to answer the following questions:

1. What are the L2 learning effort levels of students majoring in English language and literature?
2. Does the students' L2 learning effort differ across the groups of gender, age, year of study and perceived English proficiency?

METHOD

Research Design

The present study was conducted in a quantitative survey design. Researchers prefer using quantitative surveys when they aim to generalize results from sample groups to larger populations to draw inferences regarding some characteristics, attitudes or behaviors of these populations (Creswell, 2014). In this study, a questionnaire survey was administered as it was highly cost-effective and time-saving for the researcher to obtain data from the target group of students in the given time.

Participants

The students majoring in English language and literature at a state university in Türkiye were selected as the population of the study. Total population sampling method, which refers to including all members of the target population in the data collection process, was considered to be appropriate for the scope of the research since the research population was not adequately extensive to select a sample group from it. Hence, the students from all years of study in the department were informed about the purpose and scope of the study besides anonymity and confidentiality matters, and were requested to participate in the survey. A total of 150 volunteer students provided responses to the survey. The descriptive results regarding the personal information of these students are provided in Table 1 below.

Table 1. Descriptive Results of Participant Information

		f	%
Gender	Female	108	72.0
	Male	38	25.3
	Missing	4	2.7
Age	18-22	118	78.7
	23 and above	30	20.0
	Missing	2	1.3
Year of Study	Preparatory	52	34.7
	Freshmen	33	22.0
	Sophomores	34	22.7
	Juniors	27	18.0
	Seniors	4	2.7
Perceived L2 proficiency	Low	19	12.7
	Intermediate	117	78.0
	High	13	8.7
	Missing	1	0.7
Total		150	100

As illustrated in Table 1, the female students (72.0 %) constituted almost two-thirds of the respondents while the male students were much fewer (25.3 %) in number. As for the students' ages, two groups were determined for analysis in the study: those between the ages of 18 and 22 were in the first group and those students at or over the age of 23 were in the second. The descriptive results showed that the students between the ages of 18-22 were in majority (78.7 %) whereas the students who were 23 years old or older were only one-fifth (20.0 %) of participants overall. As regards their years of study, the students were in five groups and the group with the highest number of participants was preparatory year (34.7 %) in the department, followed by the sophomores (22.7 %), the freshmen (22.0%) and the juniors (18.0 %), who had close participant members. The seniors (2.7 %), however, were quite few in number. As a matter of fact, the number of students studying at the final year in the department is only four in total. The students were also requested to state their perceptions regarding their English language proficiency. They were asked to choose from levels 1 to 6, but their responses were cumulated and evaluated in three levels as low, intermediate and high. The students who perceived themselves at intermediate level (78.0 %) were more than two-thirds of the total number. Those students finding their L2 proficiency level low (12.7 %) and high (8.7 %) were similarly much less in number.

Data Collection

The research data was collected through a questionnaire form consisting of two sections, the first interrogating personal information and the second presenting the Foreign Language Learning Effort Scale (FLLES) developed by Karabıyık and Mirici (2018). The personal information the students were asked to provide included their gender, age, year of study, perceived English proficiency and high school department (foreign language department or the others) as mentioned above. The FLLES was designed as a 5-point Likert-type scale comprising 34 items and four dimensions. The dimensions in the scale were determined as procedural effort (items 4, 10, and 16), substantive effort (items 1, 3, 5, 7, 9, 11, 13, and 15), focal effort (items 6, 12, and 17) and non-compliance (items 2, 8, 14). Procedural effort entails engagement in classroom-specific requirements such as joining in classroom tasks and completing assignments. Substantive effort connotes being actively involved in the language learning process. Focal effort, as the third dimension, comprises attentive learner behaviors in the L2 classroom. Lastly, non-compliance dimension encompasses behaviors impeding the effort to be displayed in L2 learning (Karabıyık & Mirici, 2018).

Data Analysis

The reliability of the scale was established with the internal consistency analysis ($\alpha = .85$) and test-retest reliability analysis ($r = .86$, $n = 64$, $p = 0.00$), and the validity was assured with exploratory and confirmatory factor analyses with satisfactory fit for the four-factor (60.77 % of total variance explained) model besides predictive validity analysis and convergent and discriminant validity analyses (Karabıyık & Mirici, 2018). For the present study, the Cronbach's alpha value for the scale was determined to be .83, indicating that it was a reliable data collection tool.

The research data was collected in the autumn semester of the 2022-2023 academic year upon research ethics committee approval. The data set was transferred to statistical analysis software. Firstly, negatively worded items were reverse-coded and the missing values were replaced with mean scores. This could be possible owing to the fact that the percentage of these values in total data set was lower than 2 % (Seçer, 2015). Initial analyses were carried out to determine the normality of distribution among the data. The normality test results are presented in Table 2.

Table 2. Results of the Tests of Normality

Scale /Subscale	N	Kolmogorov-Smirnov Results	Skewness	Kurtosis
L2 learning effort	150	.200	-.35	.25
Procedural effort	150	.000*	-1.00	1.66
Substantive effort	150	.000*	-.10	.09
Focal effort	150	.072	-.54	.00
Non-compliance	150	.000*	-.91	.05

*p<.05

In the evaluation of population distribution, normality was tested via Skewness and Kurtosis values and the results of Kolmogorov-Smirnov analysis. The acceptable Skewness and Kurtosis values were determined to be between +1.5 and -1.5 as suggested by Tabachnick and Fidell (2013). As Table 2 demonstrates, all values for the overall FLLES signified a normally distributed population. However, Kurtosis value for the procedural effort subscale was not within this range. As the Kolmogorov-Smirnov results also showed a departure from normality ($p<.05$), it was determined that population distribution for this subscale may not be normal. The Kolmogorov-Smirnov results for other two subscales, namely substantive effort and non-compliance, similarly displayed divergence from normality ($p<.05$). As a result, non-parametric inferential analyses were used in the study when the effects of the independent variables (gender, age, year of study, and perceived L2 proficiency) on responses to these subscales were tested.

Research Ethics

This study was undertaken cautiously with respect to research ethics. Research data were collected after the research ethics committee approval was granted and the participants were informed about the purpose and scope of the study and the voluntary and anonymous nature of the data collection process.

FINDINGS

The determination of English language and literature department students' foreign language learning effort levels was the primary purpose of the current research. With the purpose of answering the first research question, descriptive analyses were conducted to establish the mean, standard deviation, minimum and maximum values for the overall FLLES scale and the subscales. The results are disclosed in Table 3 below. The mean values at the interval of 1.00-1.80 represented the frequency of "never" whereas those between 1.81-2.60 were interpreted as "rarely"; 2.61-3.40 as "sometimes"; 3.41-4.20 as "often"; and 4.21-5.00 as "always".

Table 3. Results of Descriptive Analyses for FLLES and its Subscales

Scale /Subscale	N	Min	Max	$\bar{X}$	SD
L2 learning effort	150	2.12	5.00	3.86	.52
Procedural effort	150	1.00	5.00	4.16	.70
Substantive effort	150	1.50	5.00	3.56	.64
Focal effort	150	1.67	5.00	3.95	.70
Non-compliance	150	1.67	5.00	4.26	.77

According to the results depicted in Table 3, the overall L2 learning effort level of the students was in "often" interval ($\bar{X}$=3.86). As regards the effort sub-dimensions, the highest mean value was identified for the non-compliance ($\bar{X}$=4.26). As the item scores for this subscale were reverse coded during the calculation of the total scale, it has to be noted that the results should be reverse-interpreted in that the high mean score indicated very low levels of non-compliance, to be precise, standing for the "never" frequency. In other words, the students indeed reported that they hardly ever exhibited non-compliance behaviours. Another subscale with a high scoring was the procedural effort ($\bar{X}$=4.16). The students, according to self-reports, very frequently, almost always, exerted procedural effort in L2 learning. The other two dimensions of effort, focal and substantive, were also within the "often" interval, although with lower mean values ($\bar{X}$=3.95 and $\bar{X}$=3.56, respectively). Consequently, it was concluded that the students participating in the study reported that they frequently exerted effort to learn English as a foreign language.

With the aim of answering the second research question, the differences in the EFL students' L2 learning effort according to some learner variables were elaborated. The students' gender was the first variable tested with respect to its effects on responses. Independent samples t-test was used in the analyses of responses to overall FLLES and focal effort subscale, and Mann-Whitney U test was applied to the responses to procedural effort, substantive effort and non-compliance subscales.

Table 4. Independent samples t-test and Mann-Whitney U Results for Gender as a Variable

Scale /Subscale	Gender	N	$\bar{X}$	SD	t	p
L2 learning effort	Female	108	3.94	.46	3.04	.032*
	Male	38	3.64	.63		
Focal effort	Female	108	4.02	.64	2.63	.005**
	Male	38	3.73	.80		
			Mean rank	Sum of ranks	U	p
Substantive effort	Female	108	78.78	8508.00	1482.00	.011*
	Male	38	58.50	2223.00		
Procedural effort	Female	108	80.73	8719.00	1271.00	.000***
	Male	38	52.95	2012.00		
Non-compliance	Female	108	74.25	8019.50	1970.50	.708
	Male	38	71.36	2711.50		

*p<.05; **p<.01; ***p<.001

The findings showed that gender was a significant factor in the determination of the students' L2 learning effort both in general and in focal, substantive and procedural effort dimensions (p<.05). For all constructs, female students scored higher than their male peers, demonstrating higher L2 learning effort (Table 4). The only subscale for which the difference across genders was insignificant was the non-compliance, yet this subscale also received higher ranking from female students.

The students' age was another factor tested for its relation to their responses to FLLES. As the respondent ages were evaluated in two groups, Independent samples t-test and Mann-Whitney U were used as statistical analyses. The results are displayed in Table 5 below.

Table 5. Independent samples t-test and Mann-Whitney U Results for Age as a Variable

Scale /Subscale	Age	N	$\bar{X}$	SD	t	p
L2 learning effort	18-22	118	3.86	.50	-.21	.828
	23 & older	30	3.88	.60		
Focal effort	18-22	118	3.94	.69	-.46	.643
	23 & older	30	4.01	76		
			Mean rank	Sum of ranks	U	p
Substantive effort	18-22	118	76.83	9066.50	1552.50	.188
	23 & older	30	65.32	1959.50		
Procedural effort	18-22	118	71.11	8391.50	1370.50	.053
	23 & older	30	87.82	2634.50		
Non-compliance	18-22	118	72.66	8573.50	1552.50	.287
	23 & older	30	81.75	2452.50		

From Table 5 above, it can be concluded that the difference in the students' responses to FLLES and the subscales across age groups was insignificant ($p>.05$), indicating that age was not a noteworthy factor influencing the students' L2 learning effort.

Measuring the effect of the students' year of study in the department on their self-reported L2 learning effort was another purpose of the study. The students participating in the survey were from five different levels, the preparatory year included; and therefore, One-Way ANOVA and its nonparametric counterpart, Kruskal Wallis H were utilized in the determination of the significance of differences in student responses resulting from their years of study. Homogeneity of variance was confirmed for the One-Way ANOVA test ($p>.05$).

Table 6. One-Way ANOVA and Kruskal Wallis H Results for Year of Study as a Variable

Scale /Subscale	Year of Study	N	$\bar{X}$	SD	F	p
L2 learning effort	Prep	52	3.97	.53		
	1	33	3.80	.53		
	2	34	3.81	.41	3.41	.011*
	3	27	3.67	.54		
	4	4	4.52	.31		
Focal effort	Prep	52	3.96	.74		
	1	33	3.99	.66		
	2	34	3.87	.57	.54	.667
	3	27	3.91	.81		
	4	4	4.41	.78		
			Mean Rank		$\chi 2$	p
Substantive effort	Prep	52	92.21			
	1	33	77.09			
	2	34	62.82		28.80	.000**
	3	27	48.46			
	4	4	135.38			
Procedural effort	Prep	52	74.39			
	1	33	61.94			
	2	34	78.10		6.86	.143
	3	27	87.17			
	4	4	100.88			
Non-compliance	Prep	52	75.51			
	1	33	63.41			
	2	34	89.18		8.16	.086
	3	27	69.41			
	4	4	100.00			

*p<.05; **p<.001

The comparison of mean scores across groups indicated varying levels of significance in the relationship between L2 learning effort and its dimensions and year of study (Table 6). As regards the overall L2 learning effort, a significant difference ($p<.05$) was observed in the mean scores in favour of the senior students. The mean values of the other four groups displayed a partly negative year-effort relationship where L2 learning effort partially decreased (a very slight difference was observed between the rankings of sophomores and juniors) as the year of study advanced. On the subscale level, no significant difference was observed for procedural and focal effort and non-compliance behaviours whereas substantive effort levels were significantly different according to the year of study. In a similar vein with the results for general L2 learning effort, this dimension also received the highest ranking from the seniors whereas the scores of the other four groups of students were in a negative relation with year of study. In other words, substantive effort levels regressed as the years advanced when the scores of these four groups (preparatory year students, freshmen, sophomores and juniors) were considered.

The self-perceived proficiency in English language was another factor tested with respect to its influence on the participant students' responses to the scale. As L2 proficiency was evaluated at three levels (low, intermediate and high) in the study, One-Way ANOVA was applied to the overall FLLES and the focal effort subscale since they had normally distributed populations, whereas Kruskal Wallis H was adopted as the analysis of testing the relationship for the subscales with irregularly distributed populations. Homogeneity of variance was confirmed for the One-Way ANOVA test ($p>.05$). Table 7 below illustrates the analysis results

Table 7. One-Way ANOVA and Kruskal Wallis H Results for Perceived Proficiency as a Variable

Scale /Subscale	Perceived L2 proficiency	N	$\bar{X}$	SD	F	p
L2 learning effort	Low	19	3.74	.52		
	Intermediate	117	3.88	.50	.60	.547
	High	13	3.82	.74		
Focal effort	Low	19	4.03	.55		
	Intermediate	117	3.95	.70	.56	.568
	High	13	3.76	.90		
			Mean Rank		$\chi2$	p
Substantive effort	Low	19	69.92			
	Intermediate	117	75.12		.54	.762
	High	13	81.31			
Procedural effort	Low	19	59.74			
	Intermediate	117	77.38		2.81	.245
	High	13	75.85			
Non-compliance	Low	19	60.66			
	Intermediate	117	77.71		2.78	.248
	High	13	71.62			

The results revealed that the values for general effort and its dimensions showed slight and negligible differences across the groups of proficiency levels (Table 7). It was, therefore, concluded that the students' perceptions about their L2 levels did generate hardly any difference in the effort they exerted in learning English ($p>.05$).

To summarize, findings from this study enabled descriptive and inferential conclusions regarding the EFL learning effort of students of English language and literature at a state university in Türkiye. The descriptive findings revealed a moderate-to-high frequency of EFL learning effort. The inferential findings demonstrated significant differences for the variables of gender and year of study while age and perceived English proficiency did not produce any difference in student responses. Female students displayed higher levels of effort than their male counterparts did and as for the year of study, the seniors showed highest frequency of effort. The findings will be interpreted in the light of available research.

DISCUSSION & CONCLUSION

Effort has been recognized as a crucial indicator of favorable learner characteristics including higher motivation, self-efficacy beliefs and positive attitudes in the field of SLA, yet research on L2 learning effort has been mostly restricted to this subsidiary role, and little attention has been paid to characterize and describe it in its own right. It was not until recent years that learning effort was empirically investigated as an independent construct

(Ersoy, 2021; Genç & Köksal, 2021; Karabıyık & Mirici, 2018; Özer & Başarır, 2020). This study set out to explore the L2 learning effort of a group of tertiary-level EFL learners and the significance of some learner variables in determining the students' effort levels. The students participating in the study were enrolled in English language and literature program at a state university in the eastern region of Türkiye. Research data were gathered via the FLLES developed by Karabıyık and Mirici (2018). The students reported that they "often" (M=3.89) expended effort in their L2 studies. This may be evaluated as a satisfactory result. However, when the specific setting and the characteristics of the subject group in the study are taken into consideration, the result is below the expectations.

As an academic actively lecturing in the department, the researcher acknowledges that the majority of the students in the department had low language proficiency scores when they were placed in the department and the communicative competence of the students is not generally improved to the levels necessary for meeting the requirements of the department even after one-year preparatory program. The students commonly experience difficulties in comprehending the content of literature courses delivered with English medium instruction. It is therefore of utmost importance for these students to exert high, even extra effort to overcome their insufficiencies and augment their L2 skills as the significance of individual effort in developing academic and literacy skills has been established in previous research (Adamuti-Trache & Sweet, 2013; Arratibel & Bueno-Alastuey, 2015; Carbonaro, 2005; Ersoy, 2021; Kelly, 2008). Furthermore, substantive effort, which connotes the integrative, self-directed and therefore more sophisticated aspect of effort, received the lowest ranking whereas procedural effort, which is characterized with task-oriented behaviors, was reported to be exerted with the highest frequency. This result implies that the students more frequently approached to language learning as a task to be fulfilled than as a process to be internalized and accomplished with the attainment of learning outcomes. A follow-up research on the individual, social and/or contextual factors impeding the students' engagement and exertion of higher effort could provide an insight for attempts to escalate the L2 learning effort levels.

The study results also provided information regarding the effects of the students' gender, age, year of study and perceived L2 proficiency on their EFL learning effort. The results did not imply significant differences across age and perceived L2 proficiency groups. On the other hand, gender was found to be a significant factor in determining the amount of expended effort. Female students reported apparently higher L2 learning effort than the male students in the department. This result corroborates previous research. Kelly (2008) similarly found that girls outperformed boys with respect to the effort they exerted in their studies. Yeung (2011) also investigated student effort in schoolwork in Australian primary and secondary schools and found student effort to be higher for female students. Examining Canadian native and immigrant students' study efforts, Adamuti-Trache and Sweet (2013) also found that female students displayed higher study efforts when compared to male students, attributing more of their success to effort, and producing higher grades and higher literacy scores. In a Turkish EFL context, Yetkin and Ekin (2018) found significant differences in intended effort levels of secondary school students across gender groups in favor of female students. Similarly, Genç and Köksal (2021) reported that gender was one of the individual factors resulting in significant differences in the extent of EFL learning effort exerted by digital natives, and females were the group demonstrating greater effort. As previously mentioned in this paper, effort has been associated substantially with motivation in and positive attitudes towards L2 learning, and gender-related research in SLA has mostly pinpointed higher motivation (Ryan, 2009) and more positive attitudes (Gardner & Lambert, 1972; Ellis, 1994) for female foreign language learners. It is, therefore, possible to explain the higher effort levels for female students with the effects of such other closely-associated personal factors. Further gender-focused correlational studies taking effort as a separate construct might shed more light on this relationship.

The students' year of proficiency was another factor producing significant differences in the students' L2 learning effort levels. The senior students reported the highest L2 learning effort. It has to be noted here that the number of students at this grade was only four and that three of these students were international students coming from Ghana, an officially English-speaking country. The inequality in the number of group members and the potential difference in language learning motivation and many other characteristics of these students when compared to their Turkish peers makes it difficult to infer assertive conclusions. On the other hand, when the results from the other four groups of students were evaluated, a decrease was observed in advancing years of study. The preparatory year students displayed the highest level of effort whereas juniors showed effort in the lowest frequency. Several studies disclosed similar results. Yeung (2011) reported lower levels of effort from students from higher grades. Similarly, Yetkin and Ekin (2018) recorded a steady decrease in student effort in higher grades of school. This result may also be related to some extent to the students' motivation. As motivation is highly related with effort, so might be demotivation. Research has shown that demotivation in foreign language learning decreases as students advance to higher grades of education (Falout & Maruyama, 2004; Falout et al., 2009). The

determination and elimination of demotivating factors might contribute to the prevention of the grade-led decline in L2 learning effort. Specifically focusing the on demotivation and effort relationship with further research might provide more accurate and explicit implications regarding this argument.

Limitations

The present study bears some methodological limitations to be acknowledged. The most noteworthy of all is that the results of the study are based on student self-reports which hold the potential for response bias. Secondly, the conclusions drawn are limited to data from one single data collection tool, a quantitative survey. Further research might utilize from triangulated approaches. Lastly, the study results are delimited to a convenience sample in a particular context and they should not be considered generalizable.

Statements of Publication Ethics

The author declares obedience to the principles of publication ethics. An approval was granted for the present study by Iğdır University Research and Publication Ethics Committee with the document number E-37077861-900-87068 on December 14, 2022.

Researchers' Contribution Rate

The author as the single contributor of the research designed, conducted and reported the overall study.

Conflict of Interest

The author discloses no conflict of interest.

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Examination of ELT Lecturers' Digital Technology Integration Levels via SAMR Model during Emergency Remote Education

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Abstract

It is undeniable that humanity depends heavily on the effective application of technology in today's globalised and competitive world, and the field of language education is strongly impacted by the era of digitalisation, which facilitates interactive and transformative teaching environments on various language teaching platforms. Moreover, it is necessary to combat various pandemics and devastating natural disasters through technological advancements without falling behind the 21st century. The current century demands a higher level of awareness and practicality regarding technology facilitation, apart from higher-order skills. Considering this cognitive approach and awareness, the present study investigated the digital technology integration levels of the English Language Teaching lecturers during the COVID-19 pandemic emergency remote education conditions using Substitution, Augmentation, Modification, Redefinition (SAMR) Model. A correlational design was employed through the administration of a Likert-type questionnaire to 243 English Language Teaching lecturers at 20 universities geographically dispersed into the seven districts of Turkey. The universities were selected based on the statistical data of the Nomenclature of Territorial Units for Statistics. The results indicated that synchronous teaching platforms were mainly utilised as overhead projectors, revealing the dominant usage of Substitution level without the lecturers' effective interferences in the activities. Transforming either the frame or content of the original materials was also largely promoted under the Modification level, but it was placed after the Redefinition level, which is time and effort-demanding, and promoted more extensively after the Substitution level. The Augmentation level was the least promoted one, since the participants considered that increasing or decreasing the number of robotic activities is less useful than Modification and Redefinition level-appropriate practices. Furthermore, correlations were found between the participant lecturers' digital technology integration levels and their gender, background education and online teaching experiences, whereas seniority and age were not significant indicators of the participants' digital technology integration levels.

Keywords: SAMR model, digital technology integration, emergency remote education

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İngiliz Dili Eğitimi Öğretim Görevlilerinin Acil Durum Uzaktan Eğitim Sürecinde Dijital Teknoloji Entegrasyon Düzeylerinin SAMR Model Çerçevesinde İncelenmesi

Öz

21. yüzyılda insanoğlu hayatın her alanında baskın şekilde dijitalleşmektedir ve bu süreçte aslan payı eğitim alanına, özellikle de dil eğitimine düşer. Dijitalleşmeyi en yararlı şekilde derslere entegre etmek ve dil eğitimini yüzyılın gerisine düşürmemek için çağın hız kesmeden getirdiği pandemik salgınlar ve doğal afetler ile akılcı ve çözümcü bir tutum ile savaşmak gerekir. Bu bilinçle, mevcut çalışma birincil amaç olarak KOVİD-19 sürecinde uygulanan acil durum uzaktan eğitim sürecinde üniversitelerde İngiliz dili eğitimi akademisyenlerinin dijital teknolojiyi hangi düzeyde çevrimiçi derslerine entegre ettiklerini SAMR Modelini kullanarak açıklamaya çalışmıştır. İkincil amaç olarak da akademisyenlerin yaş, cinsiyet, kıdem, eğitim düzeyleri ve çevrimiçi eğitim tecrübeleri ile dijital teknoloji entegrasyon düzeyleri arasında önemli düzeyde anlamlı ilişki olup olmadığı araştırılmıştır. Çalışmada nicel araştırma desenine bağlı olarak SAMR Modeli anketi kullanılmıştır. Türkiye örnekleminde, gönüllük esas alınarak 243 katılımcı ile KOVİD-19 süreci acil durum uzaktan eğitim çevrimiçi İngilizce derslerindeki dijital teknoloji entegrasyonu incelenmiştir. Sonuçlar göstermektedir ki çevrimiçi dersler büyük oranda yüz yüze ders materyallerinin hiçbir değişiklik yapılmadan çevrimiçi platformlara yansıtıldığı bir ortam olmuştur. Bunun yanında, aynı ders konusunu sayıca yüksek veya az aktiviteler ile güçlendirmek yerine mevcut çevrimiçi aktiviteyi içerik olarak değiştirmek ve adapte etmek daha çok tercih edilmiştir. Bunlarında ötesinde büyük ölçüde birçok materyalin sıfırdan geliştirildiği görülmüştür. Dijital teknoloji entegrasyonunun KOVİD-19 sürecindeki özeti olarak öncelikle akademisyenlerin var olan materyalde seviye, içerik, sayı ve/veya çeşit yönünden hiçbir değişiklik yapmadan olduğu gibi kullanma yolunu seçtiği, ikinci olarak da kullandıkları materyali dersin tabiatına uygun olarak baştan sona kendileri geliştirme yoluna gittikleri tespit edilmiştir. Akademisyenlerin dijital teknoloji entegrasyon düzeyleri ile cinsiyet, eğitim düzeyleri ve çevrimiçi eğitim tecrübeleri ile aralarında ilişki bulunurken; kıdem ve yaş ile aralarında ilişki bulunmamıştır.

Anahtar kelimeler: samr model, dijital teknoloji entegrasyonu, acil durum uzaktan eğitim

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INTRODUCTION

Expeditious revolutions in the field of technology have been accompanied by the obligation of unique reinstatement in every single chapter of life in the 21st century, especially the chapter of education, regarding Information and Communication Technology (ICT). Following the fast-paced evolving technological advancements, the global world is seeking competent alumni from higher education bodies. In that instant, updating education with technology became a crucial teaching strategy (Howard et al., 2000; Mirzajani et al., 2016), and Ertmer (2005) relates the necessity of technology integration into education for effective teaching and learning practices. Along the same line, Prensky (2001) explains that technology integration into education is a stepwise process; it is not a sudden interference. In the same vein as Prensky, Alivi (2019) underlines the importance of technology integration into language education and recommends a hierarchical procedure of augmenting the level-appropriate practices. At this moment, the four-level framework called SAMR Model developed by Puentedura (2006) aids in guiding the hierarchical integration of technology into education: it starts with the Substitution level and evolves into the Redefinition level. The reason for employing the SAMR Model as a framework is that the SAMR Model explains the digital technology integration degree of the ELT lecturers stepwise, and describes the requirements of effective digital technology integration by benefitting from a hierarchical process similar to Bloom's Taxonomy.

Wilson and Conyers (2021) claim that educators have failed in performing effective actual classroom tasks though they are responsible for digital technology integration into education with its instructional strategies. It is an indisputable fact that arming lecturers with theoretical knowledge, and not examining their actual classroom practices is a pitfall. Lecturers' digital technology integration practices are recommended to be checked in 21st-century education institutions, since it is not a voluntary action but it is an obligation. This obligation has been faced all around the world suddenly with the outbreak of the COVID-19 Pandemic: all fields of education have been transformed into Emergency Remote Education (henceforth ERE) conditions as the natural drawback of the immediate lockdown conditions. While the developed countries have handled the digital technology integrated classes with average success, developing countries have been challenged with various problems caused by insufficient experience and preparedness. Moreover, underdeveloped countries have fallen behind the rest of the world countries due to unequal technical conditions during ERE. Turkey is counted among the developing countries, and inspecting lecturers' digital technology integration practices into their actual classroom practices has become an obligation in order to grasp the immediate picture of education during ERE. Martin (2020) stresses that very little has been explored about ELT teachers' digital technology integration levels, and ERE shall be viewed as an opportunity to explore it via SAMR Model.

The number of studies examining the digital technology integration levels into education from the SAMR Model perspective was very limited in the literature it was so rare in the field of education, and the number of researches is even not available in the field of language education in Turkey setting. The primary aim of the present study was to examine the ELT lecturers' digital technology integration levels via SAMR Model during Emergency Remote Education (ERE) process caused by COVID-19 Pandemic. The secondary aim was to discover whether ELT lecturers' digital technology integration levels during the ERE could be predicted via independent variables or not. To explore the abovementioned purposes, the following research questions guided the present study.

1. What are the levels of digital technology integration of English Language Teaching lecturers in online teaching in terms of the SAMR model (for each level) during the time of emergency remote education in the process of the COVID-19 Pandemic in Turkey?

2) Do English Language Teaching lecturers' levels of digital technology integration change significantly in accordance with their gender, age, seniority, background education, and online teaching experience at the time of emergency remote education in the COVID-19 Pandemic process?

Literature Review

Each century has brought its idiocractic features and paradigm shifts in terms of education in history, and those features and paradigm shifts were ranging from schooling systems to teaching designs, along with educators' beliefs, consciousness, competencies, etc. Today's education system was designed in parallel to the Industrial Age, but tomorrow's education system is going to be designed in accordance with the Digital Technology Age (Arstorp, 2018). The major transformation in the field of education is discernible between before and after the 2000s;

education was in the form of knowledge flow from teacher to students before the 2000s, but the roles have changed in the 2000s. Moreover, today's education has gained a mission of growing up graduates in seek of navigating reliable sources and evolving in the same line with the century (OECD, 2015). Since the 21st century is the age of digital technology, digital technology integration into education has become indispensable. The main attractive feature of integrating digital technology into the education field has been annihilating the problems aroused by geographical, and physical distances. Benefitting from distance education mode gives students the chance to equal education conditions to a certain extent, and helps to trigger higher-order thinking skills (Morris, 2021). Adversely, distance education also creates the digital divide which is known as the gap between those who have access to technology and who do not have access to the technology. Digital divide is the serious washback effect of the distance education on the target audience. Apart from that, distance education contributes to the expansion of all disciplines and grades of education via its cost-efficient and adaptable dimensions for both educators and students of 21st-century natives and immigrants. Its application requires time, passion, and careful design for ELT medium disciplines (Aziz, 2010; Hamilton et al., 2016; Kolb, 2019; Morris, 2021). In line with the increasing level of digital technology integration into education disciplines via distance education modes, a hierarchical technology evaluation model was developed in 2006 by Puentedura. The model centres on four basic tiers: Substitution, Augmentation, Modification, and Redefinition. Martina (2020) states that technology-integrated classes should not be misunderstood with the replacement of manual sources with digital sources, they are redesigning authentic tasks by providing students with the opportunities to extend their ICT competencies and language skills. That is why the SAMR model was considered to be the perfect fit model to evaluate and reflect on ELT lecturers' digital technology integration levels during ERE. Each abbreviation in the model name stands for the different levels of digital technology integration (Substitution, Augmentation, Modification, Redefinition).

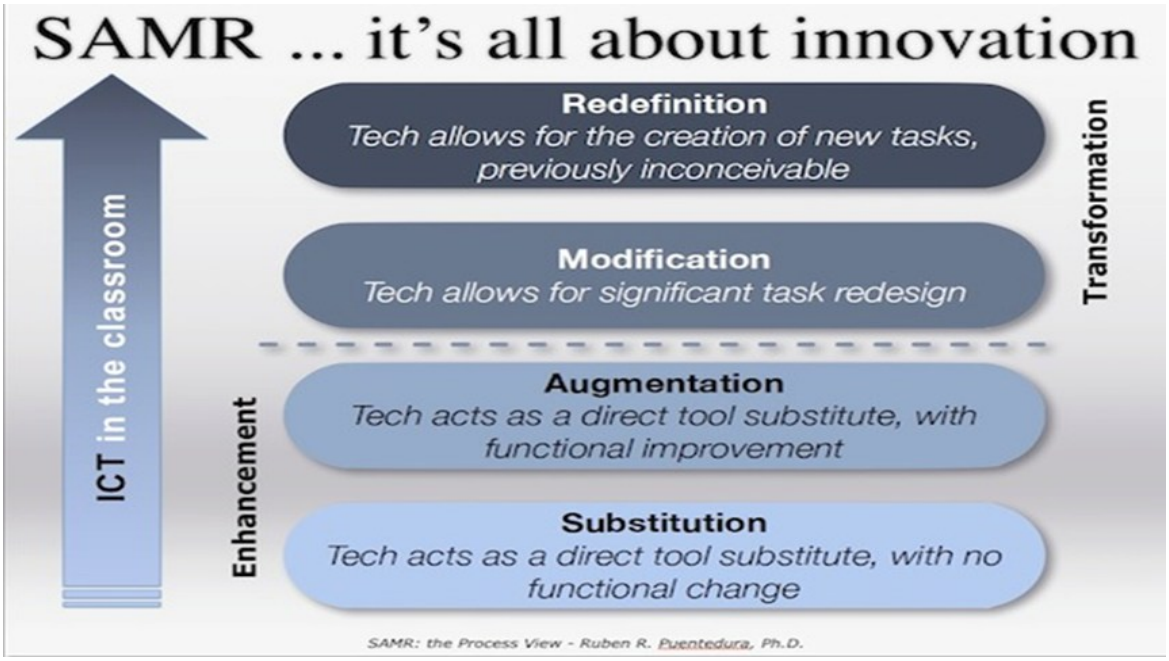

Figure 1. SAMR Model (Puentedura, 2006)

Substitution level: As the name refers, Substitution means that technology is acted as a direct tool to substitute manual sources without change (Puentedura, 2006). In the real-life application, it functions like an overhead projection, without any outer interferences to the ready manual sources, just replacing the paper-pen format with the online teaching platforms (Beisel, 2017).

Augmentation level: Puentedura summarizes this level as technology is acted as a direct tool to substitute the manual sources with average functional improvement. It proceeds similarly to the Substitution level with small changes regarding employing the functional applications of dictionary programs, applications or online dictionaries while studying four main skills. Through employing the Augmentation level, the aim is to enrich the mechanic or productive activities in numbers.

Modification level: While the focal aim is to enrichen the identified classroom tasks in the first two levels, the Modification level aims at enhancing higher-order skills via a variety of changes in the planned tasks.

Modification level pokes the meaning of a significant level of redesigning the existing practices functionally (Puentedura, 2006). Technology integration does not mean presenting various functions of the technology, but it regards guiding students to reach 21st-century century communication and collaboration skills via transformation of the immediate practices.

Redefinition level: Puentedura (2006) defines redefinition as the level of permitting the creation of novel tasks or projects, formerly unthinkable. The focus is on 21st-century critical thinking and creativity skills. In terms of language education, students are given chances to practice their four main language skills in accordance with the academically level-appropriate lesson designs. The predominant purpose here is to make language students feel out of the box in the learning process via authentic practices.

The SAMR Model and technology are interrelated. Technology is perceived as a source which has the power to change teaching practices, and the content of the SAMR Model focuses on the levels of integrating digital technology into actual classroom practices with the purpose of duplicating the functional application of the digital technology. Therefore, each level of the SAMR Model describes a different dimension of employing digital technology for teaching practices.

METHOD

Research Design

For the present research study, a correlational research design was adapted in order to clarify the relationship between the dependent and the independent variables via a quantitative research tool. The correlational research design enables researchers to examine and reflect on the level of the relationship among variables, which are sometimes more than two, and it permits researchers to evaluate whether one variable controls the other variable regarding statistical values (Creswell, 2003). With the purpose of responding to the immediate research questions, correlation analysis was employed for the relationship examination between the two constructs. Dörnyei (2007) cites that correlation analysis shows to what extent the two implicated constructs are interrelated.

In addition, the correlational research design was selected in order to ensure credible, objective, transferrable, and cost-effective data (Creswell, 2003). Furthermore, quantitative data collection tools enabled reaching a high number of participants via online questionnaires under the COVID-19 lockdown conditions.

Data Collection Tools

Suggested by Dörnyei (2007), the wording of the items in the questionnaire was examined in terms of clarity and simplicity in order to abstain from the negative formation (i.e., using no or not) and ambiguous language structures. In the seeking process of the appropriate questionnaire, the research questions, the purpose of the study, and the related literature were the main frame, and SAMR Model Perception Questionnaire developed by Thomas Martin in 2020 was employed in the present study with the permission of the owner of the questionnaire. The questionnaire was selected, since it was appropriate for the context and the participants of the research study. The questionnaire is a forty-one-item Likert-type with a three-factor model ranging from “never” to “always”, and was developed with the aim of evaluating lecturers’ digital technology integration regarding four levels: Substitution, Augmentation, Modification, and Redefinition. In order to check the reliability of the questionnaire, a piloting study with 173 participants in the form of an online questionnaire via Google Forms was conducted, and it was found reliable with the Cronbach's Alpha value at the cut-off point .905 ($\alpha > 0.7$). In the actual questionnaire, an extra session was added to the questionnaire for collecting demographic information of the participants for the second research question.

Table 1. Breakdown of the items

Levels	Number of the items
Substitution	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Augmentation	14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29
Modification	30, 31, 32, 33, 34, 35, 36,
Redefinition	37, 38, 39, 40, 41

Participants

243 ELT lecturers took part in the study voluntarily under the COVID-19 lockdown conditions. There were not any specific participant selection criteria, and convenience sampling was applied (Creswell, 2003). Participants were reached via institutional e-mails after getting the permission from the legal authorities. By bounding on the NUTS (Nomenclature of Territorial Units for Statistics) data, 20 different public and foundation universities dispersed geographically into the seven districts of Turkey were selected for the study by caring the density of ELT lecturers in each district. Out of 1077 ELT lecturers' contact, 243 of them agreed to take part in the online questionnaires: 162 (66.7%) of them were female lecturers and 81 (33.3%) of them were male lecturers.

Data Collection Process

The data collection process was conducted via online questionnaires through institutional e-mail servers by relying on an Ethics Committees Approval Letter. Candidate participants were sent e-mails including information about the purpose of the study, short PowerPoint slides on the SAMR Model prepared by the researcher, a YouTube video link prepared by Puentedura, and Ethics Committee Approval Letter apart from the questionnaire link. The data collection process took five months, and participants were sent reminder e-mails one month after the first mail.

Data Analysis

The total number of participants determined the data analysis test method. Since the total participant number was 243, parametric tests were decided to run after checking the distribution of normality of the data.

Table 2. Data Analysis Methods

Research Questions	Data Analysis Method
1	= >Descriptive analysis
2	= > Hierarchical multiple regression

Preliminary tests (the distribution of normality, linearity, multicollinearity, and homoscedasticity) were run in order to employ the multiple hierarchical regression tests (Pallant, 2011).

Research Ethics

In the first step, the approval of the owner of the questionnaire was consulted for employing the questionnaire in the present study. Secondly, an Ethical Committee approval letter was collected and sent to the legal authorities in terms of employing the questionnaire. Thirdly, participants were informed about the purpose of the study and all related ethics. Their consent was consulted via a consent form, and participants were ensured that their names would be kept anonymous.

FINDINGS

This study was conducted with 243 ELT lecturers working at 20 various universities in Turkey via online questionnaires in the ERE process caused by the COVID-19 pandemic in 2020-2021. The data were analysed through SPSS program (22.00), and the findings were presented in accordance with the research questions.

Findings 1: What are the levels of digital technology integration of English language teaching lecturers in online teaching in terms of the SAMR model (for each level) during the time of emergency remote education in the process of the COVID-19 pandemic in Turkey?

The purpose of the first research question was to investigate ELT lecturers' digital technology integration levels' breakdown into the SAMR Model levels (Substitution, Augmentation, Modification and Redefinition). The SAMR Model Perception Questionnaire had 41 items with three Likert-type items: 1) Never; (2) Sometimes; (3) Always. As recommended by Martin (2020), a mean value of 3 (mean value = 3) was enrolled as the positive signal, a mean value of 2 and higher (mean value ≥ 2) was enrolled as a lukewarm-to-positive signal, a mean

value of 2 (mean value = 2) was enrolled as the neutral signal, and mean value lower than 2 (mean value < 2) was enrolled as a negative signal of the relevant items regarding the SAMR Model.

Since the total number of participants exceeded 200 (N = 248), parametric analysis was employed as the first step in pursuit of testing the distribution of normality. In order to be ensured about the distribution of normality, outliers analysis was conducted and Residual statistics were presented in Table 1.

Table 3. Residual Statistics for Outliers Analysis

	Min.	Max.	Mean	SD.	N
Predicted Value	34.35	46.30	40.88	2.27	248
Std. Predicted Value	-2.87	2.38	.00	1.00	248
Std. The Error of Predicted Value	.97	.281	1.66	.35	248
Adjusted Predicted Value	34.60	46.62	40.89	2.28	248
Residual	-38.37	32.62	.00	10.68	248
Std. Residual	-3.55	3.02	.00	.99	248
Stud. Residual	-3.59	3.05	.00	1.00	248
Deleted Residual	-39.22	33.33	-.00	10.94	248
Stud. Deleted Residual	-3.68	3.10	.00	1.00	248
Mahal. Distance	.96	15.43	4.97	2.51	248
Cook's Distance	.00	.04	.00	.00	248
Centred Leverage Value	.00	.06	.02	.01	248

Two main lines were examined in this table: Residual line and Cook's Distance. According to the literature, Std. Residual referenced interval value should be between - 3.29 and + 3.29, (Frost, 2019). Table 1 showed that there was an outlier value in the data set. Cook's Distance line supported the Residual line, since it was higher than + 1 (Cook's Distance Max. > + 1). To identify outliers lines in the data, the Casewise Diagnostics were examined in Table 2.

Table 4. Casewise Diagnostics for Outlier Examination

		Std. Residual	SAMR Model	Predicted Value	Residual
Case Number	64	-3.36	2.00	38.37	36.37
	66	-3.55	.00	38.37	-38.37
	70	-3.02	71.00	38.37	32.62
	74	3.01	71.00	40.01	30.98
	160	3.05	72.00	40.59	31.40

Table 2 showed which lines were the outliers, and were required to be omitted from the data set in order to guarantee the distribution of normality. The outliers were; 64, 66, 70, 74, 160, and they were omitted, and the rest of the responses (N = 243) were analysed via SPSS. Following this, the Kolmogorov-Smirnov test was applied (see Table 3). When the distribution of normality was ensured (D (243) = 0. 045, p > 0.001), parametric tests were run.

Table 5. Kolmogorov-Smirnov Test for Distribution Of Normality

	Statistic	df	Sig.
SAMR Model	.050	243	.045

After ensuring the distribution of normality, descriptive statistics were conducted. In the first stage, ELT lecturers' general technology integration levels via SAMR Model were checked before the level-specific analysis.

Table 6. General Overview of the SAMR Model Descriptives in Descending Way

Item numbers	*n*	*M*	*SD*
3	243	2.76	.50
9	243	2.65	.57
14	243	2.61	.56
5	243	2.58	.55
6	243	2.56	.62
1	243	2.54	.63
39	243	2.46	.63
8	243	2.45	.69
12	243	2.38	.82
25	243	2.37	.71
18	243	2.33	.68
36	243	2.31	.72
31	243	2.30	.60
32	243	2.27	.68
34	243	2.25	.70
11	243	2.24	.73
2	243	2.22	.73
27	243	2.22	.74
4	243	2.21	.75
40	243	2.20	.75
7	243	2.18	.82
38	243	2.17	.72
23	243	2.16	.77
20	243	2.12	.78
33	243	2.07	.71
35	243	2.07	.74
17	243	2.05	.73
41	243	2.04	.76
10	243	2.04	.78
15	243	2.02	.76
24	243	1.99	.82
37	243	1.96	.76
22	243	1.95	.80
26	243	1.94	.80
16	243	1.90	.72
13	243	1.83	.85
19	243	1.82	.73
21	243	1.56	.72
30	243	1.34	.63
28	243	1.31	.59
29	243	1.29	.61

In an explanatory manner, the highest mean values intensified around the Substitution and Redefinition levels, and the lowest mean values intensified around the Modification level. The majority of the mean values fluctuated around the mean values between 2 and 3, which referred lukewarm to the confident approach. This data pointed out that a dominant number of the participants nearly "Always" dealt with technology in classes

theoretically at the basic level during ERE. Undoubtedly, a detailed examination was necessary for each of the SAMR Model levels in order to reflect on the participants' digital technology integration practices.

Table 7. Descriptive Statistics of The SAMR Model Levels

	n	*M*	*SD*
Substitution	243	2.36	4.06
Augmentation	243	1.98	5.72
Modification	243	2.09	2.79
Redefinition	243	2.17	4.52

Table 5 showed that except for the Augmentation level (M = 1.98), the rest of the three levels' cumulative mean values were close to each other.

1.1. Substitution level:

This level inspected to what extent ELT lecturers substituted manual sources with digital ones without any personal interference via 13 items.

Table 8. Substitution level Descriptives

Items	Mean	SD
Item 1	2.54	.63
Item 2	2.22	.73
Item 3	2.76	.50
Item 4	2.21	.75
Item 5	2.58	.55
Item 6	2.56	.62
Item 7	2.18	.82
Item 8	2.45	.69
Item 9	2.65	.57
Item 10	2.04	.78
Item 11	2.24	.73
Item 12	2.38	.82
Item 13	1.83	.85
Cumulative mean value	2.36	

It was clear with the high mean values that Substitution level got a certain and undeniable place in the online classes within 12 items except Item 13 (M = 1.83), which did not change the main result.

1.2. Augmentation level

The Augmentation level is the second level in the hierarchical evolution of the SAMR Model and inquiries about enriching the digital classes via augmented practices.

Table 9. Augmentation Level Descriptives

Items	*M*	SD
Item 14	2.61	.56
Item 15	2.02	.72
Item 16	1.90	.72
Item 17	2.05	.73
Item 18	2.32	.68
Item 19	1.81	.73
Item 20	2.12	.78
Item 21	1.56	.72
Item 22	1.95	.80
Item 23	2.16	.77
Item 24	1.99	.82
Item 25	2.37	.71
Item 26	1.94	.80
Item 27	2.22	.74
Item 38	1.31	.59
Item 29	1.29	.61
Cumulative mean value	1.98	

According to Table 7, participants' reinforcement of the online classes fell behind the positive indicator (M = 3) and items mainly yielded either neutral or negative mean values, which generated negative cumulative mean value (M = 1.98). The Augmentation level was performed poorly.

1.3. Modification level

This third level examined the alterations made by ELT lecturers via various reasons on the practices in the online classes during ERE.

Table 10. Modification Level Descriptives

items	*M*	*SD*
Item 30	1.34	.65
Item 31	2.30	.60
Item 32	2.27	.68
Item 33	2.07	.71
Item 34	2.25	.70
Item 35	2.07	.74
Item 36	2.31	.72
Cumulative mean value	2.09	

Modification level descriptives did not fluctuate around extreme ends, and they densified around the mean value of 2 and 2.50. The concerned values refer that online practices expose to various alterations in different ways.

1.4. Redefinition level:

The fourth level inquired about 243 participant ELT lecturers' redesigning practices in the online classes by benefitting from the technology.

Table 11. Redefinition Level Descriptives

items	*M*	*SD*
Item 37	1.96	.76
Item 38	2.17	.72
Item 39	2.46	.63
Item 40	2.20	.75
Item 41	2.04	.76
Cumulative mean value	2.17	

Excluding item 37, the rest of the items generated mean values higher than 2, which implied favourably supported redesigned ELT practices.

1.5. The Summary of the first research question findings:

Figure 2 was prepared by relying on the descriptive statistics reached via SPSS analysis in order to summarize the responses to research question one.

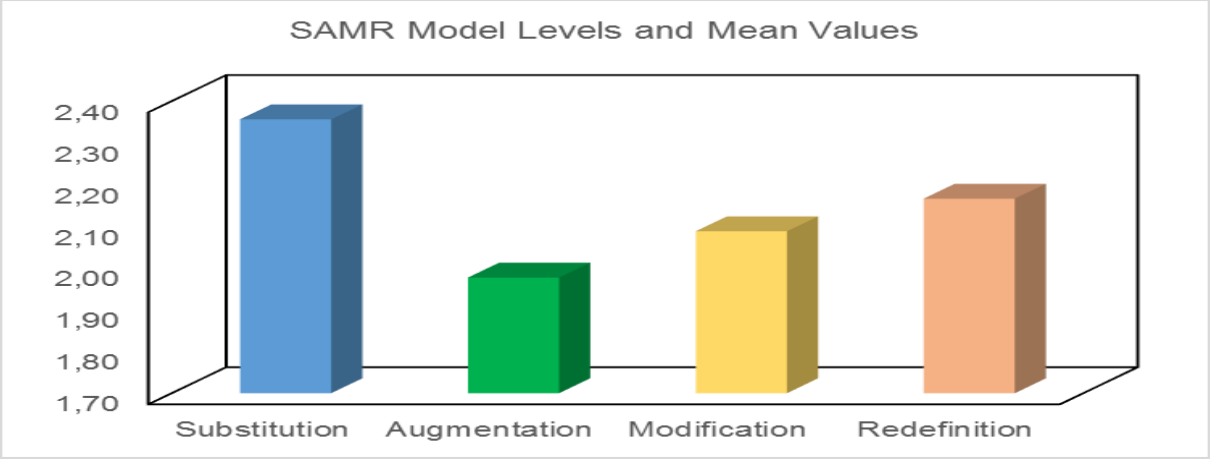

Figure 1. Findings of SAMR Model Levels

As seen in Figure 1, although some gaps were discerned among the items, in the whole picture, cumulative mean values of the levels were adjacent to each other excluding the Augmentation level. The findings signified that participants' practices of SAMR Model levels were not so far from each other, and their digital technology integration levels did not evolve hierarchically.

Findings 2. Do ELT lecturers' levels of digital technology integration change significantly in accordance with their gender, age, seniority, online teaching experience and background education level at the time of experiencing emergency remote education in the Covid-19 Pandemic process?

Hierarchical multiple regression analysis was run to respond to the second research question. Pallant (2011) suggests that four pre-conditions (distribution of normality, linearity, multicollinearity, and homoscedasticity) should be examined before employing the hierarchical multiple regression analysis.

The distribution of normality was already checked for the first research question and proved in Figure 2 that it was guaranteed. As all columns were mainly under the u-shaped curve in the histogram, the Distribution of normality was ensured.

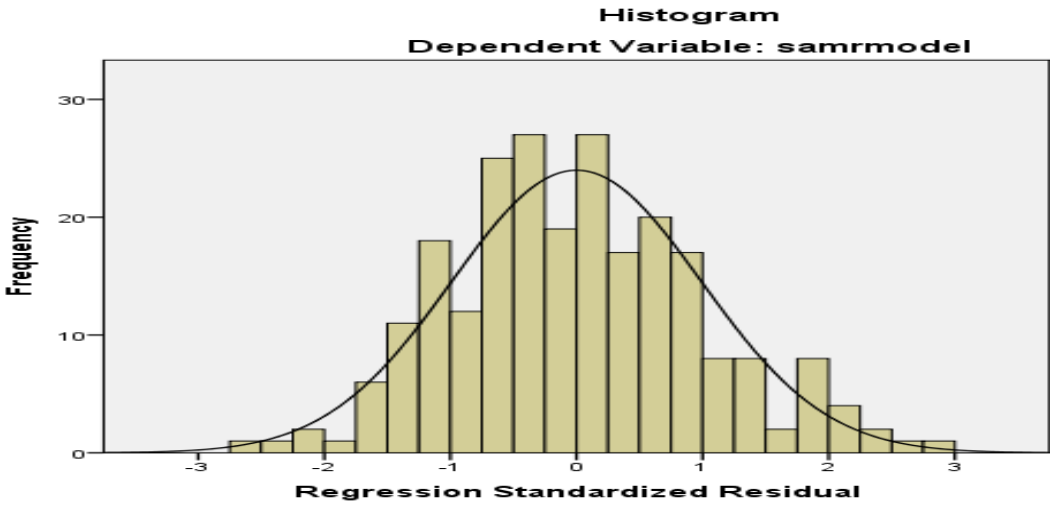

Figure 2. Histogram For SAMR Model

A multicollinearity check was conducted firstly via Pearson Correlation analysis with the cut-off point r < .80, and the VIF value was controlled. In the related literature, if the VIF is < 4, there is no multicollinearity problem (Hair et al., 2010).

Table 12. Multicollinearity Check of the Independents

	Condition Index	VIF
(Constant)	1.00	
Gender	6.40	1.02
Age	6.75	2.98
Seniority	7.62	3.06
Background education	12.21	1.16
Online education experience	15.81	1.13

The second way of checking multicollinearity was to control the Condition Index value of the Independent Variables. Condition Index value should be (CI < 30) lower than 30 to ensure multicollinearity (Büyüköztürk, 2011). As seen in Table 10, The Condition Index (CI) values were: CI < 30, so multicollinearity was ensured.

Homoscedasticity was tested via the Durbin-Watson value as stated in the Model Summary of the Regression in Table 13.

Table 13. Model Summary of the Hierarchical Multiple Regression

Model	Enter
R	.214
R Square	.04
Adjusted R Square	.02
Std. Error of the Estimate	8.89
Durbin-Watson	1.84

Table 11 showed that homoscedasticity was ensured, since the Durbin-Watson value was 1.84, which was in the referenced interval (1 < DW <3). According to Table 11, the variations in the SAMR Model levels were defined with a ratio of .02 % by Gender, Age, Seniority, Background education, and Online Teaching Experience.

Table 14. The Relationship between the SAMR Model and Independent Variables

		SAMR MODEL	Gender	Age	Seniority	Background Edu.	Online teaching exp.
Pearson Correlation	SAMR Model	1.00	-.12	.013	.00	.12	.12
	Gender	-.12	1.00	.155	.09	.00	02
	Age	.01	.15	1.00	.81	.29	23
	Seniority	.00	,097	.81	1.00	.32	.29
	Background education	.12	,00	.29	.32	1.00	.26
	Online teaching experience	.12	,02	.23	.29	.26	1.00
Sig.(1-tailed)	SAMR Model	.	,.02	.42	.49	.02	.02
	Gender	.026	.	.00	.067	,.49	.36
	Age	.42	.00	.	.000	.00	.00
	Seniority	.49	.06	.00	.	.00	.00
	Background education	.02	.49	.00	.00	.	.00
	Online teaching experience	.02	.36	.00	.00	.00	.

According to Table 14, a significant relationship was noticed between:
SAMR Model and Background education (r (241) = .12, p < .05),

SAMR Model and Gender (r (241) = -.12, p < .05),
SAMR Model and Online teaching experience (r (241) = .12, p < .05).
No significant relationship was noticed between:
SAMR Model and Seniority (r (241) = .00, p > .05),
SAMR Model and Age (r (241) = .01, p > .05).

Table 15. Anova Table of the Hierarchical Multiple Regression

Model		Sum of Squares	df	Mean Square	F	Sig.
Enter	Regression	1088.59	5	217.71	2.22	.05
	Residual	22730.98	232	97.97		
	Total	23819.58	237			

Table 14 pointed out there were no purposeful effects of any of the independent variables (Age, Gender, Online Teaching Experience, Seniority, Background education) alone when the rest of the independent variables were controlled over the dependent variable (SAMR Model).

Table 16. Hierarchical Multiple Regression

Variable	Unstandardized		Bootstrapping BC'a %95 CI		Standardized			Correlations		Collinearity Statistics	
	B	Std.Error	Lower limit	Upper limit	ß	*t*	Sig.	Part	Partial	Tolerance	VIF
(Constant)	39.81	2.94	34.01	45.61		13.51	.00				
Gender	-2.69	1.37	-5.41	.01	-.12	-1.95	.05	-.12	-.12	.97	1.02
Age	.61	1.20	-1.76	2.98	.05	.50	.61	-.03	.03	.33	2.98
Seniority	.96	1.04	-3.01	1.09	-.10	-.92	.35	.05	.06	.32	3.06
Background education	1.41	.88	-.33	3.15	.11	1.59	.11	.10	.10	.85	1.16
Online teaching experience	1.39	.80	-.18	2.98	.11	1.73	.08	.11	.11	.88	1.13

By defining background education, age, seniority, online teaching experience, and gender as independent variables, ELT lecturers' digital technology integration levels via SAMR Model were attempted to be foreseen via Hierarchical Multiple Regression analysis. According to the analysis, an inconsequential regression model, F (5, 232) = 2.22, p>.001) was revealed. Moreover, the variance of the dependent variable was defined only at the proportion of .02 % (R2 adjusted = .03) by the independent variables (background education, age, seniority, online teaching experience, and gender).

According to the Multiple Hierarchical Regression Model of the present study:
Independent variable Background education does not predict the SAMR Model dependent variable positive and meaningful, ß = .11, t (232) = 1.59, p >.05, pr2= .0108.
Independent variable Age does not predict the SAMR Model dependent variable positive and meaningful,
ß =.05, t (232) = .50, p >.05, pr2= .09.
Independent variable Seniority does not predict the SAMR Model dependent variable positive and meaningful, ß = -.10, t (232) = -.92, p >.05, pr2= -.0036.
Independent variable Online teaching experience does not predict the SAMR Model dependent variable positive and meaningful, ß = .11, t (232)= 1.73, p >.05, pr2= .0121.
Independent variable Gender does not predict the SAMR Model dependent variable positive and meaningful, ß = -.12, t (232) = -1.95, p >.052, pr2 = .0144.
The Regression Formula of the present study is (for each new participant to the present study)
SAMR Model = 39.81 + -2.69 * Gender + .61 * Age + -.96 * Seniority + 1.41 * Background Education + 1.39 * Online Teaching Experience.

DISCUSSION & CONCLUSION

The present study set out to discover ELT lecturers' levels of digital technology integration into their online classes during the ERE process via the SAMR Model developed by Puentedura (2006). Since the SAMR Model can be accepted as an average novel model in the field when compared to common topics in the field, the number of studies on its implication is not high. However, there are still limited studies in the world context that employed the SAMR Model for evaluating the digital technology integration into the online classes of various modes of distance education in divergent disciplines in the field of education (Hockly, 2012; Jude et al., 2014; Romrell, Kidder & Wood, 2014). Nonetheless, very scarce of them were conducted in the field of language education (Kukulska et al., 2017), and the present study tried to contribute fill the gap in the field to a certain degree in the early years of the SAMR Model development.

Although Puentedura (2006) mentions a hierarchical evolvement among the levels in the SAMR Model similar to Bloom's Taxonomy developed in 1956, in the immediate study the situation was different. In contrast to related studies' hierarchical evolution model (Hamilton et al., 2016; Jude et al., 2014; Martina, 2020; Romrell et al., 2014), the findings in the present study showed that ELT lecturers' digital technology integration levels did not evolve increasingly in one certain way. The results are in contradiction with that of Norris and her friends (2017) in terms of not reaching the higher-order skills stepwise. While ELT lecturers' digital technology integration practices centred around the Substitution level at the beginning of the COVID-19 ERE process, the volume of the practices did not pursue the Augmentation level with a higher promotion as expected. While the Augmentation level was not promoted decently, ELT lecturers signalled via their self-reports that they mainly interfered with either content or general frame of the tasks by transforming them for various reasons ranging from academic level equilibration to students' interest areas. In contrast to enriching activities, modification activities were dominantly performed at the degree of research assignments on the internet. At the Redefinition level, the target is to enrich transformative and higher-order skills (Martin, 2020). However, in the present study, it was not preferred and performed deservedly as much as the Substitution level practices, since the Redefinition level practices demand time and effort of the lecturers via redesigning each online task from tap-to-toe by caring for students' academic levels, and interests, in addition to the syllabus and methodological approaches. Although descriptive statistics of the Redefinition level and the Substitution level were not at extreme edges, the Redefinition level could not meet the intended target. Similar to two studies in the field of distance education (Gürer et al., 2016; Yaman, 2015), online classes and teaching platforms substituted only face-to-face classes and manual sources like an overhead projector in the ERE process. According to the results, the reason can be explained by the last-minute transition from face-to-face classes to synchronous classes without caring about the preparedness level. There was not an opportunity to conduct a need analysis on productive ELT syllabus, content, materials, infrastructure, and training appropriate for synchronous language education (Akkaş, 2023). Unavoidably, it became a tough process to benefit from the advantages of synchronous teaching and meet the goals of synchronous language education. Naturally synchronous education mode in ERE presented lecturers with a large number of materials, but it could not be grasped for the sake of productive ELT education, since synchronous language classes were not interactive enough regarding quality, class hours, and lecturers' preparedness level apart from expectancies of the students. That was why synchronous classes were stuck at the Substitution level (Pepeler et al., 2018). One another indispensable drawback of the ERE process was that productive skills could not be polished as much as receptive skills in the ELT (Doğan, 2020).

The secondary aim was to examine whether ELT lecturers' digital technology integration levels vary in terms of the independent variables: age, gender, background education level (Bachelor, Master, and Ph.D.), online teaching experience, and seniority via a hierarchical multiple regression model. In the same vein as the studies on distance education; gender and online teaching experience independent variables were found to be related to the ELT lecturers' digital technology integration levels regarding the SAMR Model evaluation (Akkaş, 2023; Işıklı, 2017; Pepeler et al., 2018; Seven, 2012; Şirin & Tekdal, 2015). The participants' background education levels were noticed closely related to the SAMR Model, despite seniority and age. ELT lecturers did not perform digital technology integration practices in accordance with their age or seniority in their profession.

In an explanatory manner, participant ELT lecturers were quite content with the utilisation of the Substitution level, which implied that most of the participants were short of updated professional training, and conscious of 21st-century education initiations. It is a pity to reveal that English language education during ERE fell behind the needs of the competitive global world, and it stepped backward by reasoning purely on manual sources, passive students, dull content, and low-level technical preparedness. In a nutshell, on the same side with

Howlett et al. (2019), higher-order skills could not be promoted in synchronous education during ERE in Turkey as targeted in face-to-face education in contrast to most of the world countries regarding language education.

Eventually, some recommendations are summed in parallel to the discussions and conclusions. It is vital to benefit from the advantages of employing budget-friendly synchronous language classes by investing in educators' preparedness level, since educators are the first chain in the language education circle. They should be qualified with both technical and methodological background education via professional training sessions organized regularly by the institutions either on a small scale or on a national scale. Apart from that, they are required to be provided with digitally authentic materials in order to make students feel out of the box. Need analysis is suggested to be made at regular intervals via short and user-friendly self-reports or 15-minute meetings in organizations for both motivating them and filling up the gaps. In this way, institutions message lecturers that they are safe and ready for all modes of education with supportive administrators. Fulfilment of those suggestions enables making sudden transmissions from face-to-face education to synchronous education smoothly and speedy to a great extent. We should not fall behind the century, as every minute technology is advancing along with education, and pandemics such as COVID-19, catastrophes, and natural disasters (such as earthquakes, tornados, and floods) are hitting the world within the century one after another, and all of a sudden. The only dependable weapon to battle against them is technology, which enables continuity and sustainability via its effective integration into daily life. Depending on that, it is wise to keep in mind that fixing a broken chair is more difficult than creating it from zero point. We should always be alert for all kinds of unusual circumstances beforehand, instead of trying to fix the problems while experiencing them.

As exists in all kinds of research studies, the present study has limitations as well. This study was conducted quantitatively to reach a higher number of participants in order to ensure generalisability and to represent the whole context under COVID-19 lockdown conditions. Moreover, the numerical data is short of adequate explanation from the participants' voices. That is why it is advisable to employ a qualitative study in order to back up the numerical data and to reveal the underneath reasons of the iceberg by examining all the blind points of the self-report research tool.

Conflict of Interest

The researchers have no conflict of interest in this study state.

Statements of Publication Ethics

Both of the researchers hereby declare that they obeyed, and pursued all of the ethical conditions via the Ethical Committee Approval Letter issued with E-358553172-300-00001845121 on the date of 02.11.2021.

Researchers' Contribution Rate

Both of the researchers' contribution rates are equal to the present manuscript.

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The Effect of Special Education Teachers' Knowledge Sharing on Innovative Work Behaviors

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Abstract

The dynamic and ever-changing structure of the special education field and the developmental needs of children with special needs make knowledge sharing important for special education teachers. The current study aims to examine the effect of the knowledge-sharing process on the innovative work behavior of special education teachers in private education institutions. This study employed a descriptive research model which is one of the quantitative research models. A total of 244 special education teachers, 75 male, and 169 females, were included in the study. The findings of the study show that the mean scores of the Innovative Work Behavior Scale and the Knowledge Sharing Scale do not differ significantly according to the gender of the teachers, the educational status of the teachers, and the type of the teachers' institution. On the other hand, the average score of innovative work behavior idea generation and implementation sub-dimension differs significantly according to the seniority of the teachers. In other words, in the idea generation and implementation sub-dimension, the average score of teachers with 11-15 years of professional seniority was found to be significantly higher than the average of teachers with 0-5 years of professional seniority.

Keywords: knowledge sharing, innovative work behavior, private education institutions, special education

Özel Eğitim Öğretmenlerinin Bilgi Paylaşımlarının Yenilikçi İş Davranışlarına Etkisinin İncelenmesi

Öz

Özel eğitim alanının dinamik ve sürekli değişen yapısı ile özel gereksinimli çocukların gelişimsel gereksinimleri, özel eğitim öğretmenleri için bilgi paylaşımını önemli hale getirmektedir. Bu araştırmada özel eğitim kurumlarında bilgi paylaşım sürecinin özel eğitim öğretmenlerinin yenilikçi iş davranışına etkisinin incelenmesi amaçlanmıştır. Araştırmada nicel araştırma modellerinden betimsel araştırma modeli kullanılmıştır. Araştırmaya, 75 Erkek ve 169 Kadın olmak üzere toplam 244 özel eğitim öğretmeni dahil olmuştur. Araştırmanın bulguları Yenilikçi İş Davranışı Ölçeği ve Bilgi Paylaşımı Ölçeği puan ortalamalarının öğretmenlerin cinsiyetlerine, öğretmenlerin öğrenim durumlarına ve öğretmenlerin kurum türüne göre anlamlı olarak farklılaşmadığını göstermektedir. Buna karşın yenilikçi iş davranışı fikir üretme ve uygulama alt boyutu puan ortalamasının öğretmenlerin kıdemlerine göre anlamlı olarak farklılaştığı bulunmuştur. Diğer bir deyişle fikri üretme ve uygulama alt boyutunda, 11-15 yıl arası mesleki kıdeme sahip öğretmenlerin puan ortalaması 0-5 yıl arası mesleki kıdeme sahip öğretmenlerin puan ortalamasından anlamlı olarak yüksek olduğu sonucu bulunmuştur. Bulgular, araştırma amacı çerçevesinde tartışılmış olup ileri araştırmalara ve özel eğitim öğretmenlerine yönelik önerilerde bulunulmuştur.

Anahtar kelimeler: bilgi paylaşımı, yenilikçi iş davranışı, özel eğitim kurumları, özel eğitim

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INTRODUCTION

Knowledge has been a concept that has been perceived as "power" throughout history, since knowledge has settled based on life, knowledge is created with values, efficiency, and innovation (Güçlü and Sotirofski, 2006). Knowledge, both as a value and as a power, is one of the most important arguments that transform our lives. For this reason, the production of knowledge as a value and power is very important for the development and strengthening of the society we live in. Knowledge production can be defined as taking new information from other sources and adapting it to the social environment (eg, the institution in which it works) and using it (Nonaka & Takeuchi, 2019).

Sharing knowledge and experience is one of the most important phenomena for institutions, and sharing knowledge and experience has an important role in the formation and continuation of corporate culture. Moreover, effective knowledge-sharing helps institutions to manage their decision-making processes in a healthier way (Işık, 2018). In this context, sharing knowledge and experience among employees in an institution and transforming them into Innovative Work Behaviors has critical importance (Kim & Lee, 2013). Knowledge and expression sharing by employees in a workplace are seen as a prerequisite for innovative work behavior. For this prerequisite behavior to occur, it is necessary to make practices and arrangements for the development and maintenance of individual and collective knowledge sharing within the institution. The primary goal of Innovative Work Behavior is to ensure that new ideas emerge willingly in institutions. In this way, employees can adapt to the requirements of the job by developing ideas, encouraging and improving them, and can update themselves and their institutions at the same time (Bos-Nehles et al., 2017; Ceylan & Özbal, 2005).

Today, innovation is of great importance for institutions to represent themselves effectively and to contribute to social development, and it is a reality accepted by everyone. Researchers highlight that one of the important indicators that enable an institution to be successful is the innovative behavior of its employees (Yuan & Woodman, 2010). Innovative behavior is defined as the behavior shown in different stages such as producing a new idea, acting collectively, cooperating, and implementing (De Jong & Den Hartog, 2007). In this context, innovative work behavior can be considered as a multi-element structure that includes all behaviors based on improvement and development, in which all employees in the workplace can contribute to corporate development.

There are five main components/indicators of innovative work behavior including (a) creativity, (b) idea generation, idea support, idea realization, and idea implementation (c) organization manager/leader, (d) colleagues or workgroup working in the same organization, (e) equipment, facilities and time (Ulusal ve Yüreğir, 2022). Innovative work behavior is closely related to employees' creativity and idea-generation processes. Therefore, creativity should be seen as the first step of the innovation process (De Jong & Den Hartog, 2007). One of the most important factors that can affect creativity is the individual's inner interest in the task (Çapraz et al., 2014; Yuan & Woodman, 2010). One of the institutional variables that significantly affect innovative behaviors is the director or leader of the institution. The leader has a strong influence on the innovative behavior of the employees (Yukl, 2010). Another variable that affects idea generation within an organization is colleagues or workgroup members in the work environment (Scott & Bruce, 1994). The relations and cooperation of the employees within the institution support the formation of the accepted behavior and attitude climate, in other words, the formation of the corporate culture. Opportunities to support institutional innovation and development should be sought in the production of innovative ideas in an institution, and solutions should be produced by determining the performance differences of the employees (De Jong & Den Hartog, 2007). Innovativeness can be supported and sustained by sharing knowledge and experience in an organization and learning that supports the professional development of employees.

Innovation is an important fact and value for many professions and employers, as well as an extremely important approach for the teaching profession and educational institutions, which are dynamic structures in terms of innovation and development. It is necessary to say that educational institutions, whose raw material is information, are at the forefront of institutions that need to keep up with this information age we live in and that train human resources. Today, the need for more flexible and sustainable learning environments and different teaching methods and techniques is increasing due to changing living conditions. Professional skills and competencies required by teachers (e.g., skills in differentiated instruction, technological competencies, critical thinking and problem-solving skills, communication and collaboration skills, cultural competencies, and continuous professional development) are also changing in today's schools, where needs differ according to individuals and groups based on institutional goals, existing resources do not always solve problems, standards are not always effective, and change is rapid (Töre, 2019).

One of the educational institutions where the needs differ is the educational institutions where special education services are provided. The developmental needs and characteristics of groups with special needs benefiting from special education services also differentiate the professional needs of teachers working in this field. The roles and responsibilities of special education teachers require working and collaborating with different disciplines, considering the developmental needs and characteristics of children with special needs. The multidimensional developmental needs of children with special needs have led to a lot of research in this area and to the emergence of many different methods, strategies, and models in this context. Interdisciplinary cooperation should be made to meet the developmental needs of children with special needs and scientifically based practices should be used by teachers in educational interventions (Snyder et al., 2003).

Many challenges require special education teachers to generate and implement innovative ideas. One of them is the development and successful implementation of individualized education programs (IEP). According to the literature, successful implementation of IEPs depends on teachers' sharing their knowledge and expertise on this subject, working in collaboration with other teachers or experts, and sharing their knowledge and experiences with pre-service teachers to create pre-service gains (Winn & Blanton, 2005). Successful outcomes of educational interventions for children with special needs depend on collaboration (Anderson, 2008; Winn & Blanton, 2005), effective teachers engage in professional conversations rather than isolate themselves (Darling-Hammond & Richardson, 2009) and collaboration is better than other teachers' practices (Darling-Hammond, 2006). Many variables require special education teachers, such as IEPs, to cooperate, produce innovative ideas, and produce solutions to problems related to the system or students. Research emphasizes the importance of special education teachers' ability to find creative solutions to the challenges they face (Scruggs & Mastropieri, 2015) and the significance of collaboration (Friend & Cook, 1992).

Special education is the field in which theoretical and practice-based change is experienced the most in the education sector and where there is an effort to find solutions to many problems. For this reason, it is inevitable for special education teachers working in the field of special education to support their professional development based on theory and practice, to cooperate with their colleagues and other disciplines to serve their students better, to produce effective solutions to problems and to take action to solve problems. For special education teachers to be successful in the field of special education, which is in an extremely dynamic and intense change process, they need to adopt an innovative approach and produce, support, and implement innovative ideas in the face of problems in this direction. For this reason, special education teachers need to constantly renew their knowledge and find solutions to the problems they experience. It should be noted that special education environments have a very dynamic structure in this respect. This dynamic structure naturally forces special education teachers to change their educational practices. On the other hand, new human resources are constantly included in the field and up-to-date information needs to be shared with these candidates. This study aims to examine the impact of knowledge sharing on teachers' innovative work behaviors in special education institutions, thereby supporting teachers' professional development and ensuring that students receive better education. Additionally, it can guide educational administrators and policymakers in developing strategies that encourage innovation. In this way, more effective and innovative teaching practices in the field of special education will be promoted.

METHOD

Research Design

In this study, the descriptive research model, one of the quantitative research models, was used. The descriptive research model is generally defined as a quantitative research model that aims to describe and understand a situation or event in detail (Büyüköztürk et al., 2023). A descriptive research model explains the characteristics, behaviors, or attitudes of a population or sample group, objectively explaining a particular event or situation. In this research model, researchers usually use standard tools such as questionnaires, observations, and scales to collect data. This research model is generally used in the study of a new event or situation and aims to describe a situation in detail before testing hypotheses, rather than testing a hypothesis. This model is generally used for research on a new event or situation (Büyüköztürk et al., 2023; Mishra and Alok, 2022).

Working Group

The sample of the research consists of special education teachers working in public and private education institutions in Istanbul and Çanakkale. Before the participants were determined, necessary permissions were obtained from the Çanakkale and Istanbul National Education Directorates for the conduct of the research. After obtaining permission from the relevant institutions, the schools and rehabilitation centers were contacted and the

teachers working in these educational institutions were informed about the research. In these information meetings, an informed consent form was given to the teachers. In determining the participants, the prerequisites were (a) that the teachers were special education teachers, (b) that they had at least five years of experience in the profession, and (c) that they had spent the last five years of their professional career in special education settings. Special education teachers who provided the informed consent form to the researchers and met the prerequisites were included in the study. The first reason why the second and third prerequisites are sought for the participants included in the research is to ensure that they have similar experiences with the education of children with special needs. Secondly, it is to have sufficient professional experience to minimize the lack of experience of being a new teacher and finally to internalize behaviors that reflect the corporate culture such as knowledge sharing and innovative work behaviors. The demographic information of the participants included in the study is shown in Table 1.

Table 1. Demographic Information on Participants

Variable	Introductory Features	n	%
Gender	Man	75	31
	Woman	169	69
School Type	State	159	65
	Private*	85	35
Education Status	Bachelor	201	82
	Postgraduate	43	18
Professional Service Period	5-10 Years	111	45
	11-15 Years	82	34
	16 Years and Above	74	21

*Special Education and Rehabilitation Center: Support education service is provided.

According to Table 1, approximately 70% (n=169) of the participants included in the study are female and 30% are male. 65% of the participants work in public schools (separate educational settings for children with mental retardation and autism), while 35% work in special education and rehabilitation centers. Most of the participants were undergraduate graduates and approximately 20% of them were postgraduate graduates, and almost half of the participants have a professional experience of 5-10 years.

Data Collection Tools

In this study, four data collection tools were used, namely the Participant Information Form, the Informed Voluntary Consent Form, the Innovative Work Behavior Scale, and the Knowledge Sharing Behavior Scale. The Participant Information Form, developed by the researcher, is a form that collects demographic information such as age, gender, and professional seniority of the participants involved in the research. Similarly, the Informed Consent Form developed by the researcher is a written agreement in which it is determined that the teachers involved in the research voluntarily participate.

The Innovative Work Behavior Scale, developed by Janssen (2000), was adapted into Turkish by Töre (2017). The scale consists of 3 sub-dimensions: Idea Generation, Idea Promotion, and Idea Realization, and there are three items in each sub-dimension (Janssen, 2000). In the Turkish version of the scale, there are two sub-dimensions: " Idea Generation and Idea Realization " and " Idea Promotion for ideas". The Cronbach α reliability value of the adapted scale is .87 (Töre, 2017). The score interval coefficient for the arithmetic means of the scale was found to be 0.80. The evaluation range of the arithmetic averages of the scale is “very low” between 1.00-1.80; “low” between 1.81-2.60; “medium” between 2.61-3.40; and between 3.41-4.20 is determined as “high” and 4.21-5.00 as “very high”.

The Knowledge Sharing Behavior Scale was developed by Chennamaneni et al., (2012) and adapted into Turkish by Töre (2017). The scale consists of seven items, and four sub-items of the scale was administered to the participants after the pilot application. The Cronbach α reliability value of the scale is .81. The score interval coefficient for the arithmetic means of the scale was determined as 0.80. The evaluation range of the arithmetic means of the scale is “very low” between 1.00-1.80; “low” between 1.81-2.60; “medium” between 2.61-3.40; between 3.41-4.20 is determined as “high” and 4.21-5.00 as “very high”.

Data Collection Process

Before determining the participants, ethical permission was obtained from the ethics committee of Çanakkale On Sekiz Mart University with the decision dated 03.03.2022 and numbered 05/29, and then the relevant institutions were contacted after obtaining data collection permission from the Istanbul Directorate of National Education with the letter dated 02.06.2022 and numbered 50899543. Special education teachers working in the educational institutions where the research will be conducted were informed about the research. An Informed Voluntary Consent Form was given to the teachers who wanted to participate in the study. Teachers who filled in the Informed Voluntary Consent Form and submitted it to the researcher and met the prerequisites were included in the study. To collect data from teachers through the scales determined within the scope of the research, the date and time of the interview were determined. Data were collected through face-to-face interviews with the teachers at the specified date and time. The data were collected by coding the scales.

Data Analysis

To determine the normality distribution of the data obtained in the study, the skewness and kurtosis values of the data were examined. Accordingly, the skewness and kurtosis values of the data were between -1.5 and +1.5. Due to the normal distribution of the data, the analysis of the data obtained in the study was carried out using parametric tests. Data were analyzed in the SPSS program with a t-test and ANOVA test to determine whether there is a difference between the mean scores for the "Knowledge Sharing" and "Innovative Work Behavior" scales. The values for the normality distribution of the data are presented in Table 2.

Table 2. Findings Regarding Normality of Data

Scale and Sub-Dimensions	n	Skewness value	Kurtosis value
Innovative Work Behavior	244	-0.31	-0.18
Idea Generation and Realization	244	-0.32	-0.04
Idea Promotion	244	-1.17	0.50
Knowledge Sharing	244	-0.98	0.42

Research Ethics

Before starting to collect the research data, ethical permission was obtained from the ethics committee of Çanakkale On Sekiz Mart University with the decision dated March 3, 2022, and numbered 05/29, and then data collection permission was obtained from the Istanbul Directorate of National Education with the letter dated June 2, 2022, and numbered 50899543.

FINDINGS

The study aims to investigate the effect of the knowledge-sharing process on the innovative work behavior of special education teachers in private education institutions. The data obtained in the research were interpreted by analyzing the arithmetic mean ($\bar{x}$), frequency (f), standard deviation (s.d.), t-test, and ANOVA test. Descriptive statistics regarding the sub-dimensions of the scales used in the study are given in Table 3.

Table 3. Innovative Work Behavior and Knowledge Sharing Scale Average Scores

Scale and Sub-Dimensions	n	($\bar{x}$)	Standard Deviation
Innovative Work Behavior	244	4.27	0.48
Idea Generation and Realization	244	4.08	0.60
Idea Promotion	244	4.63	0.49
Knowledge Sharing	244	4.38	0.70

To examine whether the Innovative Work Behavior and Knowledge Sharing Scale differ according to their sub-dimensions, a t-test was conducted for unrelated samples. Accordingly, the data presented in Table 3 show that the Innovative Work Behavior mean score is very high ($\bar{x}$=4.27). Similarly, the mean score of the Knowledge Sharing Scale was determined to be at a very high level ($\bar{x}$=4.38). The differentiation of the mean scores of the Innovative Work Behavior and Knowledge Sharing Scale according to the gender of special education teachers is shown in Table 4.

Table 4. The Difference Between Innovative Work Behavior and Knowledge Sharing Scale Mean Scores According to Teachers' Gender

Scale and Sub-Dimensions	Groups	n	Mean ($\bar{x}$)	SD	t	p
Innovative Work Behavior	Man	75	4.19	0.50	-1.57	0.119
	Woman	169	4.30	0.47		
Idea Generation and Realization	Man	75	3.99	0.65	-1.60	0.110
	Woman	169	4.12	0.57		
Idea Promotion	Man	75	4.60	0.51	-0.72	0.472
	Woman	169	4.65	0.48		
Knowledge Sharing	Man	75	4.26	0.76	-1.87	0.063

According to the data in Table 4, the mean scores of the Innovative Work Behavior Scale and the Knowledge Sharing Scale did not differ significantly in any of the sub-dimensions depending on the gender of the special education teachers. Accordingly, the scores obtained from the sub-dimensions of the scale are close to each other in terms of the genders of the special education teachers. The differentiation of the mean scores of the Innovative Work Behavior and Knowledge Sharing Scale according to the education level of special education teachers is shown in Table 5.

Table 5. The Difference Between Innovative Work Behavior and Knowledge Sharing Scale Scores According to Teachers' Educational Status

Scale and Sub-Dimensions	Groups	n	Mean ($\bar{x}$)	SD	t	p
Innovative Work Behavior	Bachelor	201	4.25	0.49	-1.28	0.203
	Postgraduate	43	4.35	0.44		
Idea Generation and Realization	Bachelor	201	4.06	0.61	-1.28	0.150
	Postgraduate	43	4.20	0.51		
Idea Promotion	Bachelor	201	4.63	0.48	-0.25	0.799
	Postgraduate	43	4.65	0.53		
Knowledge Sharing	Bachelor	201	4.39	0.68	0.43	0.669

According to the data in Table 5, the mean scores of the Innovative Work Behavior Scale and the Knowledge Sharing Scale did not differ significantly in all of the sub-dimensions of the scale according to the educational status of the special education teachers. Accordingly, the scores obtained from the sub-dimensions of the scale form the impression that the special education teachers do not change according to their educational status. Table 6 shows the differentiation of the mean scores of the Innovative Work Behavior and Knowledge Sharing Scale according to the type of institution where special education teachers work.

Table 6. The Difference Between Innovative Work Behavior and Knowledge Sharing Scale Scores of Special Education Teachers According to Institution Type

Scale and Sub-Dimensions	Groups	N	Mean ($\bar{x}$)	SD	t	p
Innovative Work Behavior	State	159	4.29	0.46	1.08	0.282
	Private	85	4.22	0.52		
Idea Generation and Realization	State	159	4.11	0.57	1.10	0.274
	Private	85	4.03	0.64		
Idea Promotion	State	159	4.65	0.49	0.52	0.607
	Private	85	4.61	0.49		
Knowledge Sharing	State	159	4.39	0.68	0.22	0.823
	Private	85	4.37	0.72		

According to the data in Table 6, the mean scores of the Innovative Work Behavior Scale and Knowledge Sharing Scale did not differ significantly according to the type of institution they work in. In this context, the scores obtained from the sub-dimensions of the scale show that the special education teachers do not change according to the type of institutions they work. The differentiation of the mean scores of the Innovative Work

Behavior and Knowledge Sharing Scale according to the professional seniority of special education teachers is shown in Table 7.

Table 7. The Difference Between Innovative Work Behavior and Knowledge Sharing Scale Scores According to Teachers' Professional Seniority

Scale and Sub-Dimensions	Groups	n	Mean ($\bar{x}$)	SD	SS		F	p	Difference
Idea Generation and Realization	0-5 Years	111	3.95	0.60					
	6-10 Years	43	4.18	0.50	In-group	3			
	11-15 Years	39	4.25	0.60	between groups	240	3.40	0.01	C>A
					Total	243			
	16 Years and Above	51	4.15	0.62					
Knowledge Sharing	0-5 Years	111	4.26	0.64					
	6-10 Years	43	4.41	0.59	In-group	3			
	11-15 Years	39	4.43	0.50	between groups	240	2.84	0.03	D>A
					Total	243			
	16 Years and Above	51	4.59	0.60					

According to the data in Table 7, the mean score of the idea generation and implementation sub-dimension of Innovative Work Behavior differed significantly according to the professional seniority of the special education teachers (F= 3.40; p= .01). Likewise, the Knowledge Sharing mean score differed significantly according to the seniority of the teachers (F= 2.84; p= .03), and the posthoc test was performed to determine between which groups the significant difference was. Before the test, the homogeneity of the variances was checked, and the variances were homogeneously distributed. As a result of the Tukey test, the average score of teachers with 11-15 years of professional seniority ($\bar{x}$=4.25) and the average score of teachers with 0-5 years of professional seniority ($\bar{x}$=3.95) was found to be significantly higher. The average score of Knowledge Sharing ($\bar{x}$=4.59) of teachers with a professional seniority of 16 years and above was significantly higher than the mean score of teachers with a professional seniority of 0-5 years. The relationship between the Innovative Work Behavior and Knowledge Sharing Scale mean scores is shown in Table 8.

Table 8. The Relationship Between Innovative Work Behavior and Knowledge Sharing Scale Mean Scores

Scale and Sub-Dimensions	1	2	3	4
Innovative Work Behavior	-			
Idea Generation and Realization	0.95*	-		
Idea Promotion	0.64*	0.37*	-	
Knowledge Sharing	0.51*	0.47*	0.36*	-

* $p < .001$

According to the data in Table 8, a moderate and positive correlation (r=.51, p<.001) was found between the Innovative Work Behavior Scale mean score and the Knowledge Sharing Scale mean score. There is a weak positive correlation between the mean score of the Idea Generation and Implementation and Supporting Idea sub-dimension and the Knowledge Sharing Scale mean score. Statistical data on the effect of Innovative Work Behavior on knowledge sharing are shown in Table 9.

Table 9. The Effect of Innovative Work Behavior on Knowledge Sharing

Independent Variable	Dependent Variable	B	SH	β	t	Sig.
Innovative Work Behavior Total	Stable	1.25	.34		3.65	.00
	Knowledge Sharing	.73	.08	.51	9.21	.00
	R=.51, R^2= .26	F=84.84	p=.00			
Idea Generation and Realization	Stable	2.14	.27		7.85	.00
	Knowledge Sharing	.55	.07	.47	8.30	.00
	R=.47, R2= .22	F=68.95	p=.00			
Idea Promotion	Stable	2.02	.40		5.09	.00
	Knowledge Sharing	.51	.09	.36	5.98	.00
	R=.36, R2= .13	F=35.76	p=.00			

The data in Table 9 show that innovative work behavior positively affects knowledge sharing significantly (β= .51, t= 9.21, p<.001) and explains it by 26%. In the research, the idea generation and application sub-dimension positively affected knowledge sharing significantly (β= .47, t= 8.30, p<.001) and explained it at a rate of 22%. In addition, the sub-dimension of supporting the idea had a significant positive effect on knowledge sharing (β= .36, t= 5.98, p<.001) and explained it by 13%.

DISCUSSION & CONCLUSION

Special education environments are perhaps one of the educational environments where knowledge sharing should be experienced most intensely. The developmental characteristics and needs of children with special needs studying in these educational environments, which are compatible with their inadequacies, naturally make it inevitable for teachers working with children with special needs to share information. Moreover, the changing dynamic structure of special education requires constant information and knowledge sharing in this context. For this reason, it is thought that knowledge sharing is an important variable that supports innovation in special education environments.

This research aimed to examine the effect of knowledge-sharing processes of special education teachers working in private education institutions on innovative work behavior. When the literature is examined, many studies examine knowledge sharing and innovative work behavior together with various variables (eg, motivation). However, no research has been found that directly examines the effect of knowledge sharing on teachers' innovative work behaviors, and the research conducted with teachers based on this research is limited (Dokuz, 2023; Lecat et al., 2018; Töre, 2019; Tura & Akbaşlı, 2021). For this reason, it is thought that the possible results of the research will contribute to the literature.

In the study, the participating teachers participated in the Innovative Work Behavior sub-dimensions of "generating and implementing the idea" and "supporting the idea" at a very high level (x=4.27), and again at a very high level (x=4.38) in Sharing Knowledge. The mean scores of the Innovative Work Behavior Scale and the Knowledge Sharing Scale did not differ significantly according to the gender of the teachers, the educational status of the teachers, and the type of the teachers' institution. However, teachers working in private education institutions are willing to share innovative work attitudes and knowledge. When the relevant literature is reviewed, the number of studies examining the effect of teachers' knowledge sharing on innovative work behaviors is limited. This finding of the study coincides with the results of other studies in the literature. For example, in studies conducted on teachers' innovative work behavior levels in general education environments teachers' innovative work behavior levels were very high (Töre, 2019; Bodur, 2019; Aslaner, 2010; Uzun, 2022). In different studies, a significant difference was found between knowledge sharing between intellectual capital and school type and seniority variables and school type gender and seniority variables. On the other hand, there was no significant difference between intellectual capital and gender and branch variables (Başar et al., 2014; Güngör and Celep,

2016). It is thought that the reason why knowledge sharing differs in different studies based on demographic variables such as completed school, gender, and seniority year may be due to the differences in the professions and the work environment in which that profession is practiced. For this reason, the fact that knowledge sharing did not make a statistically significant difference based on demographic variables in the study can be explained by the fact that the teaching profession supports knowledge sharing.

The mean score of the innovative work behavior idea generation and application sub-dimension differs significantly according to the seniority of the teachers. In the Idea Generation and Implementation sub-dimension, the average score of teachers with 11-15 years of professional seniority was significantly higher than the average of teachers with 0-5 years of professional seniority. The average score of Knowledge Sharing of teachers with a professional seniority of 16 years and above was significantly higher than the mean score of teachers with a professional seniority of 0-5 years. As the professional seniority of the teachers increases, knowledge sharing increases. This finding of the study can be explained by the increase in knowledge sharing due to professional seniority, the greater professional experience of teachers, and their assimilation of the corporate culture. In Bakioğlu's (1996) study on the career stages of teachers, 1-5 years of professional seniority is in the "career entry phase", and 6-10 years of professional seniority is "stopping". 11-15 years of professional seniority is "experimentation," 16-20 years are professional seniority is defined as "expertise" and 21 years or more is defined as "calm". The Career Entry Phase is the period when the teacher starts his/her career, and the teacher develops his/her vision by criticizing his/her social reality and his/her work. When the experimentation phase is considered from the point of view of the life cycle of the teachers, this phase is a period in which a high level of physical and mental ability is achieved, and in the expertise phase, professional competence increases. In this context, teachers who are new to the profession do not have sufficient experience in developing innovative work behavior and knowledge-sharing skills. In addition, teachers who have just started their profession can benefit from experienced teachers in sharing knowledge and developing innovative work behaviors. The results of the research show that professional seniority is one of the determining variables in the increase of knowledge sharing and innovative work behaviors.

In the research, innovative work behavior affects knowledge sharing, idea generation, and application sub-dimension positively affects knowledge sharing, and the idea support sub-dimension positively affects knowledge sharing. Therefore, for teachers working in special education environments to share more information, it is necessary to take measures to prevent the disadvantage of low professional seniority. Especially to develop innovative work behavior, it is necessary to differentiate the bureaucratic structures of the schools, to adopt and effectively implement effective leadership practices, and to experience innovative practices in the education process of teachers (Töre, 2019). In addition, teachers are expected to exhibit a participatory, encouraging, tolerant, and supportive approach by being aware of the roles and responsibilities of school administrators, and to lead the creation of an innovative school culture (Uzun, 2022). Teachers who tend to innovate in institutions should be supported (Kıroğlu & Albayrak, 2017). In addition, in-house in-service studies should be carried out periodically to increase knowledge sharing. Characteristics of children with special needs and the complex nature of disability can support knowledge sharing through case reports and create a basis for the emergence of innovative behaviors to solve potential problems.

Special education teachers constantly need up-to-date information to meet student's needs and learning needs. As an innovative work behavior, teachers can develop the skills to search for information, access resources, and share this information with colleagues. The Internet and other technological tools offer great opportunities for easy access and sharing of information. For this reason, special education teachers must facilitate access to information to meet the needs of children with special needs. In addition, working with children with special needs means collaborating with many people. Special education teachers are in frequent contact with other teachers, experts, families, and other stakeholders. As an innovative work behavior, teachers can share knowledge by communicating effectively. For this reason, special education teachers need to share information by increasing their cooperation with other people in the life of the child with special needs. In this context, communication technologies and social media platforms should be considered as facilitating factors for cooperation and knowledge sharing among teachers. Therefore, knowledge sharing can enable special education teachers to discover innovative teaching methods, tools, and resources. Moreover, knowledge sharing enables teachers to share new approaches, technologies, and best practices. Thus, it may be possible for innovative applications to become widespread and reach a wider area of influence.

It is important for teachers to constantly improve themselves and stay up to date, and knowledge sharing enables teachers to learn from colleagues, experts, and researchers. This provides teachers with the opportunity to develop their professional skills, gain new ideas and contribute to the continuous learning process. Knowledge

sharing helps teachers develop their innovation and creativity skills. In particular, sharing the latest information in the literature can offer teachers new ideas and perspectives, and this will allow teachers to re-evaluate existing methods and develop more effective and innovative approaches. In addition, networks and communities established among teachers should be considered an important part of knowledge sharing. For this reason, special education teachers should be in regular contact with their colleagues, share their experiences, and solve problems together. These communities encourage the emergence of innovative ideas and enable teachers to learn from each other. In addition, knowledge sharing will contribute to the development of innovative practices aimed at increasing the education quality of students. By experimenting with different methods, teachers can improve student's learning outcomes and provide better support to students at risk of failure.

As a result, knowledge sharing stands out as a fundamental element of innovative work behaviors for special education teachers. This supports teachers' efforts to increase continuous learning, collaboration, innovation, and student achievement. Thanks to knowledge sharing, teachers can follow the developments in the sector, share their knowledge and experiences, and serve their students more effectively. Knowledge sharing enables teachers to learn from each other and share best practices in the process

Limitations

Conducting this research with special education teachers can be considered as the only limitation of the research.

Statements of Publication Ethics

Ethical permission was obtained from the ethics committee of Çanakkale On Sekiz Mart University with the decision dated March 3, 2022, and numbered 05/29.

Researchers' Contribution Rate

The authors collaboratively worked on each part of this study. Author contributions are shown in the table below.

Authors	Literature review	Method	Data Collection	Data Analysis	Results	Conclusion
Sinan Kalkan	☒	☒	☒	☒	☒	☒
Hasan Hüseyin Selvi	☒	☐	☒	☒	☒	☒

Conflict of Interest

The authors state that they have no conflicts of interest. All co-authors have reviewed and approved the manuscript's contents, and there are no conflicting financial interests to disclose. We confirm that the submission is original and is not currently under consideration by another publisher

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Unlocking the Science in English Coursebooks: A Critical Exploration of Scientific Literacy[1]

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Abstract

Science is advancing at a rapid pace and the ability to understand it has become a universal necessity. Countries aim to cultivate individuals who comprehend the nature of science, keep up with scientific advancements, and can generate solutions for local and global challenges. Enhancing scientific literacy is generally perceived as one of the primary goals of science education. However, relying solely on science courses to impart this knowledge is not a rational approach. English courses are among the subjects that can contribute to students' scientific literacy enhancement. This is because English lessons require presenting content to students using contemporary language teaching approaches in a meaningful and specific context. One of the most important tools for providing this content is coursebooks. This research investigated the extent to which English coursebooks contribute to scientific literacy through an interdisciplinary perspective. In this study, coursebooks used at fifth, sixth, seventh, and eighth-grade levels at state schools in Turkey were analyzed. The research results revealed that all the examined coursebooks contained activities related to scientific literacy. It was founded that as the learning level increased, components of scientific literacy were more integrated into the coursebooks. In terms of the dimensions of scientific literacy, the scientific process dimension was the most represented in coursebooks with 65 activities. In light of these findings, it was evident that English coursebooks have the potential to contribute to the development of scientific literacy.

Keywords: Scientific literacy, English coursebooks, Interdisciplinary approach

İngilizce Ders Kitaplarında Bilimi Açığa Çıkarmak: Bilimsel Okuryazarlık Üzerine Eleştirel Bir İnceleme

Öz

Bilim hızla ilerlerken, bilimi anlama yeteneği artık evrensel bir gereklilik olarak kabul edilmektedir. Ülkeler, bilimin doğasını kavrayan, bilimsel gelişmeleri takip eden ve hem yerel ve hem küresel sorunlara çözüm üretebilen bireyler yetiştirmeyi hedeflemektedir. Bilimsel okuryazarlığı artırmak, genellikle fen eğitiminin temel hedeflerinden biri olarak kabul edilir. Ancak, bilimsel okuryazarlığı sadece fen derslerine dayandırmak mantıklı bir yaklaşım değildir. İngilizce dersleri, öğrencilerin bilimsel okuryazarlıklarının gelişmesine katkıda bulunabilecek dersler arasındadır. Çünkü, İngilizce dersleri öğrencilere çağdaş dil öğretimi yaklaşımlarını kullanarak belirli bir bağlamda anlamlı içerik sunmayı gerektirmektedir. İçeriği sunmak için kullanılan en önemli araçlardan biri de ders kitaplarıdır. Bu araştırma, İngilizce ders kitaplarının disiplinler arası bir perspektif ile bilimsel okuryazarlığa ne ölçüde katkı sağlayabileceğini incelemiştir. Bu çalışmada, Millî Eğitim Bakanlığına bağlı devlet okullarında beşinci, altıncı, yedinci ve sekizinci sınıf seviyelerinde kullanılan ders kitapları analiz edilmiştir. Araştırmanın sonucunda, incelenen tüm ders kitaplarında bilimsel okuryazarlığı artırmaya yönelik etkinliklerin olduğu görülmüştür. Öğretim seviyesi arttıkça, bilimsel okuryazarlık ile ilişkili aktivitelerin ders kitaplarında daha fazla yer aldığı sonucuna ulaşılmıştır. Bilimsel okuryazarlık boyutları açısından bakıldığında, bilimsel süreç becerileri boyutunun 65 etkinlik ile ders kitaplarında en fazla temsil edilen boyut olduğu görülmüştür. Bu bulgular ışığında, İngilizce ders kitaplarının bilimsel okuryazarlığın geliştirilmesine katkıda bulunma potansiyeline sahip olduğu söylenebilir.

Anahtar kelimeler: Bilimsel okur yazarlık, İngilizce ders kitapları, Disiplinler arası yaklaşım

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INTRODUCTION

Science is advancing quickly in the century we are living in. The ability to understand science is a universal prerequisite for people who don't want to feel isolated from their community or overwhelmed and disheartened by change (United Nations Educational Scientific and Cultural Organisation, 1993). The significance of scientific literacy lies in addressing global predicaments like climate change, energy resources, and public health, which necessitate not only scientific know-how but also effective communication and cooperation across diverse cultural and linguistic backgrounds. Therefore, countries need individuals who understand the nature of science, follow scientific developments, and produce solutions to local and global problems. These individuals are able to create and use scientific knowledge for the growth and prosperity of their society. However, the vast majority of people in a variety of countries are illiterate when it comes to science (BouJaoude, 2002; Özdem et al., 2010). As a result, nations must educate individuals who can understand and use science. In other words, one of the fundamental aims of nations is to improve citizens' scientific literacy. Therefore, scientific literacy has been integrated into educational processes to reach the desired improvements in several educational reforms (Çakici, 2012; Turgut & Fer, 2006).

The significance of scientific literacy has been acknowledged in diverse fields, including education. Initially, scientific literacy can promote interdisciplinary learning and foster a deeper understanding of the world. As noted by Roth and Barton (2004), science is not an isolated subject but a way of understanding the natural and social world. For example, a variety of scientific concepts have connections to language, literature, and culture. In addition, scientific literacy can aid students in fostering the consciousness of worldwide concerns and becoming accountable individuals, as argued by Bybee (1997a).

Considering the essential role of scientific literacy, the aim of science education is to develop individuals who possess a deep understanding of scientific concepts and capabilities (Holbrook & Rannikmae, 2009). Given the numerous difficulties relating to science and technology in today's society, people must be literate in science. However, the idea that scientific literacy is only related to science lessons is not an appropriate inference (Özdem, et al., 2010). Correct comprehension and interpretation of science are intimately tied to the capacity to integrate science with other subjects and apply scientific knowledge and abilities across all disciplines (Özdem et al., 2010). Integrating scientific literacy into lessons across a range of subjects can have two important benefits. First, it can help students develop their scientific decision-making abilities and deepen their understanding of science. Second, as these skills are used in other fields, scientific literacy can become more widespread throughout society.

As stated above, it is necessary to present scientific literacy through other courses. Among these courses, English, as a foreign language, can be an agent for developing scientific literacy. Because, in the course materials used in English language teaching, contents for different fields such as science subjects are presented. In this regard, it is quite probable that scientific literacy can find a place in English coursebooks. Consequently, by integrating scientific topics into English coursebooks, students can broaden their perspectives and make connections between different fields of knowledge.

While English coursebooks have been the subject of various studies such as the views of English language instructors (Akhgar, et al., 2017), the consistency with students' needs (Papajani, 2015), the language skills they focus on (Xiao-jie, 2017), the extension of anthropocentric perspective they include (Yastibas, 2020), it is noteworthy that none have specifically assessed their relationship with scientific literacy. To our best knowledge, there is no study focusing specifically on scientific literacy in English coursebooks. Therefore, this study would contribute to the literature with regards to how English coursebooks relate to science or to what extent their content reflects scientific literacy. This study endeavors to make a valuable and original contribution to the existing body of academic literature by advancing our understanding of the interplay between language education and scientific literacy promotion. In this regard, the current research addressed the following research questions.

1. How comprehensively do English coursebooks address themed topics in scientific literacy?
2. Which scientific literacy sub-dimensions are highlighted in the activities of English coursebooks?

Literature Review

There is no scientific literacy paradigm that all researchers can agree on. The phrase has been used to refer to a wide range of ideas and interpretations since it was first coined in the 1950s (Holbrook & Rannikmae, 2009; Mc Eneaney, 2003). However, to measure scientific literacy, the framework generally includes four themes, that is, science as a body of knowledge, science as a way of investigating, science as a way of thinking, and the interaction among science, technology, and society (Chiappetta, et al., 1991; Chiappetta, et al., 1993). Many

studies followed this framework since it comprises essential elements that are included in practically all definitions of the concept (Bybee & McCrae, 2011; Xuan, et al.,, 2019). The facts, ideas, principles, rules, hypotheses, theories, and models of science required for a person to be scientifically literate are referred to as the knowledge domain (BouJaoude, 2002; Chiappetta et al., 1991). The term science as a way of investigating refers to the methods and abilities used in scientific investigation, such as observing, measuring, classifying, and inferring. The third component, science as a way of thinking corresponds to a focus on how people think, reason, and reflect while creating new scientific knowledge (Chiappetta et al., 1991). The final component of scientific literacy, the interaction among science, technology, and society, refers to the influence of science on society and how society, technology, and science are related (Chiappetta et al., 1991).

This framework was revised by different researchers since the concept of scientific literacy and the traits of scientifically literate people have both been influenced by the world's rapid change. As a result of rapidly changing scientific literacy, some components were inserted such as the use of science in everyday decision-making (BouJaoude, 2002), the effective side of science (Cansiz & Cansiz, 2019; OECD, 2017), and the interrelationship of environment with science, technology, and society (Cansiz & Cansiz, 2019; OECD, 2017; Xuan et al., 2019). Although they include four major scientific literacy dimensions, their sub-dimensions vary in terms of the number of items to measure scientific literacy. In addition, the majority of these frameworks have been designed to evaluate science coursebooks (e.g., biology, physics, chemistry) and science curriculums whose major aim is to improve scientific literacy. In the current study, we utilized the framework of Xuan et al., (2019) because the main aim of English coursebooks is not only to improve scientific literacy but to increase language learners' knowledge and competence in the target language. This framework, therefore, is more suitable for the aim of this research since it is prepared for evaluation of the geography curriculum, that is, a subject different from the science curriculum. The components of the scientific literacy framework are presented in Figure 1.

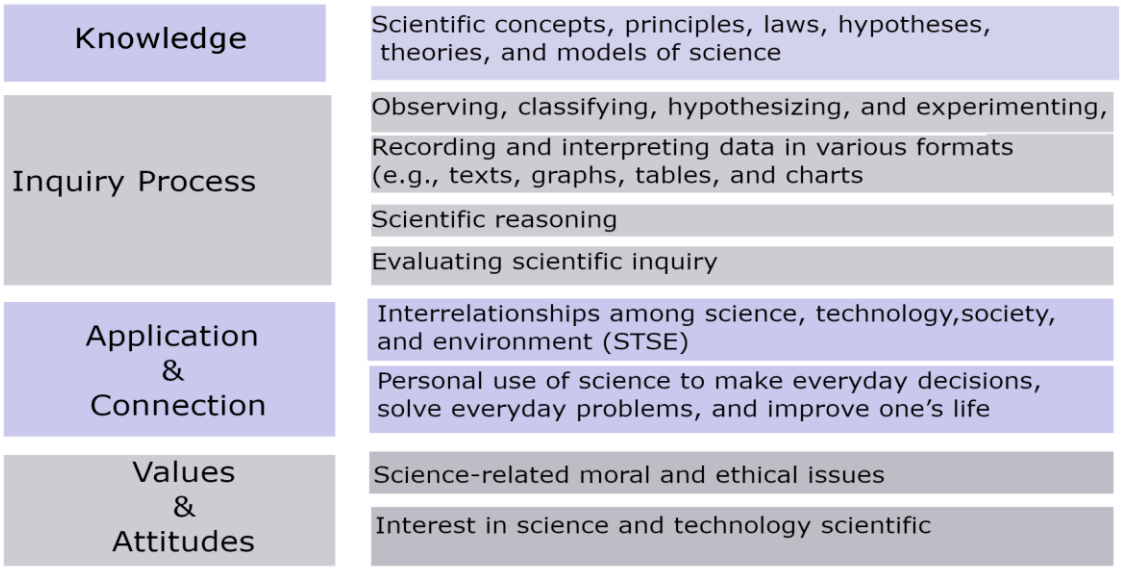

Figure 1. Dimensions of Scientific Literacy

As can be detected from the figure, the inquiry process aspect of scientific literacy was generated by creating "the investigative nature of science" and "science as a way of knowing,". In addition, the affective aspect of scientific literacy was also inserted into the framework with the title of "values and attitıdes".

In light of this framework for scientific literacy, English coursebooks that incorporate scientific topics may provide students an opportunity to develop their scientific literacy and improve their language skills. It is plausible to conclude that science-related topics which are integrated to improve scientific literacy in English coursebooks can also enhance students' language skills. Scientific language is technical and precise, and the use of scientific vocabulary in English coursebooks can help students to expand their English vocabulary and improve their reading and writing skills.

Teaching English as a second language may facilitate scientific literacy as a part of the educational process. Teaching resources, particularly English language coursebooks can be utilized to link English language instruction with scientific literacy. In other words, coursebooks play a crucial role in the learning process in varied learning environments, and having access to high-quality coursebooks can assist students' achievement (Wen-Cheng et al., 2011). Coursebooks significantly influence the progression of learning as they often function as the principal

knowledge source across diverse classroom environments (Chiappetta et al., 1991). Their content and organization directly shape not only what is taught but also how it is delivered, ultimately serving as the primary guide for the curriculum in practice (Chiappetta & Koballa, 2002; Ramnarain & Chanetsa, 2016).

The Ministry of National Education (MoNE, hereafter) is the only responsible institution that regularizes national curricula and coursebooks. Considering the new developments in language teaching methodology, MoNE updated the English language education curriculum and coursebooks prioritizing the communicative aspect of language teaching with a meaningful, contextual, and interdisciplinary perspective. Therefore, the content of the English curriculum holds a significant place in teaching because several contents and skills can easily be transferable to other areas. Integration of content in language education is handled in two ways. One is the integration of language skills such as reading and writing; the other is the integration of different themes of other disciplines into English courses. For instance, the integration of a science theme such as environment can be handled in an English lesson. With an interdisciplinary perspective, students become more motivated towards learning and grasp the value of the things they learn, and become active during the learning process (Aksoy, 2011).

English language teaching was regarded as an academic subject to be learned by concentrating on the acquisition of linguistic structures and vocabulary rather than the interaction of people via the language (Kırkgöz, et al., 2016). Later, the English language teaching curriculum has shifted from the traditional aspect of teaching such as grammar and vocabulary to a more experiential perspective with a focus of communication in English and daily usage. Whatever the methods teachers use, it should be considered that the content of English coursebooks should be presented in a meaningful and contextualized way. Therefore, contents of other disciplines such as science can effectively be used in English coursebooks. In this respect, Aksoy (2011) informs that the integration of interdisciplinary materials into English coursebooks is not a new concept, and it is applied in courses like English for specific purposes. Content-based instruction (CBI) which is a communicative approach in language teaching lets learners focus on learning subjects instead of the language itself. In this respect, CBI is defined as a method that initializes subject matter, benefits from authentic materials, increases the knowledge of learners about the new information, and pays attention to individual needs (Leaver & Stryker, 1989). That is, content-based instruction, which combines the contents of other disciplines with English courses, is the method that helps present the content contextually and may lead to communication practices of learners.

As understood from the explanations above, content integration of different subjects is the main point of interdisciplinary perspectives, which facilitate the interaction of interdisciplinary teaching approaches. Therefore, this study investigates to what extent science topics are integrated into English coursebooks in terms of scientific literacy. It is evident that interdisciplinary teaching is an appropriate approach for foreign language teaching because developing students' communicative skills is highly important with the content integration of other subjects like science (Aksoy, 2011). In other words, the integration of contents with an interdisciplinary perspective helps learners acquire the topics in connected and meaningful ways (Aladağ & Sert, 2020).

METHOD

Research Design

In this study, the document analysis method was employed. Document analysis is a form of qualitative research method, which is performed to review or assess a variety of documents (Bowe, 2009). Therefore, researchers analyze materials that contain information about concepts, events, and situations which are the basic aim of the research. The document analysis approach was purposefully chosen in our research as it perfectly complements our main objective of revealing the scientific aspects of English coursebooks and examining their potential contribution to the development of scientific literacy. The evaluation of textual and audio activities in English textbooks in terms of scientific literacy was clearly revealed through document analysis. In this study, English coursebooks were used as the documents.

Data Selection

5th, 6th, 7th, and 8th grade English coursebooks used in Turkey's secondary state schools in the 2022-2023 academic years were determined as data sources (See appendix). Although there are different books used in each grade, we randomly selected only one coursebook from each grade since the contents of the books in each grade are similar. For instance, the main themes of the 5th grade English coursebooks published by different publishers are the same. That is, the contents of the books include similar topics and activities. In addition, the current research was limited only with the books of English teaching programs of secondary schools. All the coursebooks include

ten units that focus on different themes. By taking into account the scientific literacy framework, activities in the English coursebooks were examined.

Data Analysis

Researchers analyzed English coursebooks via the content analysis technique. Content analysis is defined as the systematic categorization of qualitative or quantitative data according to predetermined themes or groups (Cohen et al.,, 2007; Fraenkel et al., 2012). There were three steps in this research for data analysis. We first searched the literature on scientific literacy to determine the appropriate framework to evaluate English coursebooks. Accordingly, we preferred a revised scientific literacy framework suggested by Xuan et al. (2019) as explained in the literature review. The nature of the study was discussed before coding the data. Agreement was also reached on the meanings of the selected aspects of scientific literacy and the content-relatedness of scientific literacy in the context of English coursebooks. In the second step, evaluation criteria in the context of the determined conceptual framework were defined, taking into account articles (e.g., Chiappetta, et al., 1993; DeBoer, 2000, OECD, 2017) on the topic of scientific literacy. The categories and guidelines for reviewing English coursebooks are outlined below.

- Knowledge: Activities in this category may include the following elements.
    - The scientific knowledge to be learnt should be presented.
    - The knowledge presented to the students can be different types of scientific knowledge such as concepts, principles, laws and theories.
- Inquiry process: The main aim of activities in this category is to have students answer a question or problem through thinking and action.
    - Such activities encourage students to use scientific process skills such as observing, measuring, classifying, drawing conclusions and recording data.
    - Activities suitable for this dimension include answering a question using given information, a graph or table, making a calculation or drawing a conclusion by comparing given values, or drawing a conclusion by reasoning.
- Application and Connection: The activities within this category are designed to illustrate the social impacts and outcomes of science. This facet of scientific literacy focuses on the practical application of science and the role of technology in benefiting or obstructing humanity, often delving into social matters.
    - Common features of activities in this dimension include explaining the benefits of science and technology to society, discussing social issues related to science or technology, and highlighting careers and jobs in science.
    - Applying scientific knowledge and principles in individual's daily lives to help them make informed choices, address common issues, and enhance their overall well-being.
- Values and Attitudes: Students' attitudes, beliefs, motivational orientations, self-efficacy and values are the focus of this type of activity.
    - Activities that focus on an interest in science and technology, environmental awareness and appreciation of scientific approaches to research are common features of the activities.
    - Activities may also focus on being responsible for personal, local, and global issues and respecting ethical standards.

Considering the framework and evaluation criterias, researchers independently examined each activity in the coursebooks including listening audios, and coded them into one of the components of scientific literacy by using MAXQDA 20 qualitative data analysis software. In the final step, they compared their analyses and found that there was an 87.2% consistency between the researchers based on the formula of total number of agreement between the raters divided by total number of agreement and disagreement (Miles & Huberman, 1994). The interrater reliability was calculated and found to be statistically significant (Cohen's Kappa = .743, $p < .000$), which indicates excellent agreement among the researchers, based on Landis and Koch, (1977) criteria.

Research Ethics

In our research, we have employed document analysis as the primary method of investigation. Therefore, it is not required to get any ethical permission concerning this research.

FINDINGS

Coverage and Depth of Science Process Skills in English Coursebooks

The science content in the English coursebook covers a range of topics, from health and nutrition to technology and natural forces. While there are similarities across the grade levels, such as a focus on health and the environment, each grade level introduces new and different topics, allowing students to develop a diverse and well-rounded understanding of science.

Table 1. Distribution of Units On Scientific Literacy

Grade 5	Grade 6	Grade 7	Grade 8
Health (Unit 5)	Yummy Breakfast (Unit 2)	Biographies (Unit 3)	On the Phone (Unit 4)
Animal Shelter (Unit 9)	Whether and Emotion (Unit 3)	Wild Animals (Unit 4)	The internet (Unit 5)
	Saving the Planet (Unit 9)	Dreams (Unit 7)	Adventure (Unit 6)
		Environment (Unit 9)	Chores (Unit 8)
		Planets (Unit 10)	Science (Unit 9)
			Natural Forces (Unit 10)

Table 1 shows that English coursebooks span various science topics across grade levels. In the 5th grade, they focus on health and animal welfare. In the 6th grade, topics include food choices, weather, and environmental conservation. The 7th-grade book covers scientists, wild animals, dreams, and the universe, while the 8th grade delves into technology, time management, physics, chemistry, and natural forces. These diverse topics engage students across different grades.

The science content covered in the English coursebooks varies significantly across the different grade levels, but some similarities can be drawn. For instance, there is a consistent focus on health and the environment throughout the four grades. In the 5th grade book, students learn about healthy eating and exercise, while in the 6th grade one, they continue to explore the science behind nutrition and also delve into environmental issues such as climate change. Similarly, the 7th-grade book includes a unit on the environment, and in the 8th-grade book, students learn about natural forces that shape the planet.

The coursebooks include sixteen units across four grade levels, with some of them containing a substantial amount of scientific content. In the 5th grade coursebook, only one out of the two units, "health", falls under the scientific domain. In the 6th grade coursebook, two out of three units are directly related to science content, "Yummy Breakfast" and "Saving the Planet", while "Whether and Emotion" cover limited activities related to scientific literacy. The 7th-grade coursebook has a total of three units, which are strongly related to science content out of five units, namely, "Environment", "Wild Animals", and "Planets". Lastly, in the 8th-grade coursebook, two out of six units, "Science" and "Natural Forces", are directly related to scientific literacy, while the other four units do not. Overall, eight units out of fifteen are totally dedicated to scientific literacy across all four grade levels. In conclusion, English coursebooks serve as valuable tools for imparting scientific literacy to learners.

In the present study, a comprehensive analysis of all activities within the units of English coursebooks for grades 5, 6, 7, and 8 was carried out. Furthermore, the number of activities specifically related to scientific literacy was determined as shown in Table 2.

Table 2. Number of the Activities inside the English Coursebooks

	Grade 5	Grade 6	Grade 7	Grade 8
Scientific Literacy related activities	11	24	73	52
Percentage of Scientific Literacy related activities	4.7%	9.4%	33.7%	20.39%
Total number of activities	234	253	216	255

As shown in Table 2, a total of 234 activities were identified in the 5th-grade book, 253 in the 6th-grade book, 216 in the 7th-grade book, and 255 in the 8th-grade book. Upon closer examination, it was observed that the proportion of activities related to scientific literacy varied across grade levels. In the 5th-grade book, 11 out of 234 activities (4.7%) were found to be associated with scientific literacy. This proportion increased to 9.4% (24 out of 253 activities) for the 6th-grade book. A more substantial rise was observed in the 7th-grade book, with 73

out of 216 activities (33.7%) being related to scientific literacy. However, the 8th-grade book showed a decrease in this proportion, with 52 out of 255 activities (20.39%) being linked to scientific literacy.

Dimensions of Scientific Literacy Across Grade Levels

The results of this study reveal the distribution of activities related to the dimensions of scientific literacy in English coursebooks across grade levels. The dimensions of scientific literacy include Knowledge, Inquiry Process, Application & Connection, and Values and Attitudes. The analysis of the activities also reveals a distinctive distribution pattern, which is presented in Table 3.

Table 3. Distribution of Scientific Literacy Dimensions Across Different Grade Levels

	Grade 5	Grade 6	Grade 7	Grade 8	Total
	f	f	f	f	f
Knowledge	1	3	25	9	38
Inquiry process	7	9	26	23	65
Application & Connection	2	12	11	15	40
Values and Attitudes	3	10	21	11	45
Total	13	34	83	58	188

Among the four dimensions, the Inquiry Process dimension had the highest number, with a total of 65, indicating a strong emphasis on fostering students' skills to investigate scientific concepts and develop problem-solving abilities. The Values and Attitudes dimension comprised 45 activities highlighting the importance of nurturing students' understanding of the ethical, social, and cultural implications of science. The Knowledge dimension encompassed a total of 38 activities, which reflect the focus on building a solid foundation of scientific concepts and principles. Lastly, the Application and Connection dimension included 40 activities, emphasizing the relevance of applying scientific knowledge to real-world situations and promoting interdisciplinary connections. Overall, the distribution of activities across the dimensions of scientific literacy underscores the diverse aspects of science education and the need for a balanced approach to nurturing well-rounded scientific literacy skills in students. Table 4 shows the sample activities included in various dimensions of scientific literacy.

The knowledge dimension is exemplified by many activities, for example, an activity in the nineth unit of the sixth grade book focusing on the 3R rules of reuse, reduce, and recycle. This activity serves to inform students about environmentally friendly practices and their importance in daily life. The inquiry process dimension is represented by some activities as in the example of students classifying planets based on their certain characteristics, such as distance from the sun and size in tenth unit of the seventh grade book. With respect to the application and connection dimension, an example can be given through an activity located in the fourth unit of the seventh grade book. In this activity students discuss ways to protect endangered animals, engaging students in real-world problem-solving. Lastly, the values and attitudes dimension is examplified in a passage of the eighth unit of eighth grade book describing Japanese students' environmental cleaning practices, highlighting their moral responsibilities and prompting learners to reflect on their values and attitudes.

The analysis of the activities in the English coursebooks revealed that some activities encompassed multiple dimensions of scientific literacy, further illustrating the complexity of the subject matter. For example, in the 7th-grade coursebook, five activities were found to address two distinct scientific literacy dimensions, while three activities simultaneously covered three different dimensions. The incorporation of various dimensions of scientific literacy within activities in English coursebooks can provide students with a comprehensive understanding of scientific concepts and their real-life applications. One such activity, featuring a dialogue between Aslı and Betty in the tenth unit of the eight grade book, effectively demonstrates the integration of multiple dimensions of scientific literacy, specifically “knowledge” as well as the sub-dimensions of “interrelationships among science, technology, society, and environment”, and “personal use of science to make everyday decisions and solve everyday problems”.

In the dialogue mentioned above, Aslı raises concerns about the Amazon Forests' destruction and the effects of climate change, stating that "Nearly 60% of them will disappear by 2030 because people cause an enormous destruction in this area" and "climate change because of global warming has negative effects on these forests." This part of the conversation showcases a sample for the knowledge dimension of scientific literacy. The dimension of Application & Connection becomes apparent when Betty asks, "You're right but what shall we do about this? We can't cope with this.", which demonstrates the need for personal involvement in addressing environmental challenges. Aslı highlights the importance of individual action in addressing environmental challenges, explaining, "I'm sure if we take precautions individually, it will be significant as a whole. This world is our home. So, I think we should shoulder responsibilities to save it.". This part of the conversation illustrates

the sub-dimensions "interrelationships among science, technology, society, and environment," and “the personal use of science in everyday contexts”.

The comparison of activities across the grade levels indicates that the Inquiry Process dimension has the highest number of activities overall, followed by Values and Attitudes, Knowledge, and finally, Application & Connection. When comparing the distribution of activities within each dimension, it becomes evident that the Knowledge dimension experiences a significant increase in activities from grade 6 to grade 7, while the other grades exhibit relatively fewer activities. In contrast, the Inquiry Process dimension displays a more balanced distribution across the grade levels, with a slight increase in activities from the 6th-grade to the 7th-grade book and a more substantial increase from the 7th-grade to the 8th-grade book. For the Application & Connection dimension, there is an observable growth in activities from the 5th grade to the 6th grade, followed by a relatively stable number of activities in the 7th-grade and 8th-grade books. The Values and Attitudes dimension exhibits an increase in activities from the 5th grade to the 6th grade and a further increase from the 6th grade to the 7th grade, followed by a slight decrease in activities in the 8th-grade book.

In summary, the distribution of activities related to the dimensions of scientific literacy varies across grade levels, with a general trend of increasing numbers of activities as the grade levels progress. The Inquiry Process and Knowledge dimensions receive particular emphasis in the English coursebooks, suggesting that these aspects of scientific literacy are prioritized as students advance through their education.

DISCUSSION & CONCLUSION

To answer the first research question regarding to what extent English coursebooks cover scientific literacy, the findings indicate that a variety of topics like health, planet, technology, etc. are connected with scientific literacy. Students are exposed to elements of scientific literacy in their English language courses, even if the specific term "scientific literacy" is not explicitly mentioned in the curriculum. When the coursebooks are analyzed based on their grade level, we can say that when the grade levels of the students increase, it is more probable for students to encounter scientific topics in English coursebooks. The current study indicates that the seventh and eighth-grade English coursebooks include more themed units related to scientific literacy than the fifth and sixth-grade coursebooks do. In a similar vein, the number and percentage of activities related to scientific literacy out of all the activities dramatically increase in the seventh and eighth-grade English coursebooks. For instance, the percentage of activities related to scientific literacy is around five percent in the fifth-grade book; however, this number increases by nearly 34 percent in the seventh-grade English coursebook. Therefore, it can be maintained that scientific literacy becomes more visible in the seventh and eighth-grade English coursebooks than in the fifth and sixth-grade ones. People’s need for science increases more as individuals begin to integrate into society because global problems that can be solved through science become the problems of individuals. For example, climate changes and genetically modified organisms can be the problems of every individual as well as the problems of societies. Therefore, increasing students’ scientific literacy may enable individuals to find reasonable solutions to these problems. At this point, the increase in the number of activities related to scientific literacy in English coursebooks as the grade level increases can be considered as a strategy to address the social problems that students may encounter. Because scientific literacy not only meets the needs of people who deal with science but also responds to the needs of all people to adapt themselves to the challenges of a rapidly changing world (Holbrook & Rannikmae, 2009). Similarly, it was stressed that scientific literacy development of students is an ongoing process starting from the early years of education (Krontiris-Litowitz, 2003; Shaffer et al., 2019). Thus, an increase in the scientific activities in the coursebooks based on the grade levels may contribute to the ongoing development of scientific literacy.

Scientific literacy is not only limited to the knowledge level of people but related to the changes in the natural world that are shaped by people’s scientific decision-making and acting processes. In this regard, maturation can play a significant role in students’ understanding of scientific knowledge since some scientific literacy attributes can be gained at later times. For instance, the nature of science education includes several attributes such as the nature of science, personal development, and social development attributes (Holbrook & Rannikmae, 2009). In other words, students need to have some intellectual capacity such as understanding the basic concepts of science as well as other higher-order thinking skills and attributes such as interdisciplinary perspective. That is, through maturation, students get the ability to connect science and other human endeavors such as learning a foreign language and relating some aspects of science with their personal lives and societal issues. ıt can be concluded that when the ages of students increase as in the example of this study, students’ understanding of scientific literacy may advance depending on their ages. On the other hand, cognitive

development of learners may facilitate the acquisition of scientific concepts as well as a second language learning. For instance, Barac, et al., (2014), in their review study on the cognitive development of bilingual learners, revealed that bilingual children have more advanced capacity than the monolingual children. It can be said that learning a language other than mother tongue may increase the students' cognitive capacities and hence they can be more successful in other topics as a result of their cognitive development. Similarly, Jia et al., (2006) acknowledged in their study on the verb processing in different age groups of bilingual learners that those who are older age groups significantly outperformed in the correct usage of English. Therefore, it can be said that maturation is an indispensable aspect of learning in that students who are in older ages may have more cognitive capacity and development and their cognitive development may facilitate the acquisition of scientific literacy as well as English. Henceforth, adding more themed units and more scientific literacy-related activities in the seventh and eighth grades English coursebooks seems meaningful as the density of scientific literacy-related activities increases depending on the maturation of learners.

Another considerable point is related to how relevant the science concepts are to the personal lives of students. Holbrook and Rannikmae (2009) emphasize that the relevance of school science is vital for the advancement of scientific literacy. In other words, when the students' perception toward the content of scientific literacy is satisfied by considering their personal and career goals, such relevance may trigger the students' motivation toward learning scientific concepts as well as English learning as they are handled together. From the teaching perspective, relevance can be connected with the initial effect of learning. With relevance, students can get answers to the question of why we study this. In other words, it may create a perception that being scientifically literate may be useful, meaningful, helpful for their understanding of the world, and effective for the regulation of their personal lives.

Considering the second research question, the English coursebooks analyzed in this study encompass a diverse range of activities related to scientific literacy, including all sub-dimensions of scientific literacy. As scientific literacy encompasses multiple dimensions, overlooking certain aspects or disproportionately emphasizing one aspect will inevitably impact educational results. As future members of society, students should possess at least a basic understanding of different aspects of scientific literacy since they will encounter science-related issues in their lives even if they do not pursue careers in scientific fields (Krajcik & Sutherland, 2010). Consequently, previous studies have primarily focused on determining the extent to which curricula and coursebooks incorporate scientific literacy. Accordingly, science curricula exhibit a disproportionate emphasis on a single dimension of scientific literacy, such as the knowledge aspect, while neglecting the consideration of the other aspects (Cansiz & Cansiz, 2019; Erdogan & Koseoglu, 2012). Contrary to the research on the evaluation of science coursebooks and curricula in the literature (e.g., Cansiz & Cansiz, 2019; Chiappetta et al., 1993) our investigation revealed that the components of scientific process skills were represented more evenly across a range of activities in English coursebooks. This balance might be due to the fact that the primary objective of English coursebooks is not to teach science concepts, but rather to develop language skills. The unique characteristic of English coursebooks, in which scientific process skills are more equitably represented, could potentially offer a solution to the imbalance found in science coursebooks concerning various dimensions of scientific literacy. By incorporating a more balanced approach to scientific literacy, English coursebooks may inadvertently provide students with a more comprehensive understanding of scientific concepts and skills. This, in turn, could contribute to a more well-rounded education, fostering scientific literacy development in conjunction with language acquisition.

English coursebooks have the potential to help students become more literate in science, which is important in today's increasingly complex world. By utilizing English coursebooks, learners can acquire an understanding of intricate scientific subjects and develop the necessary skills for effective communication within scientific contexts. On the other hand, it should be considered that the language of science significantly differentiates from the everyday language (Parkinson, 2000) regarding grammatical features, genre, etc.; therefore, more radical embedding is required than simply using the content of science for grammar and skill based exercises. However, it is important to acknowledge that students' scientific literacy enhancement does not solely rely on coursebooks. Factors such as teaching methodologies, learning environments (Üstün et al., 2020), and the quality of educators (Ding, 2022) also play a vital role in shaping students' scientific literacy development. Given the integral role English coursebooks play in providing content-rich scientific topics, one could reasonably argue that English teachers hold a pivotal position in the teaching and development of scientific literacy among students. Yet, the key role that English teachers could play in enhancing scientific literacy, considering the scientific content in English coursebooks, has been seemingly overlooked. Given these considerations, further research is imperative to gain a holistic understanding of the impact of English coursebooks on students' scientific literacy. Future studies should

specifically explore classroom teaching practices and English teachers' beliefs about scientific literacy, as these elements are critical in determining the overall learning experience and fostering the growth of students' scientific literacy skills. A comprehensive approach to examining these factors will enable the development of more effective strategies to improve students' scientific literacy through English education.

Integrating science topics into English coursebooks can be an effective way to improve students' achievement in science and language education. In other words, goals in science and language can mutually support each other. Research showed that the tools and skills developed through language education, such as reading comprehension and communication skills, can be effectively used to facilitate scientific inquiry, or the process of asking questions and seeking answers in a scientific context (Akerson,2001; Dickinson &Young, 1998). By including science topics such as space exploration, climate change, genetics, medical science, robotics and artificial intelligence, and energy, teachers can help students see the relevance and importance of science in their lives. By showing students how science is integrated into our daily lives and how it can provide solutions to complex problems, language teachers can inspire students to pursue science-related careers and become engaged citizens who understand and appreciate the role of science in society.

Subjects like Astronomy and Paleontology, particularly involving dinosaurs, are known to stir a deep sense of intrigue and curiosity among learners (Lelliott & Rollnick 2010; Salmi et al., 2017). The fascinating mysteries of outer space, or the ancient, titanic creatures that once roamed our earth, are topics that can effectively kindle the inherent desire of learners to explore and understand. In our coursebook analysis, we encountered topics on Astronomy, providing a window into the vast cosmos for students. However, it was notable that there were no subjects involving dinosaurs, a topic that is frequently a favorite among young learners. This presents a missed opportunity to harness the appeal of such engaging topics. Considering this, integrating scientific topics into English lessons could be a powerful strategy to enhance students' motivation and success in the subject. By bringing such captivating topics into the English language classroom, we can channel the students' interest in science toward improving their language skills. For instance, the 8th-grade coursebook and unit one friendship includes offering and accepting or refusing to offer with role play dialogues for different contexts. An offer for visiting science museums and science centers would contribute to students’ curiosity. As part of future coursebook revisions, we strongly recommend the inclusion of high-interest, curiosity-stimulating subjects such as dinosaurs. By doing so, we can harness the power of intrinsic motivation, catalyzing learning through the compelling vehicle of students' curiosity and interest.

It is crucial to note that the effectiveness of integrating science topics into English coursebooks relies heavily on the extent of implementation. In the study of Waldrip (2001), primary school teachers believe employing a science-based theme without solid ties to language is less productive. Conversely, creating robust links among the disciplines facilitate a more profound comprehension for students. Therefore, it can be concluded that for the desired success of students in their lessons, English teachers need to effectively utilize the science topics presented in the language coursebooks. Overall, integrating science topics into English coursebooks not only improves students’ language skills but also helps create a more scientifically literate and engaged student.

Statements of Publication Ethics

We declare that the study has no unethical problems, and there is no need for ethics committee approval since the research is based on document analysis.

Researchers’ Contribution Rate

The researchers equally contributed to the study.

Conflict of Interest

There is no conflict of interest between the authors.

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APPENDIX

The name and publisher of the books analyzed in the context of the current research.

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Kaldar, E. B., & Karamil, L. (2021). Secondary School and İmam Hatip Secondary School English Route 6. Pasifik Yayınları, Ankara.

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İlter, B., İzgi, İ., Özdemir, Ç. E., Türkeri Yeter, A. T., & Çavuşer Yünlü, Z. T. (2021). Mastermind Ortaokul ve İmam Hatip Ortaokulu İngilizce 8 Ders Kitabı. Milli Eğitim Bakanlığı Devlet Kitapları, Ankara.

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Teaching Career Ladders: Legal Regulation and Applications from the Perspective of Educators

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Abstract

The main purpose of the research was to determine the opinions and suggestions of educators about the teaching career ladder and various dimensions of this practice in Turkey. This study employed a mixed method sequential exploratory design. Data was collected using a survey, which included seventeen items as well as open-ended questions, developed by the researchers. The study employed a convenience sampling method. A total of one thousand one hundred seventeen educators participated in the study. Quantitative data was analyzed using descriptive statistics, namely frequency, percentage and Chi-square analysis. Qualitative data was analyzed through collaborative qualitative data analysis. The findings show that about half of the 1117 participants (N=520; 46,6%) were against the implementation of the Teaching Career Ladders, while 436 (39,0%) supported the current implementation. Qualitative analysis indicated that educators' suggestions on teaching profession law can be examined under two main themes: assessment and other issues. The research shows that teachers support the career promotion system but are against the system in current practice. Based on the findings in this study, it is suggested that teachers' opinions should be taken into consideration on regulations concerning their career ladders to provide more comprehensive laws and that consistency and continuity should be provided in terms of teachers' career ladders.

Keywords: career ladders, teaching profession law, teacher promotion

Öğretmenlik Kariyer Basamakları: Eğitimcilerin Bakış Açısıyla Yasal Düzenleme ve Uygulamalar

Öz

Bu araştırmanın temel amacı, eğitimcilerin öğretmenlik kariyer basamakları ve bu uygulamanın çeşitli boyutları hakkındaki görüş ve önerilerini belirlemektir. Karma yöntemin kullanıldığı çalışmada veriler, araştırmacılar tarafından geliştirilen ve on yedi maddenin yanı sıra açık uçlu sorulardan oluşan bir anket kullanılarak toplanmıştır. Çalışmada kolay ulaşılabilir örnekleme yöntemi kullanılmıştır. Çalışmaya toplam bin yüz on yedi eğitimci katılmıştır. Nicel veriler frekans, yüzde ve Ki-kare analizi gibi betimsel istatistikler kullanılarak analiz edilmiştir. Nitel veriler ise içerik analizi ile çözümlenmiştir. Bulgular, 1117 katılımcının yaklaşık yarısının (N=520; %46,6) Öğretmenlik Kariyer Basamakları uygulamasına karşı olduğunu, 436'sının (%39,0) ise mevcut uygulamayı desteklediğini göstermektedir. Nitel analiz, eğitimcilerin öğretmenlik meslek kanunu ile ilgili önerilerinin iki ana tema altında incelenebileceğini göstermiştir: değerlendirme ve diğer konular. Araştırma, öğretmenlerin kariyer yükselme sistemini desteklediklerini ancak mevcut uygulamaya karşı olduklarını göstermektedir.

Anahtar kelimeler: öğretmenlik kariyer basamakları, öğretmenlik meslek kanunu, öğretmen yükselmesi

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INTRODUCTION

Education plays a major role in the social, cultural, and economic development of countries (Altan & Özmusul, 2022; Üstün & Aydın, 2022). Put another way, students' personal and professional development in schools plays a key role in the development and progress of their countries. Therefore, almost every country in the world establishes a national education system, and the citizens of the county receive education in schools that are part of the established education system. Therefore, the success of education system is a very important issue.

The success of schools and education systems depends on many different factors. It has often been argued that one of the most important of these is teachers and their quality (Can, 2019). Teachers' effectiveness and efficiency in the classroom have a direct and significant effect on student achievement (Stronge & Tucker, 2000; Tucker & Stronge, 2005). Additionally, teacher quality is the most important factor in determining student achievement (Rice, 2003). Moreover, research indicates that teacher quality is one of the most important variables in determining the overall effectiveness of an education system (Darling-Hammond, 2000). Therefore, teacher quality is a key concept for educational research.

Teacher quality is influenced by issues such as the selection of candidates for the teaching profession (Stronge & Hindman, 2006), the education they receive (Azar, 2011), the social and financial working conditions after entering the profession (Hanushek & Rivkin, 2007), and the status of the teaching profession in society (Hargreaves, 2009). Due to the importance of teacher quality, educational authorities, who are responsible for establishing and managing the education system, aim to increase and secure teacher quality through legal regulations such as laws and regulations within the framework of the mentioned dimensions. Such laws and regulations organize various dimensions of the teaching profession by addressing them within a legal basis.

Laws and Regulations for the Teaching Profession in Some Countries

In terms of the status of career ladder practice in different countries, in countries such as England, Italy, Belgium, Denmark, Portugal and Austria, there is no career ladder practice and there is no salary difference between teachers. However, in some other countries (France, Germany, Slovenia), the practice of teaching career ladder takes place under different names and the rise in career is reflected in the salaries of teachers (Özdemir, et al., 2022). It can be said that among the many purposes of the legal regulations for the teaching profession prepared in various countries, they are mainly related to the professional development of teachers and directing young people to the teaching profession.

Ongoing professional development of teachers in many European countries is actualized in terms of teaching individuals with special needs, approaches to individualized instruction, student behavior and classroom management, professional guidance and mentoring of students, teaching cross-curricular skills, pedagogical competencies for teaching the subject area, assessment and evaluation, teaching in multicultural and multilingual settings, approaches to develop interprofessional competencies for future professions, curriculum knowledge (curriculum literacy), new technologies, school management, information technologies in teaching activities, and subject matter competencies (European Commission/EACEA/Eurydice, 2015). In non-European countries, teachers' professional development programs are also implemented in different ways. For example, in Japan, professional development programs can be divided into two categories: "'basic training' for all teachers and 'special training' for teachers' subject areas. "The activities within the scope of basic training are organized according to the professional experience of teachers and all education personnel are required to participate in these training activities (Bayrakçı, 2009)." (Abazaoğlu, 2014, p. 19). In Australia, it is deemed important to identify and reward teachers who continue their professional development and to follow innovations in information technologies closely. In Finland, which stands out with the success of its students in international assessment and evaluation exams, in-service courses are used intensively in the professional development of teachers (Abazaoğlu, 2014).

Programs have been organized in many European countries to encourage people to enter the teaching profession. For example, regulations such as "Mission Possible" in Latvia and "I choose to teach" in Lithuania are aimed both at people who are deciding what their undergraduate education and profession will be, and at people who want to change their career, and aim to encourage them to enter the teaching profession (European Commission/EACEA/Eurydice, 2015). Another example is a program in Norway called GNIST (SPARK), which aims to increase interaction and coordination between education stakeholders and thus increase the attractiveness of the teaching profession. One of the dimensions of this program was to encourage individuals to enter the teaching profession between 2009 and 2014 (European Commission/EACEA/Eurydice, 2015). In addition, in

countries such as Spain, France, Sweden and the UK, online campaigns have been used to enhance the reputation of the profession and encourage new generations to enter the profession (European Commission/EACEA/Eurydice, 2015). Along with the legal regulations on professional development in various countries, the developments and steps taken in Türkiye in terms of legal regulations related to teaching profession are important.

History of Legal Laws and Regulations for the Teaching Profession in Türkiye

The first legal regulation in Türkiye that recognized teaching as a profession was the "Orta Tedrisat Muallimler Kanunu" (Law on Secondary Education Teachers), numbered 439, which was enacted in 1924 (Orta Tedrisat Muallimler Kanunu, 1924; Tokgöz & Tokgöz, 2022). According to the same law, teachers were divided into three groups according to the level of education they taught: primary, secondary, and higher education. Subsequently, in 1930, "İlk ve Orta Tedrisat Muallimlerinin Terfi ve Tecziyeleri Hakkında Kanun" (Law on the Promotion and Recruitment of Primary and Secondary Education Teachers) was enacted by the Grand National Assembly of Türkiye (TBMM). This law regulated the grades of secondary school teachers' salaries and the seniority periods required for their promotion to a higher grade. In the period between 1923 and 1950, when the Turkish Republic was newly established and the legal basis for many areas was created, many laws were enacted regarding teachers and teaching profession (Gül & Güngör, 2022).

In the following years, the rights of teachers were not addressed by a separate law but were included in Devlet Memurları Kanunu (the Civil Servants Law) of 1965. Specifically, Millî Eğitim Temel Kanunu (the Basic Law on National Education), enacted in 1973, defined the basics of the teaching profession. In the aforementioned law, teaching is defined as "a specialized profession that undertakes duties of the State in terms of education, training and related administrative duties", drawing attention to the fact that teaching is a profession that requires special expertise (Millî Eğitim Temel Kanunu, 1973).

In order to identify the problems of teachers, a research commission was established in TBMM in 1993 under the chairmanship of the Minister of National Education and along with the participation of educators. Within the framework of the commission's work, topics such as "teacher education system, social status of teachers, personnel problems and their elimination, improvement of educational milieus, in-service training problems, employment problems" (Gül & Güngör, 2022, p. 110) were addressed and a law proposal was submitted to the TBMM. However, the commission's legislative proposal did not make it to the parliamentary agenda and naturally did not become a law.

With the "Öğretmenlik Kariyer Basamaklarında Yükselme Yönetmeliği" (Regulation on Promotion in Teaching Career Ladders), issued in 2005, it was declared that the teaching profession was divided into three career steps after the candidacy period: teacher, specialist teacher and head teacher. With this regulation, it was also announced that teachers with seven years of teaching experience could apply for the position of specialist teacher and those with six years of teaching experience as specialist teacher could apply for the position of head teacher. It was decided to conduct a written exam for promotion in career steps, but those who completed their master's or doctoral studies in their field or in educational sciences would be exempted from the exam (Öğretmenlik Kariyer Basamaklarında Yükselme Yönetmeliği, 2005). As a part of the regulation, the first exam was held in 2006, but due to legal and administrative problems, the exam could not be held in the following years, which led to various discussions in the educational circles (İş & Birel, 2022). Subsequently, some of the political parties in the Parliament submitted proposals for a teaching profession law in the following years, but none of these were enacted.

Yirminci Eğitim Şûrası (The Twentieth National Education Council) was held in 2021. The decisions taken at the Council were divided into three main headings: "Equal Opportunities in Basic Education," "Improvement of Vocational Education" and "Professional Development of Teachers." The professional development of teachers was analyzed under the sub-headings of improving teacher education, supporting the professional development of teachers and increasing the status of teaching. Some of the suggestions for increasing the status of teaching were listed as follows (20. Millî Eğitim Şûrası Kararları, 2021, s. 13): (1) Teaching Profession Law should be enacted. The law should be organized to cover teachers working in all public and private schools, (2) Salaries and personal rights should be reorganized to make the teaching profession and management more attractive, (3) The reward system for teachers should be reorganized on a data-based basis, (4) 3600 additional indicators should be given to retired and serving teachers, and (5) Teaching should be organized as a career profession. Meaningful and significant increases in the personal rights of teachers should be ensured in career progression.

Teaching Profession Law - Regulation on Candidate Teaching and Teaching Career Ladders

As a result of the recommendations made at the Council, the teaching career ladder and related practices were again on the agenda of the education community. A law proposal for Öğretmenlik Meslek Kanunu (the Teaching Profession Law) was brought to the agenda of TBMM. Subsequently, this law was published in Resmi Gazete (the Official Gazette) on February 14, 2022, with the number 7354 (Öğretmenlik Meslek Kanunu, 2022). In this law, it was stated that the teaching profession was a specialty profession, and it was divided into three career steps as teacher, specialist teacher and head teacher, after the candidacy period. In the promotion from teacher to specialist teacher, at least ten years of service was required, including the time spent as a candidate teacher. Teachers who have completed ten years of service can apply for the specialist teacher exam if they complete Uzman Öğretmenlik Eğitim Programı (the Specialist Teacher Training Program) of not less than 180 hours. Those who score 70 points or more in the written exam will become specialist teachers. In terms of the transition from specialist teacher to head teacher, the law stipulates that teachers must have worked as specialist teachers for ten years and must have completed Başöğretmenlik Eğitim Programı (the Head Teacher Training Program) of not less than 240 hours. Teachers will be exempt from the written exam for specialist teachers if they earn a master's degree and from the exam for head teachers if they earn a doctorate degree. Promotion to specialist and head teacher will contribute to both the salary and the additional indicators to be applied with a professional degree. Finally, it is also stated that the principles and procedures regarding the progression in the teaching career ladder will be regulated by a regulation.

The regulation stipulated by the law was published in Resmi Gazete (the Official Gazette) on May 12, 2022, under the name of Aday Öğretmenlik ve Öğretmenlik Kariyer Basamakları Yönetmeliği (Regulation on Candidate Teaching and Teaching Career Ladders) (Aday Öğretmenlik ve Öğretmenlik Kariyer Basamakları Yönetmeliği, 2022). In this regulation, the conditions required for candidates to apply for specialist and head teacher written exams, the conditions required for exemption from the written exam and the issues related to the training programs to be organized were explained. The law and the regulation have been the focus of positive and negative criticism by the stakeholders of the education community after they were put into practice.

Criticisms on Teaching Profession Law - Regulation on Candidate Teaching and Teaching Career Ladders

The teaching career ladder practice and issues it brought along with were mostly examined and criticized by education unions and non-governmental organizations. For example, TEDMEM (2022), which carries out research and analysis activities under the umbrella of Türk Eğitim Derneği (the Turkish Education Association), criticized the Law for not being holistic, not eliminating the scattered legislation on the profession, and not defining the duties and responsibilities of specialist and head teachers. TEDMEM (2022) criticized the Regulation on the grounds that the regulation adds new exams to the exam-oriented education system, and that master's and doctorate degrees that provide exam exemption may lead to a decrease in the quality of the programs that provide master's or doctoral degrees.

Eğitim Sen (2022) argued that the different titles given to teachers doing similar work in schools (teaching the same subjects) would lead to segregation in schools over time and consequently to mistrust. It was also stated that the change in salary according to title violates the principle of equal pay for equal work. In general, it was commented that the implementation of career ladders would not result in an increase in the quality of education.

Eğitim ve Bilim İş Görenleri (Eğitimiş - The Education and Science Workers' Union), on the other hand, emphasized that although the teaching profession should be regulated and secured by a law, the proposal does not meet their expectations in any way. They argued that the implementation of the career ladder for teachers would damage the working peace of teachers and cause conflicts between teachers and parents as well as teachers and administrators.

Eğitim-Bir-Sen (2022) stated that the Law was valuable in terms of having a separate law regulating the teaching profession, but that it did not satisfy teachers' expectations in many aspects. Eğitim-Bir-Sen (2022) stated that the implementation of career ladders, salary and grade increases for specialist and head teachers, and additional indicators were positive developments brought by the law. However, they claimed that it did not have enough content to deserve to be called a professional law in general terms. According to Eğitim-Bir-Sen (2022), the transition to specialist and head teacher should be based only on years of service, training programs and professional work. Accordingly, teachers with eight years of service should be able to directly receive the title of specialist and those with 12 years of service should be able to directly receive the title of head teacher. Teachers

with a master's degree should be exempt from the specialist teacher training program, while those with a doctorate should be exempt from the head teacher training program.

In addition to the opinions and criticisms of non-governmental organizations and education unions, some issues brought along by the Law and the Regulation have caused public debate. First of all, in terms of exemption from exams, the law and the regulation only stipulate the requirement of master's or doctorate rather than specifying clearly that such a degree must be either in the branch of the teacher (Turkish, Mathematics, Physics, etc.) or in educational sciences (Curriculum and Instruction, Educational Administration, etc.). In the Law's current form, a master's or doctoral degree from an unrelated field would exempt teachers from exams. In addition, there is no emphasis on whether the master's degree program should be non-thesis or with thesis. As a result of this uncertainty, non-thesis master's degree would provide exemption from exam just as a master's degree with thesis does (Uzman öğretmenlik sınavından tezsiz yüksek lisans yapanlar muaf olur mu? 2022, January 26). In addition, the fact that the questions in the written exam of 2022, were found to be quite easy by teachers led to comments such as why teachers were directed to master's programs or why an exam was held if everyone was going to be a specialist teacher ("Adaylardan uzman öğretmenlik sınav yorumları!," 2022, November 19). When the opinions and criticisms on the Law and the regulation were examined, it was seen that these criticisms were related to topics such as the application of career ladders system, the application of exams in the promotion, the level of questions in the written exam, the consideration of professional seniority (10 or 20 years) in the progression between the ladders and the length or shortness of this period, the increase in salary as a result of promotion, the exemption from the exam because of graduate education outside the field and the obligation to participate in electronic training programs organized to take the written exam.

The number of studies in the literature on teaching career ladders, which is a relatively new practice, is naturally limited. New research on this subject can contribute to strengthening the related literature. When the existing research on teaching career steps was examined, it was found that some of the studies were non-empirical and in the form of opinion articles (Altan & Özmusul, 2022; Can, 2019). In another study, the teaching profession law was analyzed by comparing it with the laws of Germany, China, Canada and Singapore (Dönmez Yapucuoğlu & Eryılmaz Ballı, 2022). It was also determined that some of the research articles took into account only the views of administrators (Üstün & Aydın, 2022), while others focused only on teachers from a specific discipline (Tokgöz & Tokgöz, 2022). Research articles on teachers' views were generally qualitative in design and conducted with small samples (Aksan, Gökmen, & Demir, 2023; Elagöz & Elagöz, 2023; Gül & Güngör, 2022; İş & Birel, 2022; Özdemir, et al., 2022). Although qualitative studies conducted with small samples are useful in examining the subject in depth, they are not effective in determining the tendency and distribution of teachers in general. Within the scope of the literature review, only one study was found that examined teachers' views on the teaching profession law and the implications of this legal regulation with relatively larger samples (Gürbüz, et al., 2022). In this regard, it can be said that there is a need to determine the opinions and suggestions of teachers from different disciplines and school administrators with a representative sample to bring new perspectives to the study of the subject.

Purpose of Research and Research Questions

In this context, the main purpose of the research was to determine the opinions and suggestions of teachers and school administrators, who are also teachers with management responsibilities working in various educational levels and branches about the teaching career ladder and various dimensions of this practice. In order to achieve this aim, answers to the following research questions were sought:

1.How do teachers and school administrators evaluate the teaching career ladder practice? Specifically in terms of:

a. whether it should be implemented or not,

b. exams for the promotion,

c. the level of the questions in the written exam conducted in 2022,

d. 10 years of service as a basis for promotion from teacher to specialist teacher and from specialist teacher to head teacher,

e. salary difference after promotion,

f. graduate study outside the field providing exam exemption,

g. non-thesis master's degree providing exam exemption.

2.What are teachers' suggestions about some aspects of the teaching career ladder practice? Specifically in terms of:

a. 10 years of service as a basis for promotion from teacher to specialist teacher and from specialist teacher to head teacher,

b. Distance training programs,

c. Suggestions regarding teaching career ladder system in general.

Significance of the Study

Education will undoubtedly play a fundamental role in achieving the political, economic and cultural goals of Türkiye with the qualified people it will raise. The success of education in this process depends on teachers. Considering the aforementioned importance of education in the progress of a society and its economic and cultural prominence and the dominant role of teachers in this process, it is important to examine the legal practices and regulations regarding teachers' professions from their perspective. Examining the opinions and suggestions of teachers working in Türkiye regarding the teaching career ladder can contribute to future legal regulations. This research can bring new perspectives to the examination of the research topic by determining the opinions and suggestions of teachers and school administrators from different branches regarding the teaching career ladder implementation.

METHOD

Research Design

Aiming to reach a general perspective on teachers' and administrators' opinions and suggestions on career ladders application in Turkey in 2022-2023 academic year, this study employed a mixed method sequential exploratory design that includes first quantitative data to provide an overview of the issue in question and then qualitative data to improve and clarify those statistical findings (Ivankova et al., 2006).

Population and Sample

The target population of the research included all teachers in Turkey whose number is one million two hundred one thousand one hundred thirty-eight including state and private schools (Kasap, 2022). It is pointed out that the sample should include minimum three hundred eighty-four participants for such a big population (Krejcie & Morgan, 1970). However, the researchers aimed to reach a much bigger sample and employed a convenience sampling method involving respondents who were "convenient" and there was no pattern whatsoever in acquiring these respondents (Galloway, 2005). A total of one thousand one hundred seventeen participants whose demographics were explained below provided data for the survey, and the number of participants providing data for semi-structured interview questions is four hundred nine.

Table 1. Demographics of Sample

Gender	N	%	School Type	N	%
Female	547	49,00	Preschool	38	3,40
Male	570	51,00	Primary School	369	33,00
Total	1117	100,00	Secondary School	330	29,50
Age	N	%	High School	137	12,30
22-32 years old	120	10,70	Others	243	21,80
33-43 years old	471	42,20	Total	1117	100,00
44 and over	526	47,10	Field	N	%
Total	1117	100,00	Social Sciences	778	69,70
Experience	N	%	Sciences	186	16,70
btwn 1-9 years	179	16,00	Vocational Training	96	8,60
btwn 10-19 years	372	33,30	PE & Arts	57	5,10
20 years and more	566	50,70	Total	1117	100,00
Total	1117	100,00	Status	N	%
Role	N	%	Teacher	249	22,30
Teacher	960	85,90	Expert	724	64,80
Vice Manager/Manager	157	14,10	Head	144	12,90
Total	1117	100,00	Total	1117	100,00

As Table 1 represents, the sample included 1117 teachers 570 (51,00%) of whom are males and 547 (49,00%) are females. The age group with the highest number (N=526; 47,10%) is 44 and over while it is followed by those between 33 and 43 (N=471; 42,20%) and the remaining 120 (10,70%) participants are between 22 and 32 years old. The sample included mostly teachers with an experience over 20 years (N=566; 50,70%); the number of teachers with an experience of 10 to 19 years is 372 (33,30%) and remaining 179 (16,00%) teachers have an experience between 1 to 9 years. A big majority of the participants (N=960; 85,90%) do not have a vice manager or manager title while the number of those with one of those titles is 157 (14,10%). The number of participant teachers depending on the type of school they work at is as follows: 38 (3,40%) from preschools, 369 (33,00%) from primary schools, 330 (29,50%) from secondary schools, 137 (12,30%) from high schools and remaining 243 (21,80%) from other types of schools/institutions. Teachers teaching in field of social sciences such as Turkish, Geography, Philosophy, etc. equal to 69,70% (N=778) of the total sample while the number of those teaching in a field of sciences like Math, Biology, etc. is 186 (16,70%). The number of teachers working in the vocational training field is 96 (8,60%) and remaining 57 (5,10%) are working at Physical Education or Arts fields. A total of 249 (22,30%) teachers report that they do not have a status in terms of career ladders while the number of experts is 724 (64,80%) and heads is 144 (12,90%).

Data Collection

Quantitative data was collected using a survey developed by the researchers. The survey included seventeen items all of which were replied as “Agree”, “Unsure” or “Disagree”; thus, it provides categorical data to the researchers. Out of all items, eleven were about career ladders application in general (if teachers support or are against it, how they have perceived the written exam, etc.) and remaining six items were about what teachers thought about graduate education that brought exemption from the written exam. Two experts having a PhD degree in the field of educational sciences provided expert opinions on items and proposed revisions by them were done before distributing the survey. Qualitative data, on the other hand, was collected through a semi-structured interview form that was also reviewed by experts’ opinions and contained four questions first two of which asked teachers’ and administrators’ opinions on how many years they should wait between the career ladders, from teacher to expert teacher and from expert to head teacher. The third question collects ideas about alternatives to online training provided by Ministry of Education as a prerequisite for taking the written exam. The last question opens place for suggestions on any issue to develop the career ladders application. The data collection process was carried out online through Google Forms. Survey and interview form were transferred to the online platform and the link for it was shared with the prospective participants, requesting them to take part in the research as data provider.

Data Analysis and Reliability

Quantitative data was analyzed using descriptive statistics, namely frequency and percentage. Chi-square, the cross-tabulation statistic, was used to examine if there was a statistically significant relation between demographics and survey items. Then, qualitative data was analyzed through collaborative qualitative data analysis that tries to capitalize on the benefits of coordinating qualitative data analysis in groups, while compensating for some of the challenges introduced by working with two or more analysts (Richards & Hemphill, 2018) which is often viewed as one way to enhance trustworthiness together with benefits related to integrating the perspectives provided by multiple researchers (Patton, 2015). Besides, systematicity, clarity, and transparency are claimed to be enforced by working together on the coding process (Hall et al., 2005) and having other researchers acting as an “auditor” is a way to ensure accountability (Cornish et al., 2014). As a result, the issue of coder agreement, and the broader notions of trustworthiness and credibility was provided in this research by establishing a clear protocol and codebook and then dialogue through and reach consensus on coded data (Richards & Hemphill, 2018). The collaborative qualitative data analysis allows researchers to identify themes in a deductive or inductive or both ways (Richards & Hemphill, 2018), and in this research an inductive approach was preferred as no prior themes were named before the research.

Research Ethics

The whole research procedure including data collection tool and method was subjected to the approval of Research Ethics Committee of Aksaray University and was found appropriate.

FINDINGS

The findings of the research are provided in two parts. The descriptive statistics of survey items and cross-tabulation results of significant relations between demographics and survey items are given in the first part and it is followed by answers to open ended questions in the second.

Table 2. Descriptive Results for Items concerning Career Ladders in General

Item	Disagree		Unsure		Agree	
	N	%	N	%	N	%
I am against the implementation of Teaching Career Ladders.	436	39,0	161	14,4	520	46,6
I find the classification of career ladders (teacher, expert teacher, head teacher) appropriate.	614	55,0	81	7,3	422	37,8
I find it appropriate to have an exam in the career ladders application.	851	76,2	59	5,3	207	18,5
I think the questions in the Teaching Career Ladders Written Examination are easy.	133	11,9	134	12,0	850	76,1
I think that promotion in career ladders should be based only on professional seniority without exams.	202	18,1	107	9,6	808	72,3
I think that all teachers should receive the same salary regardless of career level.	618	55,3	107	9,6	392	35,1
I think that all teachers should receive the same salary regardless of professional seniority (years worked).	777	69,6	94	8,4	246	22,0
I find the practice of salary increase according to career ladders correct.	366	32,8	75	6,7	676	60,5
I think that the 10-year working period taken as a basis for transition from teacher to expert teacher is too long.	261	23,4	112	10,0	744	66,6
I think that the 10-year working period taken as a basis for transition from expert teacher to head teacher is too long.	187	16,7	97	8,7	833	74,6
I find the requirement to take online education (180-240 hours of distance education) in order to take the Teaching Career Ladders Written Examination appropriate.	734	65,7	147	13,2	236	21,1

As can be seen in Table 2, there are 11 items asking for participants' opinions in terms of Career Ladders application. The results show that nearly half (N=520; 46,6%) of the 1117 participants report being against the implementation of Teaching Career Ladders while 436 (39,0%) of them are in favor of current application. The number of participants reporting being unsure about this item is 161 (14,4%). More than half of the participants (N=614; 55,0%) indicate not finding the current classification of career ladders (teacher, expert teacher, head teacher) appropriate whereas the number of participants finding it appropriate is 422 (37,8%) and 81 (7,3%) are unsure. The highest number of disagree (N=851; 76,2%) is in the third item that questions if participants find it appropriate to have an exam in the career ladders application. Only 207 (18,5%) participants agree with that and 59 (5,3%) report being unsure. Then comes the item which states that written exam questions are easy with the highest number of agree (N=850; 76,1%). Of the total, 133 (11,9%) disagrees and 134 (12,0%) are unsure about that item. The following item states that promotion in career ladders should be based only on professional seniority without exams and the number of agrees is high (N=808; 72,3%) while 202 (18,1%) disagree and 107 (9,6%) are not sure of it. More than half of the participants (N=618; 55,3%) disagree that all teachers should receive the same salary regardless of career level. Moreover, 392 (35,1%) participants agree with that and 107 (9,6%) are not sure of it. A majority of teachers (N=777; 69,6%) disagree that all teachers should receive the same salary regardless of professional seniority (years worked) and only 246 (22,0%) agree with the item while remaining 94 (8,4%) are unsure. 676 (60,5%) participants find the practice of salary increase according to career ladders correct. The number of participants that disagree with that item is 366 (32,8%) and 75 (6,7%) are unsure. Of 1117 participants, 744 (66,6%) agree that the 10-year working period taken as a basis for transition from teacher to expert teacher is too long; 261 (23,4%) disagree and 112 (10,0%) are unsure. A big number of teachers (N=833; 74,6%) agree that the 10-year working period taken as a basis for transition from expert teacher to head teacher is too long. The number of participants disagreeing is 187 (16,7%) and 97 teachers (8,7%) are unsure.

Table 3. Descriptive Results for Items concerning relation between Career Ladders and Graduate Education

Item	Disagree		Unsure		Agree	
	N	%	N	%	N	%
I find it appropriate that a non-thesis master's degree in a field that is NOT related to the teaching profession should provide exam exemption for promotion in the career ladders.	808	72,3	81	7,3	228	20,4
I find it appropriate that a master's degree with thesis in a field that is NOT related to the teaching profession should provide exam exemption for promotion in the career ladders.	745	66,7	97	8,7	275	24,6
I find it appropriate that a master's degree without thesis in a field that is related to the teaching profession (branch or educational sciences) should provide exam exemption for promotion in career ladders.	441	39,5	107	9,6	569	50,9
I find it appropriate that a master's degree with thesis in a field that is related to the teaching profession (branch or educational sciences) should provide exam exemption for promotion in career ladders.	256	22,9	72	6,4	789	70,6
I find it appropriate that doctoral education in a field that is NOT related to the teaching profession provides exemption from the exam for promotion in the career ladders.	723	64,7	105	9,4	289	25,9
I find it appropriate that doctoral education in a field that is related to the teaching profession (branch or educational sciences) should provide exam exemption for promotion in the career ladders.	271	24,3	76	6,8	770	68,9

As Table 3 shows, a big majority of participants (N=808; 72,3%) disagree that it is appropriate that a non-thesis master's degree in a field that is NOT related to the teaching profession should provide exam exemption for promotion in the career ladders while 228 (20,4%) agree with the item and 81 (7,3%) are unsure. Similarly, more than half of the participants (N=745; 66,7%) disagree with the item indicating it is appropriate that a master's degree with thesis in a field that is NOT related to the teaching profession should provide exam exemption for promotion in the career ladders. Nearly one-fourth of participants (N=275; 24,6%) agree with that item and 97 (8,7%) are unsure of it. Slightly more than half of participants (N=569; 50,9%) agree that a master's degree without thesis in a field that is related to the teaching profession (field or educational sciences) should provide exam exemption for promotion in career ladders while 441 (39,5%) disagree with it and 107 (9,6%) are unsure. The number of participants who agrees that a master's degree with thesis in a field that is related to the teaching profession (branch or educational sciences) should provide exam exemption for promotion in career ladders is 789 (70,6%). Less than one-fourth (N=256; 22,9%) of participants disagree with that item and 72 (6,4%) of them are unsure of it. Most of the participants (N=723; 64,7%) disagree that doctoral education in a field that is NOT related to the teaching profession provides exemption from the exam for promotion in the career ladders and nearly one-fourth (N=289; 25,9%) of them agree with it and remaining 105 (9,4%) participants are unsure of it. The number of participants with agreeing that doctoral education in a field that is related to the teaching profession (branch or educational sciences) should provide exam exemption for promotion in the career ladders is 770 (68,9%). Of the total 1117 participants, 271 (24,3%) disagree with that item while 76 (6,8%) are unsure.

Table 4. Results of Chi-Square Analysis of Gender and Master's Degree in a Non-teaching Field

			I find it appropriate that a master's degree with thesis in a field that is NOT related to the teaching profession should provide exam exemption for promotion in the career ladders.			Total	X^2	p
			Disagree	Unsure	Agree			
Gender	Female	Count	354	63	130	547	10,857	,004
		Expected Count	364,8	47,5	134,7	547,0		
	Male	Count	391	34	145	570		
		Expected Count	380,2	49,5	140,3	570,0		
Total		Count	745	97	275	1117		
		Expected Count	745,0	97,0	275,0	1117,0		

As Table 4 shows, there are 547 female and 570 male participants and the cross tabulation indicates a significant relationship ($X^2_{(2)}$ =10,857; p<,05) between the gender and participants' opinions if it is appropriate that a master's degree with thesis in a field that is NOT related to the teaching profession should provide exam exemption for promotion in the career ladders. Male participants are more likely to disagree with this item.

Table 5. Results of Chi-Square Analysis of Gender and PhD Degree in Teaching Field

			I find it appropriate that doctoral education in a field that is related to the teaching profession (specific field or educational sciences) should provide exam exemption for promotion in the career ladders.			Total	X^2	p
			Disagree	Unsure	Agree			
Gender	Female	Count	133	48	366	547	6,760	,034
		Expected Count	132,7	37,2	377,1	547,0		
	Male	Count	138	28	404	570		
		Expected Count	138,3	38,8	392,9	570,0		
Total		Count	745	271	76	1117		
		Expected Count	745,0	271,0	76,0	1117,0		

As can be seen in Table 5, the cross tabulation indicates a significant relationship ($X^2_{(2)}$ =6,760; p< ,05) between the gender and participants' opinions if it is appropriate that doctoral education in a field that is related to the teaching profession (branch or educational sciences) should provide exam exemption for promotion in the career ladders. Male participants are more likely to agree with this item.

Table 6. Results of Chi-Square Analysis of Field and Seniority as a source of Salary Increase

Field		I think that all teachers should receive the same salary regardless of professional seniority (years worked).				X^2	p
		Disagree	Unsure	Agree	Total	17,559	,007
Social Sciences	Count	527	72	179	778		
	Expected Count	541,2	65,5	171,3	778,0		
Sciences	Count	139	13	34	186		
	Expected Count	129,4	15,7	41,0	186,0		
PE & Arts	Count	33	3	21	57		
	Expected Count	39,6	4,8	12,6	57,0		
Vocational Training	Count	78	6	12	96		
	Expected Count	66,8	8,1	21,1	96,0		
Total	Count	777	94	246	1117		
	Expected Count	777,0	94,0	246,0	1117,0		

As can be seen in Table 6, the cross tabulation indicates a significant relationship ($X^2_{(6)}$ =17,559; p< ,05) between the field and participants' opinions on if all teachers should receive the same salary regardless of professional seniority (years worked). Teachers of social sciences and PE & Arts are more likely to agree while teachers of science courses and vocational training are more likely to disagree with this item.

Table 7. Results of Chi-Square Analysis of Field and Master's Degree without Thesis for Exam Exemption

Field		I find it appropriate that a master's degree without thesis in a field that is related to the teaching profession (own field or educational sciences) should provide exam exemption for promotion in career ladders.				X^2	p
		Disagree	Unsure	Agree	Total	14,720	,023
Social Sciences	Count	316	68	394	778		
	Expected Count	307,2	74,5	396,3	778,0		
Sciences	Count	65	25	96	186		
	Expected Count	73,4	17,8	94,7	186,0		
PE & Arts	Count	30	7	20	57		
	Expected Count	22,5	5,5	29,0	57,0		
Vocational Training	Count	30	7	59	96		
	Expected Count	37,9	9,2	48,9	96,0		
Total	Count	441	107	569	1117		
	Expected Count	441,0	107,0	569,0	1117,0		

As Table 7 represents, the cross tabulation indicates a significant relationship ($X^2_{(6)}$ =14,720; p< ,05) between the field and participants' opinions on if it is appropriate that a master's degree without thesis in a field that is related to the teaching profession (branch or educational sciences) should provide exam exemption for promotion in career ladders. Teachers of social sciences and PE & Arts are more likely to disagree while teachers of vocational training and science courses are more likely to agree with this item.

Findings of Open-ended Questions

The first open-ended question asks about the how many years the period taken as a basis for transition from teacher to expert teacher should be and a total of 903 teachers indicated their opinions. While the highest number of years is 35 and lowest is 1, the mean of all is 6,92. The second question asks about how many years should be taken as a basis for the transition from expert teacher to head teacher and the number of participants replying it is 900. The lowest number is one year and the highest is 25 years while the mean of all is 7,40. The third open-ended question asks for the alternatives that teachers can suggest instead of distance in-service training required to take the written exam for career ladders and following codes, categories and theme were derived from the data.

Table 8. Alternatives to Distance Education applied in Career Ladders Application

Theme	Category	Code	F	%
Alternatives	Conventional	Face to face	104	38,24
		Practice-based applications	54	19,86
		In-service training	46	16,91
		Seminar	44	16,17
		University-led training	17	6,25
		Short-term	7	2,57
		Total:	272	100,00
	Online Supported	Other Resources (books, study guides, presentations)	34	49,28
		Self-study	31	44,93
		Hybrid	4	5,79
		Total:	69	100,00

Table 8 shows that the qualitative data for the third question was labeled under one theme that is "Alternatives" and two categories below it, namely "Conventional" under which there are 6 codes and "Online Supported" with 3 codes linked to. Within the "Conventional" category that represents more traditional methods as alternatives to online in-service training, the code with the highest frequency (F=104; 38,24%) is named as "face to face" that clearly explains itself. A deputy principal (VM60) explains it as follows: "*Trainings should be distributed over a year and be face-to-face. It should contribute to the development of the teacher. Distance education is of no use.*" The code with the second highest frequency (F=54; 19,86%) is called practice-based applications that refer to a demand by teachers to include more hands-on activities to get prepared to career ladders.

The code third in terms of frequency (F=46; 16,91%) is in-service training. Then comes the fourth code (F=44; 16,17%) that is seminar indicating a more academic meeting with the experts that will lead to exchange of both theoretical information and applications for professional development. The code that is fifth in terms of groundedness (F=17; 6,25%) is named as university-led training that includes the suggestions of teachers to receive a training at universities and a teacher (T228) indicates it as: "*I think it would be more appropriate to cooperate with universities in the province and provide necessary trainings in the field of teaching.*" The last code in this category is called as short-term (F=7; 2,57%) and indicates that teachers are complaining the duration of online training courses too. A teacher (T251) explains it as follows: "*I want the duration of the trainings to be monitored to be shortened and spread throughout the year or until the year in which the exam will be held, I do not think that teachers follow the trainings because they are long as they are currently in practice.*" while T471 complains as "*Distance education is the best. But the trainings are very long...*"

The fourth open-ended question asks participants "Do you have any other suggestions regarding the implementation of the teaching career ladders?" and answers for this question were categorized within two themes as "Assessment" and "Other Issues". The "Assessment" theme includes four categories, namely additional activities with 6 codes, multi-dimensional with 5 codes, further training with 3 codes and exam with 2 codes in it. The "Other Issues" theme includes only one category called work-life, and there are 6 codes in it.

Table 9. Suggestions by Teachers to Improve Career Ladders Application

Theme	Category	Code	F	%
Assessment	Additional Activities	Seniority	146	69,52
		Projects	30	14,29
		Seminar/course	12	5,71
		Scientific Products	9	4,29
		In-service training	8	3,81
		Writing books	5	2,38
		Total:	210	100,00
	Multi-dimensional	Manager	14	48,28
		Parents	5	17,25
		Student performance	4	13,79
		Students	3	10,34
		Inspector Report	3	10,34
		Total:	29	100,00
	Further Training	Graduate Degrees	35	53,85
		Graduate Degrees with special quota	21	32,31
		Field Specific In-service training	9	13,84
		Total:	65	100,00
	Exam	Quality	24	57,14
		Field-specific	18	42,86
		Total:	42	100,00
Other Issues	Work-life	Peace at workplace	30	48,39
		Continuity	13	20,97
		Retirement plans	9	14,52
		Punishment	5	8,06
		Appointment of managers	3	4,84
		Private schools	2	3,23
		Total:	62	100,00

In the assessment theme, the category with the highest number of coding is named as additional activities in which there are suggestions of teachers regarding alternatives to written exam for career ladders. The most frequently linked code in this category is seniority (F=146; 69,52%) that offers years of experience as a strong alternative to the written exam. A teacher (T15) explains it as "*I believe in professional experience; working in the field, in the field should be essential, I think the exam is an unnecessary practice.*" while a similar opinion is expressed as "*I think that all teachers who have completed 5 years should be expert teachers and all teachers who have completed 15 years should be head teachers.*" (T595). The code that is second in terms of groundedness is named as projects referring to the extra duties by teachers as project coordinators and/or workers. For example, T330 points out "*Teachers who carry out voluntary projects such as e-twinning, Erasmus, Tübitak should be*

exempted from the career ladders exam." and T184 highlights as "*Instead of exams, teachers should be asked to work for the benefit of society. Project should be requested…*" The next code whose frequency is 12 (5,71%) is called as seminar/course projecting opinions for attaining scientific meetings. The following code, on the other hand, is named as scientific products referring to articles, conference proceedings etc. and has a frequency of 9 (4,29%). In-service training is the code with the next highest frequency (F=8; 3,81%) and as its name refers participants offer professional development courses provided by Ministry of Education. The last code in this category is writing books (F=5; 2,38%) in which teachers offer asking for writing coursebooks for their lessons as an additional qualification. A principal (M47) explains it as "*Those with books, articles, etc. should be made experts or head teachers without taking the exam.*"

The second category in the assessment theme is names as multi-dimensional referring to various sources of assessments to be included in the evaluation of teachers through their career ladders rather than a written exam. The first code below it is called manager (f=14; 48,28%) indicating school managers to have a say in the assessment of teachers in the transitions between career ladders. A school principal (M10) explains it as "*The opinions of school principals about the teacher can also be included in the scoring.*" and similarly a teacher (T599) offers that "*The school principal should be consulted about the lectures and organization of the expert teachers.*" The code second in terms of frequency is parents (F=5; 17,25%) and asks for the integration of parent evaluations of teachers. A teacher (T852) explains it as "*Students and parents can be considered to evaluate the performance of the teacher.*" Then comes student performance (F=4; 13,79%) explaining that students' performance in standardized tests might supply an overview of teachers and can be used to move one step forward in career ladders. The two other codes remaining in this category are students (F=3; 10,34%) which includes assessment of teacher performance by learners and inspector reports (F=3; 10,34%) examining teachers' performance within a period.

The next category, named as further training, includes teachers' suggestions on higher educational degrees (MA and PhD) as requirements of higher career ladders together with in-service training that is field-specific. The code with highest frequency is graduate degree (F=35; 53,85%) and rooted in two different ways; a group of teachers offer a compulsory graduate degree for further career ladders while some others suggest it as an option. A teacher who is also the vice principal of a school (VM19) explains it as "*There must be a requirement to have a master's degree with a thesis in their field. Depending on the outcome of this, a career ladder should be gradually built up every 5 years.*" and a teacher (T150) state that "*Teachers with a master's degree in their field should immediately become expert teachers without an exam and without a time limit. Teachers with a PhD in their field should become head teachers immediately, without an exam and without a time limit.*" The next code with the highest frequency is called as graduate degrees with a special quota (F=21; 32,31%) and includes the idea of offering teachers a special quota in graduate degree programs to encourage them. A school principal (M36) states it as "*Special quotas should be provided for teachers to do master's and doctorate degrees. Master's degree holders should become experts and doctorate holders should become head teachers without any year requirement.*" The last code here is field specific in-service training (F=9; 13,84%) that points out teachers demand the in-service training in their specific field of study rather than pedagogical knowledge. A teacher (T249) explains it as "*If there is to be such a system, I would like to be an expert in my field. And I suggest that the trainings should be adjusted accordingly and that there should be an exam related to my field.*"

The following category is named as exam (the one that was conducted in 2022) in which teachers either complain the way it took place or offer an alternative. The most frequent code in this category is called as quality (F=24; 57,14%) indicating a discomfort about the written exam that is perceived as too easy and not selective. A teacher with the title of vice principal (VM30) defines the situation as "*This process should be done with a more professional approach. The selectivity of exam questions should be increased.*" and a teacher (T284) complains that "*The topics should be related to current education and training. The career ladders exam did not add anything to me, in fact it made me feel very nervous.*" The second and last code in this category is called as field-specific (F=18; 42,86%) indicating that teachers require the written exam to include items from their specific field of study rather than general topics in education. A teacher (T219) clarifies it by saying "*Each teacher should take the career ladders exam related to his/her field. Questions should be prepared for each field in its own just like in the KPSS (Centralized Civil Servant Selection Exam) field exam.*"

The last category is named as work-life which includes teacher opinions about the effect of career ladders application on teaching profession. The code with the highest frequency is called peace at workplace (F=30; 48,39%) and includes both positive and negative teacher thoughts and experiences triggered by teacher career ladders. For example, a teacher (T5) states that "*I am completely against this practice, a teacher is a teacher. There can be no discrimination between teachers in the same school; if there is, working peace can be disrupted.*" and T274 puts forward a similar thought as "*The career ladders focus only on salary differentials and do not*

measure whether a teacher is an expert or a head teacher. It is a practice that disrupts labor peace and alienates really good teachers." The code with the second highest frequency is named as continuity (F=13; 20,97%) that consists of teacher opinions and mostly complaints on the life of career ladders application. A vice principal (VM43) indicates it by saying "*If this practice is to be done, it should be done every year. It was done 15 years ago. This should be done fairly.*" And a teacher points out the same issue by saying that "*As a teacher who has been working for 27 years, I would like to express that the teachers who could not take this exam 17 years ago for various reasons (due to my health problems) have just become experts. Although our retirement period has come, we will retire before we can be the head teacher. I kindly request that this important loss of my colleagues who are deprived of rights like me be eliminated urgently.*" The next code is retirement plans with a frequency of 9 (14,52%) and draws attention on the complaints of participant teachers that the salary increase brought by moving forward in the career ladders is not preserved when they are retired. A teacher (T38) explains it as "*In case of retirement, there should be at least a partial positive contribution.*" Another code is called punishment (F=5; 8,06%) referring to the inequality perceptions of teachers who have not been allowed to take career ladders exam due to official punishments they have had. A vice principal (VM65) clarifies it as "*Teachers who do their job very well but cannot take the exam because of a punishment should also be given the right to take the exam.*" The next code is called as appointment of managers (F=3; 4,84%) including a suggestion that career ladders should be used when appointing school managers and vice managers by giving priorities to head and expert teachers. A teacher (T75), for example, states that "*It would be appropriate to select managers from head teachers and vice managers from expert teachers...*" The last code in this category is called as private schools (F=2; 3,23%) and is seen as important since it highlights the inequality increase between teachers working for the state and private schools. A vice manager clearly explains it as "*As a teacher working in the private sector, being outside of this issue at the maximum level wears me out. Because as private sector teachers, we are at the mercy of the employer, we are working under unfair conditions."*

DISCUSSION & CONCLUSION

In this research, teachers' and administrators' opinions as well as suggestions about career ladders system were analyzed. According to the findings, majority of the teachers were against the new system. This result is consistent with the other research (Tosun et al., 2014; Özdemir et al., 2022; Gürbüz et al., 2022; İlkin & Çobanoğlu, 2023). Moreover, teachers support carrier promotion system, but they are against the implemented system. Gürbüz, Aydın & Gürbüz (2022) indicated teachers do not reject the idea of carrier development system, yet they are against the current practice.

The study revealed that most of the teachers are against the written exam; they are of the opinion that promotion to higher carrier ladder should be based on the seniority rather than written exam. The qualitative research findings revealed that professional seniority, managed projects at school, attending to courses and seminars, scientific products, writing books or articles together with principal and inspector reports, parents' and students' opinions and their students' performance should be taken into consideration while evaluating teachers' proficiency for higher positions. In other words, teachers demanded a multi-dimensional assessment system rather than a single written exam. From this respect, quantitative and qualitative findings are consistent. Similarly, results indicated that the carrier ladder exam that took place in 2022 was not found to be selective enough and qualitative data also revealed that the exam was not selective, and it should include field-specific questions. Teacher profession is based on three dimensions, namely content knowledge, pedagogic knowledge, and liberal knowledge and both teacher training and selection systems are based upon them. The fact that the exam in 2022 only included questions on pedagogical knowledge brings into the agenda the problem of validity. Baş et al. (2023) found similar result in their qualitative study.

In terms of the questions about the salary increase according to the carrier system, teachers pointed out that teachers' salaries should increase with their professional seniority, but this increase should not be dependent on any written exam. In this study, although nearly half of the participants' professional seniority is less than 20 years, they support the salary increase depending on seniority. When qualitative data were analyzed, participants indicated that salary increase should be based on seniority again. Besides, it is advised by the participants that the salary increase should affect not only while they work but also when they retire. Gülden & Kaplan (2023) expressed that teachers' income should differentiate according to the professional seniority. Teachers participating the study indicated that needed professional seniority, 10 years, to take written exam is too long. According to the qualitative results, teachers proposed approximately 7 years from teacher to expert teacher step and from expert

teacher to head teacher step. From this respect, teachers share the idea of professional seniority to move between carrier ladders. In qualitative data, it is indicated that teachers currently having more than 20 years teaching experience have little chance to be head teacher.

In this study, teachers were asked about the online education process that they had to take before the exam. According to the results, most of the teachers were against online education. The reasons for their rejections revealed in qualitative dimension of the study, as participants indicate that they are open to in-service training, but they demand practice based or workshop for their professional development. Online in-service training courses cannot meet their demands and needs. Similar results were found in different studies (Azar, 2011; Can, 2019; Gültekin & Çubukçu 2008; Gürbüz et al., 2022).

Teachers are against the idea of being exempt from the written exam because of higher education not related to teaching profession (graduate degrees). Conversely, they support the idea of graduation from graduate programs related to teaching profession for being exempt from written exam, also demanding a special quota for the teachers currently in-service. Dikbaş and Gül (2023) also indicated that teachers supported the idea of being exempt from any written exam for those taking MBA or Doctorate degree.

Although there is not a significant relation between participants' answers to items with their age, seniority, role, type of school they work at, and status, gender is found to have significant relation with two items, and field is found to have a significant relation with three items. According to findings, male teachers are more likely to support the idea of being exempt from written exam because of master's degree. This result may be caused from social roles of the female ones as master's degree programs last at least two years and require doing many homework and also self-study because they have more responsibility than male teachers such as being mother or doing house works. Gür & Bozgöz (2022) found that female master students are more prone to drop out their education as a result of having more responsibility at home.

Teachers teaching in the social sciences fields, art and physical training were more likely in favor of salary shifts but it is not the case for science and math teachers. This result may be because of having extra income such as private tuitions. Science and math teachers have more opportunity to give private tuitions than social sciences and art. Some study (Dinç et al., 2014; Akdemir & Kılıç, 2020) indicated that students needed extra lessons for science and math courses. Furthermore, central examination system, such as university and high school exams, nurtures these demands. According to Ministry of National Education central exam report (MEB, 2022), these courses are one of the two courses that students get lowest marks.

Except for vocational teachers, all other field teachers are less prone to idea that master's degree programs not related to teaching profession should not give the right of having a degree without written exam. This result may be because of changing vocational teacher training system. In the new system vocational teacher training programs in education, faculties were closed. In order to be vocational teacher, candidates should graduate from engineering faculties and get pedagogical training certificate. In this new system, vocational training teachers have very limited options for master education. Bayrak (2021) indicated that vocational training teachers had problems to be accepted master programs because of the changing system.

As a conclusion, teachers are not against career ladder system and salary increase together with seniority, but they oppose to have a written exam for it. They propose a multi-dimensional evaluation system and approximately 7 years seniority between titles. However, they indicate that there should be a difference between teachers with BA and MA degrees. Teachers do not reject having in-service training or any other further training options, yet they demand practice-based type of training.

Implications

Based on the findings in this study, the following suggestions are put forward.

For researchers:

1. There should be longitudinal studies to examine how perceptions of teachers about career ladders change in time.
2. There should be comparative research to investigate how teachers' perceptions are different for two applications in 2006 and 2022.

For policy makers:

1. Teachers' opinions should be taken into consideration on regulations concerning their career ladders to provide more comprehensive laws as done in the past.
2. As results of this research show, teachers may have difficulty in projecting their career plans due to constant changes in laws related to teachers' professional life. Therefore, consistency and continuity should be provided in terms of teachers' career ladders.
3. The results show that periods between career ladders should be reconsidered.

Limitations

There are a few limitations of the research. First of all, convenience sampling limits applying inferential statistics. This research is cross-sectional in design; for this reason, the data were collected from a single point in time. What is more, this research only investigated opinions and suggestions about career ladder application in 2022; so, the main focus of the study does not include opinions about the application in 2006.

Statements of Publication Ethics

The ethical evaluation of this research was carried out by the Human Research Ethics Committee of Aksaray University, dated 23.06.2023 and numbered 2023/04-11.

Researchers' Contribution Rate

Please specify the contribution rate of each author in the manuscript. Please do not change Author information; you may change or add titles according to the manuscript. No Table title is needed for this table.

Authors	Literature review	Method	Data Collection	Data Analysis	Results	Conclusion
M. Emir RÜZGAR	☒	☒	☒	☒	☒	☒
Serkan BOYRAZ	☒	☒	☒	☒	☒	☒
Yalçın DİLEKLİ	☒	☒	☒	☒	☒	☒

Conflict of Interest

This study does not have any conflict of interest and no financial or commercial support was granted by a third party, namely a person or organization.

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Investigation of Psychometric Properties of the Turkish Version of the Motivation to Lead Scale on Teachers

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Abstract

Leadership in schools is undergoing a transformation involving all school personnel, especially for teachers. Teachers constitute the basic human resource of both school principals and teacher leadership with their formal and informal leadership roles. However, understanding a teacher's emergence with a leader identity is and interpreting the motivational processes behind leadership tendencies continues to be an equation with many unknowns in the leadership literature. To identify teachers who are motivated to lead in the field of school leadership; help develop a pool of potential leaders for schools; In order to increase leader effectiveness and organizational performance, it is important to investigate the factors that motivate talented teachers to take leadership roles. For these reasons, this study, the psychometric properties of Chan and Drasgow's (2001) "Leadership Motivation Scale" (MTLS), which combines various factors in leadership, on teachers were examined. Research was conducted with teachers working in different school types in Ankara. The psychometric properties of MTLS were primarily examined in terms of content validity and language equivalence. EFA (n: 304) and CFA (n: 500) were performed to test construct validity. It was observed that the research results supported the original structure of the scale. In addition, testing the psychometric properties of MTLS on the teacher group is a first step in the related literature. In this context, it is expected that the research will provide a different perspective to both comparative research in the MTL literature and new research on school leadership.

Keywords: Motivation to lead, validity and reliability, individual differences, leadership

Liderlik Etme Motivasyonu Ölçeğinin Türkçe Formunun Öğretmenler Üzerinde Psikometrik Özelliklerinin İncelenmesi

Öz

Okullarda liderlik, tüm okul personelini özellikle de öğretmenleri kapsayan bir dönüşüm geçirmektedir. Öğretmenler hem okul müdürlüğünün hem de üstlendikleri resmi ve gayri resmi liderlik rolleri ile öğretmen liderliğinin temel insan kaynağını oluşturmaktadır. Ancak bir öğretmenin lider kimliği ile ortaya çıkışını anlamak ve liderlik eğilimlerinin arkasında yatan motivasyonel süreçleri yorumlamak liderlik alanyazınında çok bilinmeyenli bir denklem olmaya devam etmektedir. Okul liderliği alanında, liderlik etmeye motive olmuş öğretmenleri belirleyebilmek; okullar için potansiyel liderlerden oluşan bir havuz geliştirilmesine yardımcı olabilmek; lider etkinliğini ve örgütsel performansı artırabilmek için yetenekli öğretmenleri liderlik rolleri üstlenmeye motive eden faktörleri araştırmak önemlidir. Bu gerekçelerle mevcut araştırmada Chan ve Drasgow'un (2001) liderlikte çeşitli faktörleri birleştiren "Liderlik etme Motivasyonu Ölçeği" (LEMÖ)'nün öğretmenler üzerinde psikometrik özellikleri incelenmiştir. Çalışma Ankara da farklı okul türlerinde görev yapan öğretmenler ile gerçekleştirilmiştir. LEMÖ'nün psikometrik özellikleri öncelikle kapsam geçerliği, dil eşdeğerliği açısından incelenmiştir. Ölçeğin yapı geçerliğine dair kanıtlar AFA (n: 304) ve DFA (n: 500) ile sağlanmıştır. Araştırma sonuçları "sosyal-normatif LEM"; "duyuşsal-kimlik LEM"; "hesapçı olmayan LEM" olmak üzere LEMÖ'nün üç faktörlü yapısını desteklemiştir. Ayrıca LEMÖ'nün psikometrik özelliklerinin öğretmen grubu üzerinde test edilmesi ilgili alanyazında bir ilk adım olma özelliği taşımaktadır. Bu bağlamda araştırmanın hem LEM alanyazınında yapılacak karşılaştırmalı araştırmalara hem de okul liderliği konusunda yapılacak yeni araştırmalara farklı bir bakış açısı sağlaması beklenmektedir.

Anahtar kelimeler: Liderlik etme motivasyonu, geçerlik ve güvenirlik, bireysel farklılıklar, liderlik

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INTRODUCTION

Today, organizations aim to achieve organizational goals by encouraging employees to teamwork and cooperation with a horizontal hierarchical approach. This understanding allows the emergence of more than one leader in organizations. Although the critical importance of the school principal in school leadership is accepted, the leadership approach that focuses on a single person is experiencing a transformation that includes all school personnel, especially teachers (Nguyen, Harris & Ng, 2019; Wenner & Campbell, 2017). On the one hand, teachers constitute the basic human resource of the school principalship (Bush, 2018; Hitt & Player, 2019), and on the other hand, they lead all stakeholders of the school community with formal and informal leadership roles (Silva, Gimbert, & Nolan, 2000; Smylie, & Eckert, 2018). An understanding of school leadership that supports an authentic, collaborative decision-making culture that requires teachers to have a say in decisions regarding educational policy, practice and pedagogy is becoming increasingly widespread (Bellibaş, Gümüş & Kılınç, 2020; Çakır, 2020; Shen et al., 2020; Zhang & Lo Leslie, 2021). Steps are being taken to improve the leadership capacities of teachers, both abroad and at Türkiye. For example, in China, "Master Teacher Studios" programs are implemented to develop the leadership potential of teachers (Zeng & Lo Leslie, 2021). In Sweden, career development studies are carried out to improve the leadership capacity of especially talented teachers (Hirsh & Bergmo-Prvulovic, 2019). Although there are no studies directly aimed at improving the leadership skills of teachers in Türkiye, teachers are indirectly encouraged to become leaders by keeping their pedagogical knowledge and skills up to date and supporting their professional development (Gümüş, Kılınç & Bellibaş, 2022; Karacabey et al., 2022; Kılınç et al., 2021). Existing research is undoubtedly stimulating in terms of revealing and encouraging teachers' leadership potential (Bellibaş et al., 2020; Kurt, 2016; Lee & Kwan, 2021; Zhang & Lo Leslie, 2021). However, understanding a teacher's emergence with a leader identity and interpreting the motivational processes behind leadership tendencies continues to be an equation with many unknowns in the leadership literature. In this sense, identifying teachers with high leadership potential in schools and examining the source of their desire to lead can be an important start in order to develop their leadership potential. Therefore, it may be necessary to look at the issue from a perspective that includes the basic components of leadership psychology. Because an understanding of school leadership in which basic psychological structures are ignored in leadership practices will be incomplete theoretically and may not be sustainable in practice. Chan and Drasgow's (2001) leadership motivation model deserves to be examined as a structure that has the potential to meet this need in the field of school leadership.

Motivation to lead (MTL) is a theoretical approach that relates individuals' leadership orientation, leadership behaviors, and leader effectiveness to motivational processes (Amit, Lisak, Popper & Gal, 2007; Badura et al., 2020; Chan & Drasgow, 2001; Chan & Kennedy, 2018). In recent years, MTL-based research on determining the professional interests of employees in the field of organizational psychology (Clemmons & Fields, 2011; Felfe & Schyns, 2014; Porter, Riesenmy & Fields, 2016); Investments in leader selection, training and development in organizations are becoming increasingly common within the scope of development studies (Porter et al., 2016; Rossi, 2011; Vilkinas, Murray & Chua, 2020). Research indicates that the leadership behaviors of individuals with different leadership motivation may also be different (Badura et al., 2020; Chan & Kennedy, 2018). According to MTL, the emergence of leadership, leader behaviors and leader effectiveness are related to some individual characteristics and motivational processes. Popper & Mayseless (2007) support the arguments of MTL by arguing that individual characteristics and motivational components must come together in order for individuals to emerge as leaders and sustain leadership. Kennedy et al., (2021) reveals that the three-factor structure of motivation to lead explains individual differences in achieving leadership roles. Some research results show that affective identity MTL(AIMTL) and social normative MTL(SNMTL) predict leader effectiveness more strongly than non-calculative MTL(NCMTL) (Auvinen et al., 2020; Vilkinas et al., 2020). Shelia and Aycan (2023) associate the emergence of leadership with the structural features of MTL. Çetinkaya & Arastaman's (2023) qualitative research findings, in which they examined teacher leaders' motivation to lead, draw attention to the importance of motivation to lead in teacher leadership, while also revealing that teacher leaders are motivated to lead with affective identity MTL(AIMTL) and non-calculative MTL (NCMTL). Arastaman, Fidan & Ayyıldız (2023) draw attention to the mediating effect of leadership motivation on teachers' desire to become school principals.

An important feature of Chan & Drasgow's (2001) MTL model is that it combines the process of leader development and leadership performance. Additionally, MTL is based on the assumption that leadership tendency

can be learned and improved rather than the assumption that people have an innate leadership tendency. In this sense, MTL does not evoke the "big man" approach, nor does it assume that people who turn to leadership have needs such as success, power or commitment. For these reasons, understanding MTL is important in answering questions about whether individuals who are interested in leadership roles and motivated to maintain leadership make more effective leaders. In the field of school leadership, being able to identify teachers who are motivated to lead; In order to develop teachers' leadership potential and increase organizational performance, it is important to examine the processes that motivate teachers to take on leadership roles. It is thought that Chan & Drasgow (2001: 481) may provide a different perspective to school leadership studies in terms of meeting the expectations in this direction with the MTL scale, which combines various factors in leadership. For these reasons, the current research examines the psychometric properties of the Leadership Motivation Scale (MTLS) on teachers. As a matter of fact, MTLS in its original form (Chan & Drasgow, 2001), adaptation studies in different languages (Bobbio & Manganelli Rattazzi, 2006; Felfe & Schyns, 2014; Kasemaa, 2016), and Turkish adaptations (Özbezek, 2018; Polatcan & Cansoy, 2020; Turhan, 2014) that the selected sample groups represent university students or military personnel creates the need to examine the psychometric properties of MTLS on samples containing different occupational groups. In addition, the current research encourages MTL-based research in the field of school leadership; clarifying attempts to understand the characteristics of school leaders; In practice, it is expected to contribute to the review of investments in leadership training and development.

Theoretical Framework

Motivation to Lead

One of the important components of leadership is the motivational processes that push the individual to lead (Badura et al., 2020). Early studies on motivation and leadership revealed that individuals are motivated to enter leadership positions with moderate to high levels of power, low need for affiliation, and high need for self-control. (Jacobs & McClelland, 1994). However, the measurements used in these early studies caused criticisms regarding the construct validity and reliability of the studies (Meyer & Kurtz, 2006). In addition, these studies point out some theoretical and empirical deficiencies in explaining MTL as an individual difference variable. Chan and Drasgow (2001) addressed the relationship between individual characteristics and various leader behaviors with an individual differences construct called motivation to lead (MTL). Research on leadership motivation has changed direction significantly with Chan and Drasgow's (2001) MTL model.

According to Chan (1999), motivation is an interaction of complex intrapersonal processes that predict the direction, intensity, and permanence of behavior (Kanfer, Frese & Johnson, 2017). Motivation to lead is an individual differences variable that affects a leader or candidate leader's decision to undertake leadership training, roles and responsibilities, the intensity of leadership effort, and their permanence as a leader (Chan & Drasgow, 2001). Individual characteristics that position MTL as an individual difference variable also direct the individual's leadership behaviors in a particular field of work or life activity through MTL. Chan & Drasgow (2001) define individual characteristics such as leadership self-efficacy, previous leadership experience, personality, value orientations, and general cognitive abilities as antecedents of MTL. Referencing Singer's (1990) "Leadership Desire Model", Bandura's (1986) "Self-Efficacy Theory" and Ross's (1977) "Attribution Theory", Chan and Drasgow (2001) developed a social cognitive variable such as leadership self-efficacy. He suggested that individuals' leadership motivation may be explained by. As a matter of fact, considering that motivation theorists evaluate general self-efficacy as an important predictor of motivation, leadership self-efficacy has been evaluated as directly related to MTL and the closest antecedent to MTL (Chan & Drasgow, 2001). It was also hypothesized that leadership self-efficacy may partially mediate the relationships between MTL and individual characteristics such as past leadership experience, personality, socio-cultural values, and cognitive abilities. According to the researchers, another close antecedent of MTL is past leadership experience. Proven performance in leadership is a feature that motivates the individual to later take on leadership roles (Cappelli & Keller, 2014). Finally, Chan & Drasgow (2001) define intelligence as cognitive abilities such as verbal or numerical ability and analytical thinking; personality traits such as extraversion, agreeableness, responsibility, openness to experience, emotional balance; He argued that socio-cultural values such as horizontal individualism, horizontal collectivism, vertical individualism, vertical collectivism are among the distant antecedents of MTL. Chan & Drasgow (2001) developed the " Motivation to Lead Scale" to both test the individual antecedents and dimensions of MTL and to provide a measurement for MTL.

The MTL scale was developed by testing the MTL structure proposed by Chan & Drasgow (2001), item pools created through focus group discussions, and studies conducted with American and Singaporean students and Singaporean soldiers. Factor analysis results showed, firstly, that the three-factor structure of the scale fits

better than the single-factor structure; secondly, each dimension of the MTL points to different sets of precursors; Finally, it has been shown that the three-factor structure is positively related to each other (Chan, et al., 1999; Chan & Drasgow, 2000; Kessler, et al., 2008).

Affective identity MTL (AIMTL) is related to the individual's individual goals and expectations that are effective in assuming leadership roles (Rosch, Collier & Thompson, 2015). It is based on the assumption that some individuals are interested in leadership roles because they take pleasure in leading (Amit & Bar-Lev, 2012). Individuals with high affective identity MTL are individuals who take pleasure in leading, being at the center of a group and taking responsibility (Clemmons & Fields, 2011). Research reveals that individuals with high affective identity MTL (AIMTL) tend to be more extroverted and social than other individuals in the group, and that they value competition and success (Chan, Rounds, & Drasgow, 2000; Tafero, 2007). Additionally, these individuals have greater leadership self-efficacy and past leadership experience; They are individuals who are motivated to leadership with a sense of duty and responsibility (Tafero, 2007).

According to social normative MTL (SNMTL), individuals are attracted to leadership roles out of a sense of duty or obligation. Individuals motivated for leadership with social normative MTL feel a deep commitment to the groups to which they belong (Amit & Bar-Lev, 2012); tends to reject social inequalities while accepting social hierarchies within the group (Chan et al., 2000). In addition, these individuals are likely to have more leadership self-efficacy and past leadership experience, like individuals with high affective identity MTL (Chan et al., 2000; Kessler et al., 2008). Research reveals that individuals' personality traits characterized by agreeableness and conscientiousness (Tafero, 2007), as well as vertical individualistic and vertical collectivistic value orientations, are positively related to social normative MTL (SNMTL) (Chan & Drasgow, 2001).

Finally, Non-calculative MTL (NCMTL) is based on the assumption that individuals assume leadership roles without any expectation of personal benefit (Amit et al., 2007). In this sense, individuals with high non-calculative MTL (NCMTL) display a selfless stance in leadership, contrary to traditional expectation-oriented motivation approaches. On the other hand, individuals with high non-calculative MTL have horizontal collectivistic socio-cultural values; tend to have an agreeable and tolerant personality and are likely motivated to lead regardless of past leadership experience (Chan et al., 2000; Chan & Drasgow, 2001).

While the MTL scale brings a different perspective to leadership research with its antecedents and three-dimensional structure, adaptation studies of the scale have also been carried out in different cultural contexts. For instance, in Bobbio & Manganelli Rattazi's (2006) adaptation study to Italy, evidence was provided for the validity and reliability of the scale with 15 items. Amit et al., (2007: 144) added patriotic and ideological MTL factors to Chan & Drasgow's (2001) original scale form. Adaptation studies conducted by Felfe & Schyns, (2014), Kasemaa (2015), and Özbezek (2018), Polatcan & Cansoy (2020), Turhan (2014) in Turkey have shown that MTL is a valid and reliable measurement tool.

METHOD

In the study, the psychometric properties of MTLS were tested on teachers. Prior to the research, permission to use the scale was obtained from Chan Kim Yin via e-mail, and Ethics Committee approval was received from Hacettepe University Rectorate with a letter dated 21.03.2023 and numbered E-35853172-300-00002756620.

Research Design

In the first stage of the research, the scope of the original scale form was examined, and language equivalence was ensured. To understand whether the scale items adequately represent the content with content validity; with language equivalence, it is aimed to ensure the equivalence of the meanings of the items in Turkish and the original language. In the second stage, evidence for the construct validity of the MTL was obtained by EFA and CFA. In the final stage, Cronbach Alpha internal consistency coefficients for EFA and CFA sample groups were used to determine the reliability of the scale; In order to determine the item discrimination analysis, item-total correlations were calculated; It was examined whether the overall scores of MTL differed in the lower 27% and upper 27% groups.

Participants

The population of the study consists of 25205 teachers working in different types of schools in Altındağ, Çankaya, Keçiören, Mamak and Yenimahalle districts of Ankara. There are different opinions about the

recommended sample size for factor analysis in scale development and adaptation studies. According to Tabachnick & Fidell (2001), a sample of 150 people is sufficient for factor analysis. Bryman & Cramer (2005) stated that a sample size of 5 to 10 times the number of scale items is sufficient for factor analysis. Çokluk, Şekercioğlu and Büyüköztürk (2010) stated that a sample of 300 people is good for factor analysis and a sample of 500 people is very good. In this study, the sample size for EFA was determined as 300 teachers, taking into account all the opinions suggested for factor analysis. Simple random sampling method was followed to determine the participants. The scale form was answered by 309 teachers. After performing extreme value analysis on the sample group, EFA was completed with the data collected from 304 teachers. EFA sample information is shown in Table.

Data Collection

The scale Hazar and Hazar (2017) developed was used to determine children's digital game addiction levels. As a result of factor analysis conducted in the scale development process, a structure consisting of the Cronbach alpha coefficient of 0.91 and 24 items and four factors were obtained. These four factors are “excessive focus and conflict towards digital gaming”, “development of tolerance in duration of playing and the value of the game”, “postponement of individual and social tasks”, and “psychological-physiological reflection of deprivation and being hooked on digital games”.

A semi-structured interview form was developed to reveal children's digital game habits and perceptions of digital game addiction and how they are affected by digital games. Firstly, a draft interview form with 12 questions suitable for the research was prepared. Additionally, arrangements for interview form were made in line with feedback received from two field experts working on digital game and digital game addiction. A pilot study was conducted with eight children, a girl, and a boy, from each grade level at secondary school. According to the findings obtained from the pilot study, the interview form was finalized by adding probes to one question.

Table 1: EFA Sample Information

Variables	Category	Frequency	Percentage
Gender	Female	225	74.00
	Male	79	26.00
Education Status	License	242	79.60
	Master	62	20.40
School Level	Pre-school	65	21.40
	Primary school	74	24.30
	Secondary sch.	83	27.30
	High school	82	27.00
Total		304	100.00

When Table 1 is examined, 74% (n=225) of the teachers in the EFA sample are women and 26% (n=79) are men. 79.6% (n=242) of the teachers are graduates of license programs and 20.4% (n=62) are graduates of master programs. 21.4% (n=65) of the teachers are in preschool; 24.3% (n=74) were in primary school; 27.3% (n=83) were in secondary school; 27% (n=82) work in high school. In the EFA sample, the number of female teachers compared to their male counterparts; The number of teachers graduating from license programs is significantly higher than that of teachers graduating from master programs. On the other hand, the distribution of teachers according to school type is quite close to each other.

By following the sampling process followed in the EFA process, the sample size of the CFA was determined as 500 teachers. The sample size was kept higher in order to test the factor structure of the scale more reliably with confirmatory factor analysis (Bryman & Cramer, 2005; Çokluk et al., 2010). The scale form was answered by 506 teachers. After performing extreme value analysis on the sample group, CFA was completed with the data collected from 500 teachers. CFA sample information is shown in Table 2.

Table 2: CFA Sample Information

Variables	Category	Frequency	Percentage
Gender	Female	342	68.40
	Male	158	31.60
Education Status	License	394	78.80
	Master	106	21.20

School Level	Pre-school	21	4.20
	Primary school	215	43.00
	Secondary sch.	84	16.80
	High school	180	36.00
Total		500	100

When Table 2 is examined, 68.4% (n=342) of the teachers in the CFA sample are women and 31.6% (n=158) are men. 78.8% (n=394) of the teachers graduated from master programs and 21.2% (n=106) graduated from license programs. 4.2% (n=21) of the teachers are in preschool; 43% (n=215) were in primary school; 16.8% (n=84) were in secondary school; 36% (n=180) work in high school. In the CFA sample, the number of female teachers compared to their male teachers; The number of teachers graduating from license programs is significantly higher than that of teachers graduating from master programs. On the other hand, the number of teachers working in primary and high schools is higher than those working in preschool and secondary schools. In this sense, EFA and CFA sample distributions are largely consistent.

Data Analysis

In this part of the research, the features of MTLS and the data analysis process are explained.

MTL Scale

The purpose of MTLS is to measure the motivational processes behind individuals' desire to become leaders. MTLS was created as a result of research on American, Singaporean students and Singaporean soldiers. With the item pool created by the researchers through focus group interviews and the exploratory factor analyzes conducted with the participation of American, Singaporean students and Singaporean soldiers, affective-identity, social-normative and noncalculative analyzes were consistent with all three samples. They obtained a three-dimensional 27-item scale consisting of 9 items each, including motivation to lead. Scale dimensions are positively related to each other. For this reason, a general leadership motivation score may be obtained from the scale. With the one-dimensional model, a person's motivation to take a leadership role may be measured as the sum of all leadership motivations; With the three-dimensional model, affective identity, none calculative, and social normative motivation to lead may be measured. The internal consistency of the dimensions of the MTLS was .91 -.84 in affective-identity leadership motivation for all three samples; .84-.80 in the dimension of none calculative leadership motivation; It is between .75 and .65 in the dimension of social-normative leadership motivation (Chan & Drasgow, 2001: 484-486).

Scope Validity

For the content validity analysis of MTLS, the relevant literature was first scanned in detail. Then, the original form of the scale and adaptation studies conducted in different cultures were examined (Bobbio & Manganelli Rattazzi, 2006; Felfe & Schyns, 2014; Kasemaa, 2016; Özbezek, 2018; Polatcan & Cansoy, 2020; Turhan, 2014). Additionally, the results of a recent qualitative study conducted in the Turkish context revealed inferences that the three-factor structure of MTL is compatible with the leadership motivations of teacher leaders (Çetinkaya & Arastaman, 2023).

Language Equivalence

The language equivalence study of MTLS was carried out by two English language experts and a faculty member who is fluent in English and is an expert in educational administration and translation. First of all, the items in the original form of MTLS were translated into Turkish by the researcher and an English language expert. The scale form, which was then translated into Turkish, was translated into English by another English language expert. The scale form obtained by completing the bidirectional translation processes is Özbezek, (2018), Polatcan & Cansoy, (2020); It was compared with the scale forms adapted into Turkish by Turhan (2014). Finally, the draft scale form, which was revised with the suggestions of nine teachers, was checked in terms of meaning and content, and it was made ready for application by taking the appropriate opinions of one measurement and evaluation and two education administration field experts.

Construct Validity

Evidence for the construct validity of the MTL was provided by EFA and CFA, respectively. While responding to the scale items, the participants stated that "they participated in group work in their schools;

imagining that the teachers in the group have similar education, knowledge and experience; and, if someone from the group was to be elected leader, they were asked to consider their reasoning for assuming the leadership role."

Before proceeding with data analysis, normality, linearity and outlier analyzes were performed on the data set to determine whether the data met the eligibility criteria for EFA. Additionally, whether there was multicollinearity between the variables was tested by examining the variance increase factor (VIF) and tolerance values (Field, 2013; Tabachnick & Fidell, 2007). As a result of the analysis, the tolerance value is above .10; It was observed that the VIF value was below 10. According to these results, it can be stated that there is no multicollinearity between the variables (Field, 2013; Tabachnick & Fidell, 2007). Then, to determine the sample adequacy criteria, Kaiser-Meyer-Olkin (KMO); Bartlett coefficients test scores were examined to test the suitability of the data structure. Based on the assumption that the scale dimensions are related to each other, EFA was performed by horizontal rotation using the principal components method.

The factor structure of MTL was tested with CFA on a different data set than the EFA data set. First of all, the normality, linearity and extreme values of the data were examined. Whether there was multicollinearity between the variables was tested by examining the variance increase factor (VIF) and tolerance values (Field, 2013; Tabachnick & Fidell, 2007). In CFA, the level of significance of each item's relationship with the relevant factor and acceptable fit ranges for model fit indices were examined, and covariances were created between error values to reach acceptable goodness of fit values. In this way, a structural equation model was established by considering the relationships between the latent variables. Finally, Cronbach Alpha Internal Consistency Coefficient for EFA & CFA groups; Item-total correlations were calculated. It was examined whether MTL general scores differed in the lower 27% and upper 27% groups.

FINDINGS

Exploratory Factor Analysis (EFA)

Some descriptive statistical analyzes were performed before analysis. According to the analysis, the skewness coefficient value is -.654, the kurtosis coefficient value is .199; The correlation between the items was found to be r< .85. The KMO value calculated to determine whether the data obtained from the EFA sample (n=304) met the sample adequacy criteria was 0.94; The Bartlett test ($\chi 2 = 6946.408$; $df = 351$, $p < 0.01$) calculated to test the suitability of the data structure was found to be significant. According to Büyüköztürk (2018), the fact that KMO is greater than 0.60 and the Bartlett test is significant explains that the data set is suitable for EFA.

It is aimed to reach meaningful conceptual structures from the variables with the principal components method, since the data set provides the basic conditions for performing EFA (Büyüköztürk, 2018). In addition, horizontal rotation was performed based on the assumption that the scale dimensions are related to each other. Although it is recommended to exclude items with a factor loading difference of less than 0.10 in the EFA (Stevens, 2002), no items were removed from the scale since no overlapping items were found in the analysis. As a result of the analysis, a three-factor structure with an eigenvalue above 1 emerged. These factors were found to explain 67.72% of the total variance. The factor loadings of the scale are shown in Table 3.

Table 3: Factor Loads of MTLS

Items	SNMTL	AIMTL	NCMTL
It is not right to decline leadership roles.	.842		
I would only agree to be a group leader if I know I can benefit from that role. *	.815		
I never expect to get more privileges if I agree to lead a group.	.806		
I would never agree to lead just because others voted for me. *	.794		
I agree to lead whenever I am asked or nominated by the other members.	.790		
I was taught in the value of leading others.	.776		
I feel that I have a duty to lead others if I am asked.	.749		
It is an honor and privilege to be asked to lead.	.694		
Leading others is a waste of one's personal time and effort. *	.478		

I am the type of person who likes to be in charge of others.	.865	
I usually want to be the leader in the groups that I work in.	.857	
I have a tendency to take charge in most groups or teams that I work in.	.849	
I am the type who would actively support a leader but prefers not to be appointed as leader. *	.849	
Most of the time, I prefer being a leader than a follower when working in a group	.784	
I am the type of person who is not interested in lead**ing** others. *	.780	
I believe I can contribute more to a group if I am a follower rather than a leader. *	.775	
I am definitely not a leader by nature. *	.760	
I am seldom reluctant to be the leader of a group.	.748	
I have more of my own problems to worry about than to be concerned about the rest of the group. *	.556	
People should volunteer to lead rather than wait for others to ask or vote for them	.539	
I would want to know what's in it for me if I am going to agree to lead a group. *		.940
It is appropriate for people to accept leadership roles or positions when they are asked.		.937
I will never agree to lead if I cannot see any benefits from accepting that role. *		.884
If I agree to lead a group**,** I would never expect any advantages of special benefits.		.792
I have been taught that I should always volunteer to lead others if I can.		.777
I am only interested in lead**ing** a group if there are clear advantages for me. *		.670
I would agree to lead others even if there are no special rewards or benefits with that role.		.606

(*): items are reverse coded items.

The factor loads of the scale items in Table 3 ranged from 0.48 to 0.94. It is seen that 9 of the highest load values of MTLS items occurred in the first factor, 11 in the second factor, and 7 in the third factor. The first factor was "social-normative MTL" (SNMTL); the second factor "affective-identity MTL" (AIMTL); The third factor was named "none-calculative MTL" (NCMTL). The factors that emerged as a result of EFA were found to be compatible with the relevant literature and the MTLS original form. However, in the current analysis, it was observed that some items loaded on factors different from the factors in the original scale. The load values of the items belonging to the factors of the scale were between 0.48 and 0.84 for the "social-normative" MTL; between 0.54 and 0.87 for "affective-identity MTL"; For "non-calculative MTL" it ranges from 0.61 to 0.94. Finally, since the sample group was larger than 200, the scree plot was examined (Field, 2009). Figure 1 shows the scree plot of the scale.

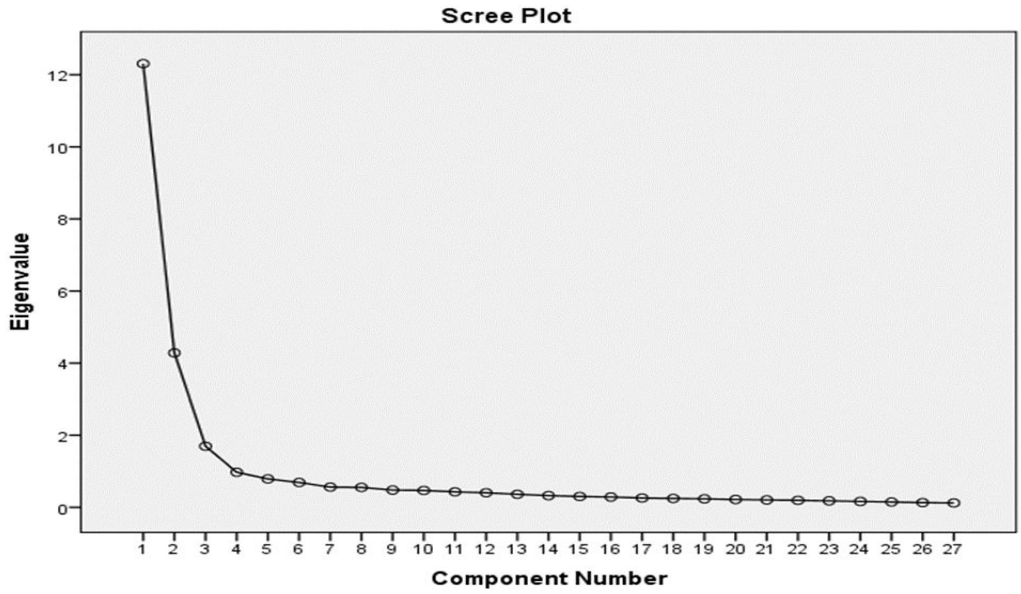


Figure 1: *Scree plot of the scale*

In this analysis, it is seen that the scree plot descends after the first factor. While this indicates that the scale may be grouped under a single factor (Büyüköztürk et al., 2018), it also indicates that the scale consists of 3 factors and that the factors make a similar contribution to the common variance after the 3rd dimension.

Confirmatory Factor Analysis (CFA)

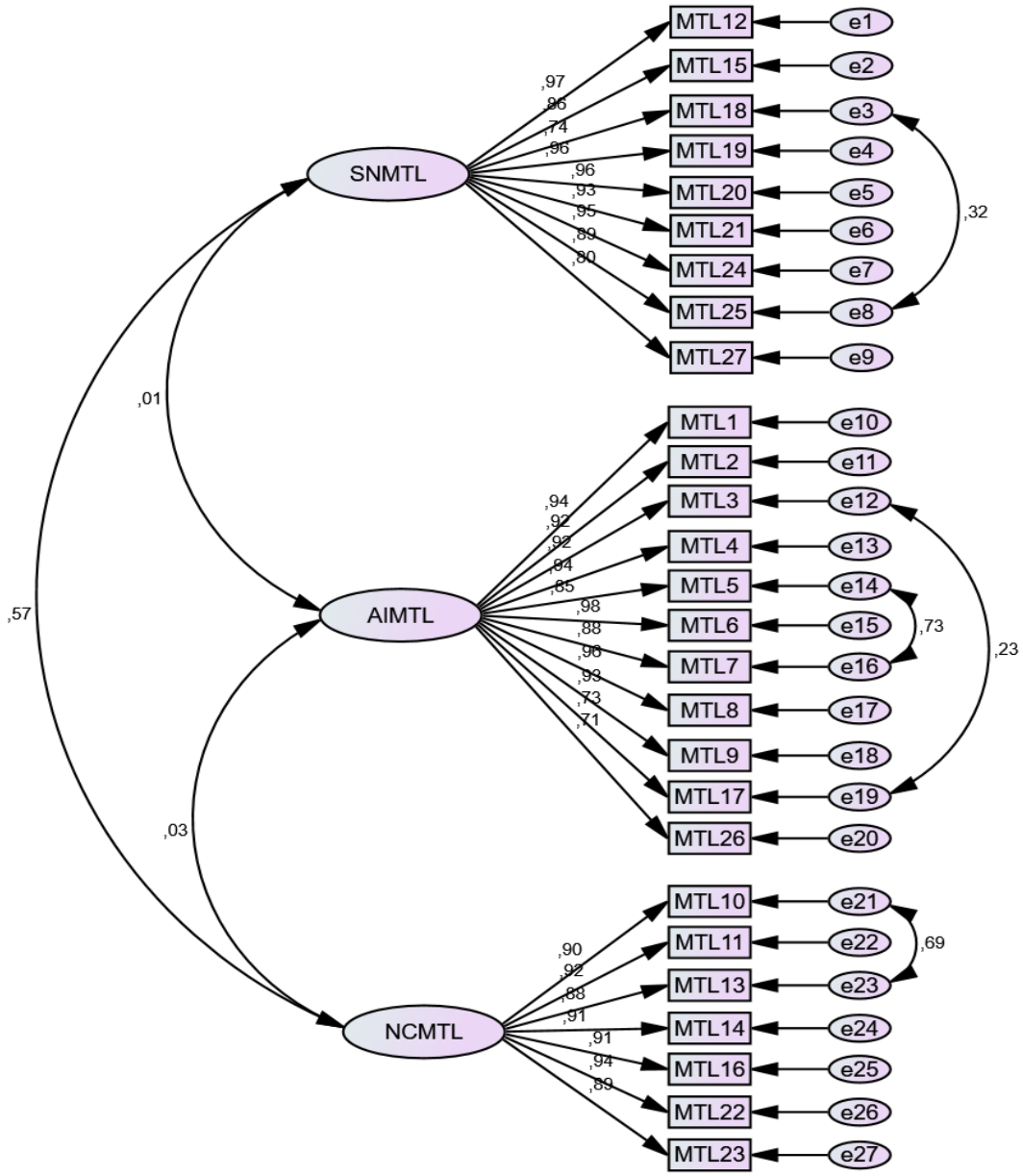
According to the results of EFA, the "Motivation to Lead Scale", which consists of three dimensions and a total of 27 items, was verified by testing with CFA. Before proceeding to CFA, descriptive statistical analyzes were performed to determine the suitability of the data set for analysis. The skewness coefficient value is -.514, the kurtosis coefficient value is -.832; correlation between items was determined as .20-.89. The data showed normal distribution; It was seen that there was a positive relationship between the items and there was no multicollinearity problem.

The AGFI and GFI goodness-of-fit values of MTLS were found below the acceptable reference ranges. In order for the fit indices to be within acceptable reference ranges, it is recommended to examine the modification suggestions that emerged as a result of the analysis (Çokluk et al., 2010). Therefore by examining the modification suggestions, 18th and 25th; 3rd and 17th; 5th and 7th; The model was retested by making covariance between the 10th and 13th items. In Table 4, acceptable and perfect fit values (Schermelleh-Engel, Moosbrugger, & Müller, 2003) and fit values obtained from the scale are shown.

Table 4: Fit Indices and Findings

Fit indices	Perfect fit indices	Acceptable fit indices	Findings
$\chi 2/df$	$0 \leq \chi 2/df \leq 2$	$2 \leq \chi 2/df \leq 5$	4.61
AGFI	$0.90 \leq AGFI \leq 1.00$	$0.85 \leq AGFI \leq 0.90$	.83
GFI	$0.95 \leq GFI \leq 1.00$	$0.90 \leq GFI \leq 95$	.85
CFI	$0.95 \leq CFI \leq 1.00$	$0.90 \leq CFI \leq 0.95$	.95
NFI	$0.95 \leq NFI \leq 1.00$	$0.90 \leq NFI \leq 0.95$	.93
IFI	$0.95 \leq IFI \leq 1.00$	$0.90 \leq IFI \leq 0.95$	.95
RMSEA	$0.00 \leq RMSEA \leq 0.05$	$0.05 \leq RMSEA \leq 0.08$	.08

As a result of CFA, $\chi 2/sd$ value was calculated as 4.61. According to Kline (2016), this value is among the acceptable fit values. Additionally, the CFI and IFI values in the model are excellent; NFI and RMSEA values are within acceptable goodness of fit limits (Schermelleh-Engel et al., 2003); AGFI and GFI values were found to be close to acceptable values (Marsh, Hau, Artelt, Baumert, & Peschar, 2006). Figure 2 shows the structural equation model obtained as a result of CFA**.**

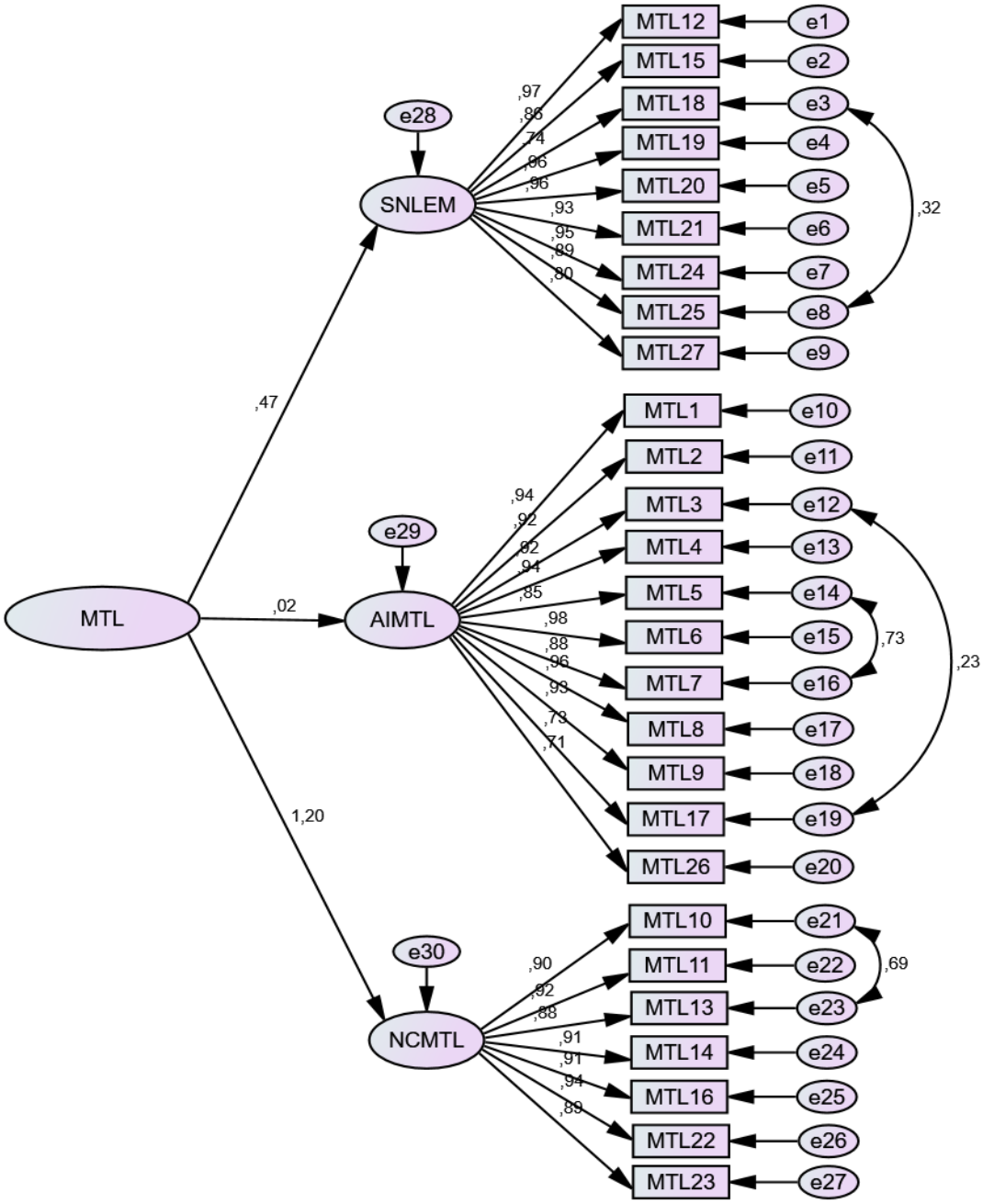


CMIN/df: 4.61; AGFI: .83; GFI: .85; NFI: .93; CFI: .95; IFI: .95; RMSA: .08

Figure 2: *CFA Structural Equation Model*

When Figure 2 is examined, the first factor, social normative MTL (SNMTL), consists of nine items. Item factor loadings of SN MTL vary between 0.74 and 0.97. The second factor, affective identity MTL (AIMTL), consists of 11 items. AIMTL's item factor loadings range from 0.71 to 0.98. Lastly, the third factor, non-calculative MTL (NCMTL), consisted of seven items. The factor loadings of NCMTL are between 0.89 and 0.92.

Finally, second-level factor analysis of the scale was made and the fit indices were examined. In the structural equation model created as a result of the second level CFA, the $\chi 2$/df value was 4.61; AGFI value .83; GFI value of .85; NFI value is .93; CFI value .95; The IFI value is .95 and the RMSA value is .08. In Figure 3, the factor loadings of the three-dimensional model obtained as a result of the second level CFA are shown.



CMIN/df: 4.61; AGFI: .83; GFI: .85; NFI: .93; CFI: .95; IFI: .95; RMSA: .08

Figure 3: *Second-level CFA Structural Equation Model*

When Figure 3 is examined, the first factor, social normative MTL (SNMTL), consists of nine items. Item factor loadings of SN MTL vary between 0.74 and 0.97. The second factor, affective identity MTL (AIMTL), consists of 11 items. AIMTL's item factor loadings range from 0.71 to 0.98. Finally, the third factor, non-calculative MTL (NCMTL), consisted of seven items. The factor loadings of NCMTL are between 0.89 and 0.92. In addition, according to the second level CFA results, it is seen that a total score may be obtained from the scale and the factor structure of the original scale is confirmed. On the other hand, 1.20 of the variance of leadership motivation is NCMTL; 0.47 is explained by SNMTL, and 0.02 is explained by DIMTL.

Reliability Analysis

Cronbach Alpha coefficients for EFA and CFA groups to determine the internal consistency reliability of the scale in the study; The item discrimination of the scale was made by calculating the item-total correlations and whether the general scores of MTLS differed in the lower 27% and upper 27% groups.

As a result of EFA, Cronbach's Alpha coefficient was 0.95 for all dimensions of the scale; Cronbach's Alpha reliability coefficients of the sub-dimensions were 0.93 for the social normative MTL; 0.94 for affective identity MTL, and 0.93 for non-calculative MTL were calculated.

Cronbach's Alpha coefficient was 0.94 for all dimensions of the scale as a result of CFA; Cronbach's Alpha reliability coefficients of the sub-dimensions were 0.93 for the social normative MTL; 0.91 for affective identity MTL and 0.89 for non-calculative MTL.

In the item-total correlation analysis of the scale, the correlation coefficient between the score obtained from each item and the total score obtained from the scale was calculated. Table 5 shows the correlation coefficients of the items in the MTLS.

Table 5: Item Total Correlation values

Item	Value	Item	Value	Item	Value
MTL20	.78	MTL24	.69	MTL15	.62
MTL19	.75	MTL18	.67	MTL11	.61
MTL12	.73	MTL1	.67	MTL10	.57
MTL3	.73	MTL6	.67	MTL22	.57
MTL25	.72	MTL9	.66	MTL14	.54
MTL21	.72	MTL16	.64	MTL27	.52
MTL13	.72	MTL7	.64	MTL2	.49
MTL17	.72	MTL23	.64	MTL5	.40
MTL8	.72	MTL4	.63	MTL26	.36

It is seen that the item-total correlations of MTLS take values between .36 and .78. Items with an item-total correlation of .30 and higher are defined as distinctive items (Büyüköztürk, 2018).

Finally, additional analyzes were conducted to determine the internal reliability of the scale using the lower 27%-upper 27% (discrimination) method, which is another reliability determination method frequently used in scale development and adaptation studies. Firstly, the groups comprising the 27% with the highest score and the 27% with the lowest score from the scale were determined. The difference between the scale total score averages of these two groups was compared with the t test for independent groups. The significant difference between the two groups, $p < .05$, was interpreted as another indicator of the internal reliability of the scale. In this way, it was aimed to provide additional evidence regarding the distinctiveness of the scale items. Table 6 shows the t-Test results of the 27% lower and Upper Groups of the MTLS total scores.

Table 6: T-Test Results of 27% Lower and Upper Groups of MTLS total scores

Dimension	Groups	N	M	SD	t	p
MTL	Upper	82	105.12	6.30	29.79	0.00
	Lower	82	58.30	12.76		

The t-test results applied to test the significance of the differences between the total scores of the lower and upper 27% groups showed that the scale items were distinctive.

DISCUSSION & CONCLUSION

In the study, the psychometric properties of the Motivation to Lead Scale (MTLS) developed by Chan & Drasgow (2001) were tested on teachers. The results of the research showed that MTLS can be a valid and reliable measurement tool to be used in studies in the field of school leadership.

Construct validity analyzes were consistent with both the original form of the scale and the results of the adaptation made in different cultures; the first factor was “social-normative MTL”; the second factor is “affective-identity MTL”; provided evidence supporting a three-factor structure, with the third factor being the “non-calculative MTL”. However, in the current study, 10 items loaded on factors different from those in the original scale. This may be due to the structural similarities and relationships between Social normative MTL, Emotional identity MTL and Non-Calculative MTL factors, or it may be related to the socio-cultural differences of teachers in the Turkish context. In addition, according to the CFA results, some of the model fit indices are acceptable rather than perfect. For example, $\chi 2/df$ is 4.61; NFI value .93 and RMSEA value .08 (Kline, 2016); AGFI and GFI

values were calculated close to acceptable values (Marsh, et al., 2006). The relatively low indices of some model fit may be related to the sample group. As a matter of fact, both the original form of MTLS (Chan & Drasgow, 2001) and adaptation studies in various cultures (Bobbio & Manganelli Rattazzi, 2006; Felfe & Schyns, 2014; Kasemaa, 2016; Özbezek, 2018; Polatcan & Cansoy, 2020; Turhan, 2014), military personnel or university students, while the sample group in the current study consists of teachers. Therefore, it is recommended that the results of the study be carefully evaluated in the light of this information. On the other hand, testing the psychometric properties of MTLS on the teacher group is a first step in the related literature. For this reason, it is expected that the results of the research will contribute to both comparative research in the MTL literature and new research on school leadership.

MTLS, leadership emergence in related literature (Hong, Catano, & Liao, 2011); leadership behavior (Mutalib & Ghani, 2013); Leadership identity (Middleton, Walker & Reichard, 2018) is used to explain various constructs, such as career planning for leadership positions and transitioning into formal leadership roles (Luria & Berson, 2013). The results of the current research conducted based on MTL literature are to identify teachers with leadership tendencies in the field of school leadership; encouraging talented teachers to take on leadership roles; It may be useful to create a pool of potential leaders for schools and to increase leader effectiveness and organizational performance in schools. Additionally, new research may examine the relationship of MTLS to various situational factors and specific situations.

Statements Of Publication Ethics

This research does not contain any ethical conflicts or issues that could prevent the publication of the article. Ethics Committee approval was received from Hacettepe University Rectorate with a letter dated 21.03.2023 and numbered E-35853172-300-00002756620.

Researchers' Contribution Rate

Both authors contributed equally to this study.

Conflict of Interest

The authors have no conflicts of interest to disclose.

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Eighth Grade Students' Metaphorical Perceptions of Ordered Pair and Variable Concepts

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Abstract

In this study, it was aimed to determine the metaphorical perceptions of eighth grade students regarding the concepts of ordered pair and variable, and to examine the changes in these perceptions according to gender and socioeconomic status. "Phenomenology" design, one of the qualitative research methods, was used as the research model. The sample of the study consists of 400 eighth grade students studying in four public secondary schools of a province in the Black Sea Region in the 2021-2022 academic year and selected by maximum variation sampling method. Metaphoric Perception Form (MPF) was used as a data collection tool. Content analysis was used to analyze the student metaphors related to the concepts. Chi-Square test was used to examine the change of the developed metaphors according to gender and socioeconomic status. According to the findings of the study, the metaphors related to the concept of ordered pair were grouped under 17 conceptual categories and the metaphors of *friend*, *buddy*, *sibling*, *school desk*, *twins*, *pattern* and *close friends* were mostly used. The metaphors related to the concept of variable were grouped under 10 conceptual categories and the most common metaphors were *human*, *emotion*, *chameleon*, *dollar*, *weather forecast*, *life*, *decision* and *foreigner*. While female students developed more metaphors than male students regarding the concepts of ordered pair and variable, male students used more metaphor drawings than female students. For these concepts, secondary schools with high socioeconomic status developed more metaphors than secondary schools with low socioeconomic status.

Keywords: Metaphor, ordered pair, variable, socioeconomic status

Sıralı İkili ve Değişken Kavramlarına İlişkin Sekizinci Sınıf Öğrencilerinin Metaforik Algıları

Öz

Bu araştırmada, sekizinci sınıf öğrencilerinin sıralı ikili ve değişken kavramlarına ilişkin metaforik algılarının belirlenmesi, cinsiyet ve sosyoekonomik düzeye göre bu algılardaki değişimlerin incelenmesi amaçlanmıştır. Araştırma modeli olarak, nitel araştırma yöntemlerinden "olgubilim (fenomenoloji)" deseni kullanılmıştır. Araştırmanın örneklemini, 2021-2022 eğitim öğretim yılı Karadeniz Bölgesi'ndeki bir ilimizin dört devlet ortaokulunda öğrenim görmekte olan ve maksimum çeşitlilik örnekleme yöntemiyle seçilmiş 400 sekizinci sınıf öğrencisi oluşturmaktadır. Veri toplama aracı olarak Metaforik Algı Formu (MAF) kullanılmıştır. Kavramlara ilişkin öğrenci metaforlarının çözümlenmesinde içerik analizi kullanılmıştır. Geliştirilen metaforların cinsiyete ve sosyoekonomik düzeye göre değişiminin incelenmesi için Ki-Kare testi kullanılmıştır. Araştırmanın bulgularına göre, sıralı ikili kavramına ilişkin metaforlar 17 kavramsal kategori altında toplanmış ve en çok *arkadaş*, *kanka*, *kardeş*, *okul sırası*, *ikizler*, *örüntü* ve *yakın arkadaş* metaforları kullanılmıştır. Değişken kavramına ilişkin metaforlar 10 kavramsal kategori altında toplanmış ve en çok *insan*, *duygu*, *bukalemun*, *dolar*, *hava durumu*, *hayat*, *karar* ve *yabancı* metaforları kullanılmıştır. Sıralı ikili ve değişken kavramlarına ilişkin kız öğrenciler, erkek öğrencilere oranla daha fazla metafor geliştirirken, erkek öğrenciler kız öğrencilere göre daha fazla metafor çizimi kullanmıştır. Bu kavramlara ilişkin, yüksek sosyoekonomik düzeye sahip ortaokullar, düşük sosyoekonomik düzeye sahip ortaokullara oranla daha fazla metafor geliştirmişlerdir.

Anahtar kelimeler: Metafor, sıralı ikili, değişken, sosyoekonomik düzey

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INTRODUCTION

Scientific innovations and technological developments in the world also shape teaching. Mathematics itself, which is the source of all scientific fields, prepares the ground for these changes. Where there are many changes, the methods and tools used in mathematics teaching also necessitate change. According to Hanson (1993), metaphors have become one of the transmission tools of teaching in terms of making the teaching process active with instruments such as imagination, different perspective and high motivation and making the student a part of the process.

Metaphors are one of the most effective tools to determine an individual's perspective and attitude towards a concept or to reveal his/her mistakes and misconceptions on any subject (Erdem & Satır, 2000; Sanchez et al., 2000). Metaphors guide individuals in examining what they think and how they feel about any concept and in analysing their perceptions in depth (Yalçın, 2012). Metaphor is an effort to understand a phenomenon with another phenomenon, to experience it with another concept and to bring a different perspective to phenomena (Lakoff & Johnson, 2005). Metaphor contributes to establishing a relationship and strengthening the mental map by reflecting a mental schema on another mental schema (Saban, 2009). It covers the processes of associating the objects or situations we are trying to understand with objects or situations belonging to another field of meaning. Thus, it reveals the overlooked aspects of the concept with a different perspective (Taylor, 1984). With different definitions, metaphor is the expression and often concretisation of a concept with little known properties by establishing a similarity between a concept with little known properties and another concept with well-known properties (Ocak & Gündüz, 2006; Uyan-Dur, 2016). Metaphors are not only structures consisting of analogies, but also a part of the thinking system of the mind (Cerit, 2006). Metaphors have a shaping effect on our language and accordingly on our emotions, thoughts and the way we express ourselves (Morgan, 1998). On the other hand, metaphors contribute to the determination of individuals' attitudes and perspectives towards a phenomenon, and to obtaining, interpreting, sharing and sharing data for this purpose and revealing ambiguous points (Erdem & Satır, 2000).

Metaphors are used in teaching abstract and complex mathematical concepts and revealing their reflections on students. How the student perceives the components of the course from his/her own perspective and what images he/she creates for the concepts in the course are revealed through metaphors (Güveli et al., 2011). Concepts, facts, objects and developments in the environment create perceptions in individuals. With these perceptions, the individual determines his/her feelings, thoughts and attitudes towards a concept or object (Kenç, 2019). In this case, an individual's perception of something is a variable worth examining in terms of revealing his/her attitude towards that thing and showing his/her thoughts. It is of great importance to determine the existing perceptions towards an important course such as mathematics or mathematical terms that encompasses life in every aspect.

Using metaphor is an activity of creating mental models. Mental models, which are a network of meaningful relationships between bits of information, are dynamic structures that improve students' problem solving skills and mathematical thinking (Lai, 2013). Metaphors are tools that develop imagination and intuition and enable students to learn by exploring (Fraser, 2000; Hanson, 1993; Sanchez et al., 2000). In addition, they are mental mechanisms that make a high contribution to the processes of storing and retrieving information in memory. Metaphors are tools that can be used to convey mathematical concepts indirectly due to the abstract structure of mathematics (İşçi, 2019). Metaphors have a great role in learning and memorising concepts that are difficult to learn (Arslan & Bayrakçı, 2006) and making comparisons between concepts (Çelikten, 2005). Comprehension of an unknown thing with more known things through metaphors has popularised the use of metaphors in scientific fields. Scientists have used metaphors to conceptualise scientific phenomena that are difficult to understand in disciplines such as physics and chemistry. For example, the atomic model was conceptualised with the metaphor of ‘plum pudding’ due to its similarity in shape (Schoch, 1983).

In addition to supporting students' cognitive characteristics, metaphors also support their affective characteristics. According to Fraser (2000), metaphors have aspects of developing and improving emotions and intuitions. Alkan and Ertem (2003) stated that mathematics is seen as a difficult and boring course. As a result of the abstract nature of mathematics and accumulated prejudices, students have problems in forming their own concepts and have a negative attitude towards mathematics. At this point, metaphors contribute positively to the affective characteristics of students, increase student motivation, and eliminate fear and reluctance towards the lesson (Fretzin, 2001; Osborn, 1997; as cited in Uysal, 2016). According to Fretzin (2001), increasing student

attitude and motivation through concretisation activities based on the similarities between the objects in the physical environment and the concept being taught are the advantages of using metaphors (cited in Uysal, 2016).

Each metaphor bears traces of the life of the person who creates it. Creating a metaphor is giving a new identity to a concept and this process of giving identity is realised by blending individuals' past experiences, their own mental activities and intellectual identities (Büyükbayram, 2004). The way mathematical terms or concepts are perceived by students is also considered valuable in terms of presenting the meanings that students attribute to these concepts. In line with this idea, many studies have been conducted to reveal how mathematical concepts are perceived by students or teachers. Reeder et al. (2009), in his study in which he determined pre-service teachers' beliefs about mathematics through metaphors, stated that pre-service teachers mostly associated mathematics with the concepts of "development", "travelling" and "production". Güveli et al. (2011) revealed the perceptions of prospective primary school teachers towards the concept of mathematics through metaphors. Accordingly, pre-service primary school teachers produced metaphors mostly in the categories of 'mathematics as an exciting course' and 'mathematics as a difficult and boring course'. Satmaz (2016) tried to determine the perceptions of gifted students towards Science and Art Centre (SAC) and mathematics through metaphors. The most common metaphors for SAC were 'safe and relaxing environment', 'source and transmitter of knowledge', 'developer and guide'. For the concept of mathematics, metaphors were mostly developed in the categories of 'necessary for life' and 'fun'. Kenç (2019) examined eighth grade students' metaphorical perceptions of mathematics and mathematics teachers. It was determined that students developed negative attitudes towards this course with the metaphors they produced such as 'a challenging course' and 'a boring course'. It was determined that students developed positive attitudes towards mathematics teachers with the metaphors they produced such as 'fun' and 'source of happiness'. Ergöl and Sezgin-Memnun (2020) examined the perceptions of fifth and seventh grade students towards the concept of fraction through metaphors and stated that students mostly used 'cake/pizza' and 'knife/scissors' metaphors. In addition, it was concluded that students had difficulty in making sense of the fraction concept and the use of abstract metaphors for the fraction concept increased as the grade level increased.

Algebraic thinking, which represents a special form of mathematical thinking, is an important thinking system that includes problem solving, reasoning, critical thinking and the ability to express a situation with different representations (Çelik, 2007). Algebraic thinking is a thinking system that includes proportional reasoning, understanding variables, analysing relationships between quantities, using models, providing solutions to problems encountered in daily life, making logical inferences and reasoning skills (Greenes & Findell, 1998; National Council of Teachers of Mathematics [NCTM], 2000). Starting from primary school, the concept of pattern is included in arithmetic and geometry, and students are tried to be prepared for algebra teaching (Ministry of National Education [MoNE], 2018). The fact that the foundation of the skills that will make advanced mathematics learning more effective for students, who are expected to gain mathematical abstraction skills gradually, begins to be laid in primary school reveals the role of algebraic thinking in the development of mathematical thinking. In this respect, it is important to determine students' perceptions about the concepts in linear equations belonging to algebra learning area. According to Kabael and Tanışlı (2010), the skills to be used in the sub-learning domain based on the concept of function and function knowledge should be acquired before high school mathematics education. Therefore, this study will provide insight into the readiness of students who will enter high school the following year to learn topics such as functions and analytical geometry, which involve intense abstraction, and will provide insights from their past mathematical life. In addition, student perceptions of mathematical concepts differ according to the gender variable (Doğan & Sönmez, 2019). It is also known that socioeconomic status has an effect on students' mathematics achievement (Yüksel & Ertürk, 2023).

In the literature, there are metaphor studies conducted with primary and high school students, prospective teachers, teachers and administrators. In this context, the participants' perceptions towards mathematical concepts such as whole number, fraction, pattern, set and their perceptions towards mathematics course, teaching and teacher were tried to be determined through metaphors (Ada, 2013; Berber & Sezgin-Memnun, 2018; Cerit, 2006; Çenberci et al, 2020; Çetinsoy, 2019; Ergöl & Sezgin-Memnun, 2020; Güner, 2013a; 2013b; Güveli et al., 2011; Kenç, 2019; M. Taşdemir & F. Taşdemir, 2017; Noyes, 2006; Ocak & Gündüz, 2006; Polat, 2010; Saban, 2009; Sezgin-Memnun, 2015; Soydan, 2021; Yıldırım, 2019). Since there is no study in the literature that reveals the metaphorical perceptions of eighth grade students towards the linear equations sub-learning domain, it is thought that this study will contribute to the literature.

The aim of this study is to determine the metaphorical perceptions of eighth grade students about the concepts of ordered pair and variable, which play an important role in linear equations. In addition, it is to

determine the level of differentiation of metaphor ratios developed according to gender and socioeconomic status. In line with this purpose, answers to the following problems were sought:

1. What are the metaphorical perceptions of eighth grade students regarding the concepts of ordered pair and variable?
2. Do the metaphors and metaphor drawing ratios developed for the concepts of ordered pair and variable differ according to gender?
3. Do the metaphors developed for the concepts of ordered pairs and variables differ according to the socioeconomic status?

METHOD

Research Design

In this study, the "phenomenology" design, one of the qualitative research methods, was used. Phenomenology provides the opportunity to reveal the meanings that individuals attribute to concepts, to examine the way they experience phenomena and their consciousness structures (Moran, 2000). In this study, the "phenomenology" design was used to reveal how the students structure the ordered pair and variable concepts in their minds and how their individual perceptions about these concepts are through metaphors.

Study Group

The study group of the research consists of 400 eighth grade students studying in four public secondary schools of a province in the Black Sea Region of Turkey in the 2021-2022 academic year and selected by maximum variation sampling method. Maximum variation sampling is used for the limited sample group to reflect the universe and present rich situations (Patton, 2014; Yıldırım & Şimşek, 2016). The maximum variation sampling method provides convenience in revealing and comparing the experiences of students studying in different learning environments. In this study, secondary schools in neighborhoods where students with different socioeconomic status live were selected to maximize the reflection of variation. The codes A, B, C and D were given to the secondary schools to be studied.

To determine the socioeconomic status of the schools, firstly, opinions were obtained from the District Directorate of National Education, where the research was conducted, and the administrators of the schools. Secondly, to make the socioeconomic status more effective in line with the opinions received from the institutions, the survey data applied by the school advisory teachers to determine the socioeconomic status of the students were analyzed. In the survey data, the monthly incomes of the parents were discussed. The monthly family incomes of all students participating in the study were listed as a list and then their arithmetic average was taken. Then, the school-based evaluation was started, and the monthly family incomes were listed for each school and their arithmetic averages were calculated separately. By taking the average of the family income of all students participating in the research as a criterion, schools above this average were categorized as secondary schools with *high* and *higher* socioeconomic status, and secondary schools with lower socioeconomic status were categorized as secondary schools with *low* and *lower socioeconomic* status.

Table 1. Socioeconomic Status of Schools

School	Socioeconomic Status
A	School with higher socioeconomic status (ĤSS)
B	School with a high socioeconomic status (HSS)
C	School with a low socioeconomic status (LSS)
D	School with a lower socioeconomic status (ĹSS)

Table 1 provides information about the socioeconomic status of the four secondary schools. Accordingly, A secondary school has higher, B secondary school has high, C secondary school has low and D secondary school has lower socioeconomic status.

Table 2. Information about Participants in Schools

	ĤSS		HSS		LSS		ĹSS		Total	
	f	%	f	%	f	%	f	%	f	%
Female	58	14.50	72	18.00	48	12.00	25	6.25	203	50.75
Male	54	13.50	62	15.50	57	14.25	24	6.00	197	49.25
Total	112	28.00	134	33.50	105	26.25	49	12.25	400	100

According to Table 2, 50.75% of the participants were female and 49.25% were male. 112 students from ĤSS, 134 students from HSS, 105 students from LSS and 49 students from ĹSS participated in the study.

Data Collection Tool

In this study, Metaphorical Perception Form (MPF) was used as a data collection tool. The form consists of fill-in-the-blank sentences "The ordered pair is like … because…" and "The variable is like … because…". At the same time, a drawing box was added under each open-ended question item. Drawing boxes were added in order to closely examine the students' ability to support the metaphors they developed with drawings and their processes of reducing abstract mathematical concepts to concrete. A pilot study of the data collection tool was conducted before the application. The pilot study was conducted with 54 students in four different public secondary schools, which were not included in the main study. After the necessary corrections were made as a result of the pilot study, the implementation phase started.

Data Collection and Implementation Process

The students were asked to create metaphors about the concepts of ordered pair and variable and to make explanations about the metaphor they created with the expression "because". In addition, in the drawing box under each question item, students were asked to describe the developed metaphor through drawing. During the application, the students were informed about the metaphors and examples of metaphors prepared before and outside the research topic were presented. The students were informed that the research would be used only for scientific purposes and therefore the information would not be shared with anyone else. Then, MPF was distributed to the students on a voluntary basis. The instructions written on the form were explained to the students again. In the application phase, the students were kept in the classroom during the application in order to prevent them from being influenced by each other while creating metaphors and to clarify the points that could not be understood. The implementation period lasted one lesson hour (40 minutes).

Data Analysis

Content analysis was used to analyze the metaphors created for the concepts of ordered pair and variable through MPF. Content analysis is the quantification of written or verbal information through coding, systematic grouping of texts into small sub-units and interpretation of data through inference (Balcı, 2005; Bilgin, 2000; Büyüköztürk et al., 2018). The metaphors created by the students for the concepts of ordered pair and variable were analyzed in five stages. These are coding and extracting the data, creating the metaphor list, developing categories, ensuring validity and reliability, and transferring the data to the computer environment (Saban, 2009). Chi-square test was used to examine the variation of the developed metaphors according to gender and socioeconomic status. The significance level was taken as .05 for the applied Chi-Square test.

In this stage, while examining the relationship between socioeconomic status and the rate of metaphor development, schools with high status (ĤSS and HSS) were grouped within themselves and categorized as *high socioeconomic* status and schools with low status (LSS and ĹSS) were categorized as *low socioeconomic* status.

Coding and extracting data: The forms collected from the students were classified by giving symbolic letters as A, B, C, D according to the school's name. In order to have easy access to the analyzed forms, each student form was given a code. For example, when the forms of the students in secondary school A were sorted randomly, the form of the female student in the 3rd place was coded as AK3.

When the student forms were examined, the items that could not form valid metaphor for the concepts of ordered pair or variable, left the explanation part of the metaphor starting with "because" blank, or could not establish a connection between the metaphor and the explanation sentence were excluded from the analysis. 244 forms for the concept of ordered pair and 186 forms for the concepts of variable were not taken into consideration.

Creating a list of metaphors: After eliminating the data that did not form metaphors, metaphor lists for the concepts of ordered pair and variable were created and the metaphors were arranged in alphabetical order. A total

of 86 different metaphors were developed for the concept of ordered pair and 115 different metaphors were developed for the concept of variable. The data in each student form were added to the metaphor tables via Microsoft Office Excel 2019 program.

Identifying the categories: The explanation sentences of the listed metaphors starting with "because" were carefully analyzed to understand which idea was reflected by the metaphor. Each valid metaphor was given codes reflecting its explanation. The researcher grouped the codes belonging to the metaphors in a way to reveal the similarities within themselves and divided these groups into conceptual categories that would best represent them.

The metaphors created for the concept of ordered pair in four secondary schools were divided into 17 conceptual categories. From the category in which the most metaphors were developed to the category in which the least metaphors were developed, the following categories were formed: "Sequentiality", "Togetherness", "Duality", "Relationship with Number Two", "Associating with Notation/Expression", "Specifying a Location", "Sequential and Binary", "Relating to Contrast/Difference", "Linear Relationship", "Specifying a Point", "Negative Attitude", "Determining Position with Axes", "Relating to Similarity", "Rule Hosting", " Connotation", "Associating with Repetition" and "Other". The metaphors created for the concept of variable were divided into 10 conceptual categories and listed from the category with the highest number of metaphors to the category with the lowest number of metaphors as "Variable Belonging to Live/Living", "Inanimate/Inanimate Variable", "Relating to the Unknown", "Symbolic Notation", "Negative Attitude", "Two Option Variables", "Relating to the Infinite", "Condition of Equation", "Using the Meaning of Similar" and "Other".

Ensuring validity and reliability: The metaphor lists and categorization processes for both concepts are given in detail in the findings section. In addition, expert opinion was consulted to confirm the compatibility of the created metaphors with the conceptual categories determined by the researcher. A faculty member in the Department of Elementary Mathematics Teaching was given the lists of metaphors and the categories created for the two concepts. The expert was asked to match the metaphors with the categories determined in a way not to leave the given metaphors open. The agreement of the expert and the researcher was calculated using Miles and Huberman's (1994) formula (Reliability = agreement / agreement + disagreement). Reliability shows that if the agreement percentage is above 0.70, it is at a sufficient level, and if it is above 0.90, it is at the desired level in qualitative studies (as cited in Küçükyılmaz & Duban, 2006). The percentage of agreement was 0.91 for the concept of ordered pair and 0.94 for the concept of variable.

Transferring data to computer environment: As the last step of the data analysis, the metaphors created for the two concepts and the categories determined were transferred to the computer environment as tables.

Research Ethics

First, ethics committee permission was obtained for the research. Then, the necessary permissions were obtained from the national education directorate of the relevant province to carry out the application in the selected schools. The research was conducted on a voluntary basis. Participants were informed about the purpose of the research, and it was stated that the data obtained would be protected within the limits of scientific ethics.

FINDINGS

Findings Related to the First Research Problem

In this section, the findings related to the problem *"What are the metaphorical perceptions of eighth grade students regarding the concepts of ordered pair and variable?"* are presented. The analysis of students' metaphorical perceptions of the concepts of ordered pair and variable is presented.

Findings on the concept of ordered pair: The metaphors, frequencies and percentages of metaphors created for the concept of ordered pair are given in Table 3.

Table 3. Metaphors Developed for the Concept of Ordered Pair

Metaphor	(f)	(%)	Metaphor	(f)	(%)	Metaphor	(f)	(%)
friend	13	8.33	bead	1	0.64	match scores	1	0.64
buddy	9	5.77	large number	1	0.64	market prices	1	0.64
sibling	9	5.77	object	1	0.64	table number	1	0.64
school desk	7	4.49	study	1	0.64	negative person	1	0.64
twins	6	3.85	the multiplication table	1	0.64	bus seat	1	0.64

pattern	6	3.85	double digit numbers	1	0.64	number in parentheses	1	0.64
close friend	6	3.85	fraternal twins	1	0.64	compass	1	0.64
fellow	4	2.56	farmer	1	0.64	vegetables and fruit	1	0.64
number	4	2.56	mountain	1	0.64	Sefer and Volkan Teachers	1	0.64
human	3	1.92	behavior and consequence	1	0.64	class rank	1	0.64
location	3	1.92	marriage	1	0.64	ranking	1	0.64
navigation	3	1.92	F-16	1	0.64	water	1	0.64
desk mate	3	1.92	planet	1	0.64	signboard	1	0.64
cabinet	2	1.28	rainbow	1	0.64	chart	1	0.64
friendship and enmity	2	1.28	daytime and night	1	0.64	Taha and Yigit	1	0.64
apple	2	1.28	dreams and realities	1	0.64	recipe ingredient	1	0.64
day	2	1.28	life	1	0.64	stew meal	1	0.64
good and evil	2	1.28	life challenge	1	0.64	wagon and tractor	1	0.64
digits	2	1.28	goal setting step	1	0.64	destination	1	0.64
student at school desk	2	1.28	two humans	1	0.64	letter y	1	0.64
Achilles and Patroclus	1	0.64	two-wheeled motorcycle	1	0.64	foreign	1	0.64
forgive	1	0.64	reduplication	1	0.64	side-by-side items	1	0.64
Ahmet Kural and Murat Cemcir	1	0.64	doing the work	1	0.64	jigsaw	1	0.64
family	1	0.64	miss	1	0.64	half heart	1	0.64
key issue	1	0.64	melon and watermelon	1	0.64	contestant	1	0.64
atom	1	0.64	combo	1	0.64	top three in competition	1	0.64
Bilge and me	1	0.64	north and south pole	1	0.64	food and coke	1	0.64
killing two birds with one stone	1	0.64	labyrinth	1	0.64	egg box	1	0.64
complete each other	1	0.64	l labut	1	0.64			
						total	156	100

When the metaphor frequency table in Table 3 is analyzed, the most common metaphors developed were *friend* (f=13), *buddy* (f=9), *sibling* (f=9), *school desk* (f=7), *twins* (f=6), *pattern* (f= 6), *close friend* (f=6), *fellow* (f=4) and *number* (f=4). It was observed that 86 different metaphors were developed for the concept of ordered pair and 156 (39.00%) of the 400 students who participated in the application were able to create valid metaphors. Although 11 (2.75%) students were able to create metaphors, they left the explanation part starting with "because" blank, and 27 (6.75%) students could not express the common relationship between the subject of the metaphor and its source, that is, the metaphors they developed, and the explanation part were incompatible. In addition, 206 (51.50%) students left the item blank in which they were asked to develop metaphors for the concept of ordered pair.

Table 4. Distribution of Metaphors Developed for the Concept of Ordered Pair by Schools

	ĤSS		HSS		LSS		ĹSS	
	f	%	f	%	f	%	f	%
Valid Metaphor	57	50.89	56	41.79	25	23.81	18	36.73

When the frequencies of metaphor development according to schools are analyzed in Table 4, it is observed that 57 (50.89%) students in ĤSS, 56 (41.79%) in HSS, 25 (23.81%) in LSS and 18 (36.73%) in ĹSS were able to create valid metaphors.

Table 5. Distribution of Metaphor Drawings for the Concept of Ordered Pair

	Students using metaphor drawing		Students not using metaphor drawing		Total	
	f	%	f	%	f	%
Student	98	62.82	58	37.18	156	100

According to Table 5, 98 (62.82%) of the students who created valid metaphors for the concept of ordered pair expressed their metaphors with drawings, while 58 (37.18%) did not use drawing to explain their metaphors. The student metaphors created for the concept of ordered pair were analyzed separately for each of the four secondary schools and these metaphors were analyzed and divided into conceptual categories.

Table 6. Conceptual Categories Related to the Concept of Ordered Pair

Category	Number of Metaphors (f)	Percentage (%)	Category	Number of Metaphors (f)	Percentage (%)
Sequentially	32	20.51	Specifying a Point	5	3.21
Togetherness	25	16.03	Negative Attitude	5	3.21
Duality	20	12.82	Determining Position with Axes	3	1.92
Relationship with Number Two	15	9.62	Relating to Similarity	3	1.92
Associating with Notation/Expression	10	6.41	Rule Hosting	2	1.28
Specifying a Location	9	5.77	Connotation	2	1.28
Sequential and Binary	7	4.49	Associating with Repetition	1	0.64
Relating to Contrast/Difference	6	3.85	Other	5	3.21
Linear Relationship	6	3.85			
			Total	156	100

In Table 6, the metaphors developed for the concept of ordered pair are divided into 17 conceptual categories. Students developed the most metaphors in the category of "Sequentiality" (20.51%; f=32). Afterwards, it was observed that students developed many metaphors in the categories of "Togetherness" (16,03%; f=25), "Duality" (12,82%; f=20), and "Relationship with Number Two" (9,62%; f=15), respectively. Below, the distribution of metaphors in the conceptual categories related to the concept of ordered pair according to socioeconomic status is given by creating frequency and percentage tables:

Table 7. Metaphors and Student Statements Developed in the Category of Sequentially

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Sequentiality	Buddy (3), pattern (2), key issue (1), rainbow (1), top three in competition (1), labout (1), behavior and consequence (1)	Day (2), planet (1), miss (1), bead (1), wagon and tractor (1), object (1), pattern (1), goal setting step (1), sibling (1)	Human (2), number (2), close friend (1), the multiplication table (1), twins (1)	Digits (2), bus seat (1), ranking (1), friend (1)	32	20.51

According to Table 7, 24 different metaphors were developed by 32 students in the category of "Sequentiality" and the concept of ordered pair was most associated with the metaphors of *buddy* (f=3) and *pattern* (f=3). Some student statements are as follows:

AE84: "The ordered pair is like a pattern, because it is sequential like a pattern."

BE10: "The ordered pair is like a day, because it goes on sequentially."

CK68: "The ordered pair is like a twin, because they are born one after the other."

DK15: "The ordered pair is like digits, because digits come in sequential order."

Table 8. Metaphors and Student Statements Developed in the Togetherness Category

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Togetherness	Buddy (3), fellow (2), family (1), complete each other (1), friend (1), Bilge and me (1), close friend (1)	Friend (4), sibling (3), fellow (2), jigsaw (1), close friend (1), school desk (1), human (1), daytime and night (1), half heart (1)	-	-	25	16.03

In Table 8, 13 different metaphors were developed by ĤSS and HSS students (f=25) in the category of "Togetherness" and the concept of ordered pair was associated with the metaphors of friend (f=5) and fellow (f=4)

the most. LSS and ĹSS students did not develop metaphors in this category. Some student statements are as follows:

AK8: "The ordered pair is like a buddy, because they never separate from each other."

BK130: "The ordered pair is like a jigsaw, because they don't mean anything on their own, but together they are complete."

BK78: "The ordered pair is like a sibling, because they complement each other harmoniously."

BK89: "The ordered pair is like a fellow, because they have meaning when they are side by side."

Table 9. Metaphors and Student Statements Developed in the Duality Category

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Duality	Sibling (2), Taha and Yigit (1), twins (1)	Friend (3), buddy (2), combo (1), Sefer and Volkan teachers (1), Achilles and Pacrollus (1), Ahmet Kural and Murat Cemcir (1)	Friend (1)	School desk (2), close friend (1), friend (1), contestant (1), side-by-side items (1)	20	12.82

According to Table 9, 14 different metaphors were developed by 20 students in the category of "Duality" and the concept of ordered pair was mostly associated with the metaphor of *friend* (f=5). Some student statements are as follows:

BK28: "The ordered pair is like Ahmet Kural and Murat Cemcir, because they are together in most projects."

BK66: "The ordered pair is like Achilles and Pacrollus, because they are inseparable characters in the game."

DE21: "The ordered pair is like a contestant, because each contestant forms a group of 2 for themselves."

DK10: "The ordered pair is like a school desk, because we sit in pairs."

Table 10. Metaphors and Student Statements Developed in the Category of Relationship with Number Two

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Relationship with Number Two	close friend (1), two-wheeled motorcycle (1)	Apple (2), twins (1), student at school desk (1), lettery (1)	Cabinet (2), chart (1), forgive (1)	Desk mate (2), school desk (2)	15	9.62

In Table 10, 11 different metaphors were developed by 15 students in the category of "Relationship with Number Two" and the metaphors of *apple* (f=2), *cabinet* (f=2), *desk mate* (f=2) and *school desk* (f=2) were used the most. Other metaphors were repeated only once. Some student statements are as follows:

BK63: "The ordered pair is like a student in a school desk, because two people sit in the desk."

BE83: "The ordered pair is like an apple, because it's like two parts of an apple."

CK10: "The ordered pair is like a cabinet, because it has two side surfaces."

CK16: "The ordered pair is like forgiveness, because it is like forgiving a person twice."

Table 11. Metaphors and Student Statements Developed in the Category of Association with Notation/Expression

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Associating with Notation/Expression	Table number (1), market prices (1), fraternal twins (1), friend (1), large number (1), friendship and enmity (1), two humans (1), close friend (1)	-	Foreign (1), number in parentheses (1)	-	10	6.41

According to Table 11, 10 different metaphors were developed by ĤSS and LSS students in the category of "Association with Notation/Expression" and each metaphor was repeated only once. HSS and ĹSS students did not develop metaphors in this category. Some student statements are as follows:

AE2: "The ordered pair is like the table number, because the table sequence numbers are like 0,1."

AE60: "The ordered pair is like market prices, because there are fractional numbers like 4.3 all the time."

AK54: "The ordered pair is like a close friend, because there is a black cat between close friends and a comma between the ordered pair."

AK41: "The ordered pair is like friendship and enmity, because one can be positive while the other can be negative, both can be positive and both can be negative."

Table 12. Metaphors and Student Statements Developed in the Category of Specifying a Location

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Specifying a Location	Location (3), F-16 (1), compass (1), signboard (1)	Navigation (1), student at school desk (1)	-	Navigation (1)	9	5.77

According to Table 12, seven different metaphors were developed by nine students in the "Specifying a Location" category. In this category, the concept of ordered pair was mostly associated with the metaphor of *location* (f=3). Other metaphors were repeated only once. LSS students did not develop any metaphor in this category. Some student statements are as follows:

AK35: "The ordered pair is like a compass, because we can move according to them and find our place in the country."

AK58: "The ordered pair is like a signboard, because it shows where we are."

AE4: "The ordered pair is like the F-16, because we enter the positions, and it looks like the same ordered pair."

DK30: "The ordered pair is like a navigation, because it reports location."

Table 13. Metaphors and Student Statements Developed in the Category of Sequential and Binary

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Sequential and Binary	Match scores (1)	Class rank (1), twins (1), food and coke (1)	Egg box (1), desk mate (1)	Double digit numbers (1)	7	4.49

According to Table 13, seven different metaphors were developed in the category of "Sequential and Binary" and each metaphor was repeated only once. Some student statements are as follows:

AK38: "The ordered pair is like match scores, because two numbers next to each other remind me of matches."

BE112: "The ordered pair is like twins, because they are born sequentially and in pairs."

CK46: "The ordered pair is like an egg box, because it is ordered and arranged in pairs."

DE43: "The ordered pair is like double digit numbers, because they are in pairs and in order."

Table 14. Metaphors and Student Statements Developed in the Category of Relating to Contrast/Difference

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Relating to Contrast/Difference	-	Dreams and realities (1), sibling (1), negative person (1), vegetable and fruit (1), melon and watermelon (1), north and south pole (1)	-	-	6	3.85

According to Table 14, six different metaphors were developed by HSS students in the category of "Relating to Contrast/Difference". Some student statements are as follows:

BK95: "The ordered pair is like dreams and realities, because dreams are plus and realities are minus."

BE93: "The ordered pair is like a sibling, because they are either opposites or partners."

BE127: "The ordered pair is like a vegetable and a fruit, because they are opposites."

BE122: "The ordered pair is like a melon and a watermelon, because they are both different fruits."

Table 15. Metaphors and Student Statements Developed in the Category of Linear Relationship

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Linear Relationship	Farmer (1), doing the work (1), killing two birds with one stone (1)	Pattern (1)	Study (1), water (1)	-	6	3.85

According to Table 15, six different metaphors were developed in the category of "Linear Relationship" and each metaphor was repeated only once. ĹSS students did not develop any metaphor in this category. Some student statements are as follows:

AE23: "The ordered pair is like a farmer, because the better he looks after his field, the better the results."

AK25: "The ordered pair is like doing the work, *because the more tomatoes you plant, the more tomato paste you make."*

BE84: "The ordered pair is like pattern, because it goes at a certain rate."

CE51: "The ordered pair is like, because if you go in the right direction, you'll succeed."

Table 16. Metaphors and Student Statements Developed in the Category of Specifying a Point

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Specifying a Point	Destination (1), recipe ingredient (1), sibling (1), buddy (1)	-	-	Navigation (1)	5	3.21

In Table 16, five different metaphors were developed in the category of "Specifying a Point". HSS and LSS students did not develop metaphors in this category. Some student statements are as follows:

AK9: "The ordered pair is like a destination, because the ordered pair indicates a point to be reached."

AK55: "The ordered pair is like a sibling, because even though they are far, far away, they always meet at a common point."

DE5: "The ordered pair is like a navigation, because it too points to a destination."

Table 17. Metaphors and Student Statements Developed in the Negative Attitude Category

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Negative Attitude	Life challenge (1), stew meal (1)	-	Number (2), labyrinth (1)	-	5	3.21

According to Table 17, four different metaphors related to the concept of ordered pair in the "Negative Attitude" category were developed by five students. The metaphor of *number* (f=2) was used the most. HSS and ĹSS students did not develop any metaphor in this category. Some student statements are as follows:

AK111: "The ordered pair is like a stew meal, because it is complicated."

AE48: "The ordered pair is like the difficulty of life, because you struggle, you cannot solve it, you get exhausted."

CK29: "The ordered pair is like a labyrinth, *because it's so complicated."*

CE52: "The ordered pair is like a number, because it is very difficult when you get it wrong."

Table 18. Metaphors and Student Statements Developed in Other Categories

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Determining Position with Axes	Marriage (1), mountain (1), good and evil (1)	-	-	-	3	1.92
Relating to Similarity	Twins (1)	Twins (1), sibling (1)	-	-	3	1.92
Rule Hosting	-	Pattern (2)	-	-	2	1.28
Connotation	-	-	School desk (2)	-	2	1.28
Associating with Repetition	-	Life (1)	-	-	1	0.64
Other	Reduplication (1), friendship and enmity (1), good and evil (1)	-	Atom (1), friend (1)	-	5	3.21

One student statement for each category given in Table 18 is given below respectively:

AE47: "The ordered pair is like a marriage, because the sum of the two is the result of the marriage. The abscissa is male and the ordinate is female because it is the ordinate that will raise the marriage."

BK46: "The ordered pair is like a sibling, because the first sister or brother is born, then the brother or sister is born and they are similar to each other."

BE79: "The ordered pair is like a pattern, because it follows a rule."

CE31: "The ordered pair is like a queue, because its name starts in order."

BE31: "The ordered pair is like a life, because it consists of repeating occurrences."

CE105: "The ordered pair is like a atom, because the speed and position of the atom cannot be known at the same time, the uncertainty principle."

Considering the tables explaining the conceptual categories, the metaphors developed for the concept of ordered pair were divided into 13 conceptual categories in ĤSS, 11 in HSS, 9 in LSS and 6 in ĹSS. The categories of "Sequentiality", "Duality", "Relationship with Number Two", "Sequential and Binary" are common categories created in all four secondary schools.

Findings on the concept of variable: The metaphors, metaphor frequencies and metaphor percentages for the concept of variable are given in the table below.

Table 19. Metaphors Developed for the Concept of Variable

Metaphor	(f)	(%)	Metaphor	(f)	(%)	Metaphor	(f)	(%)
human	37	17.29	flag	1	0.47	ID number	1	0.47
emotion	11	5.14	indefinite work	1	0.47	person without identity	1	0.47
chameleon	8	3.74	uniqueness	1	0.47	book page	1	0.47
dollar	5	2.34	information	1	0.47	subject	1	0.47
weather forecast	5	2.34	individual	1	0.47	bad person	1	0.47
life	5	2.34	stock exchange	1	0.47	KPSS score	1	0.47
decision	5	2.34	Buse	1	0.47	rule	1	0.47
foreigner	5	2.34	alive	1	0.47	LGS	1	0.47
hair	4	1.87	spy	1	0.47	math teacher	1	0.47
friend	3	1.40	corpse	1	0.47	spoilsport kid	1	0.47
thought	3	1.40	gender	1	0.47	school	1	0.47
day	3	1.40	effort	1	0.47	leek	1	0.47
name	3	1.40	environment	1	0.47	pastry	1	0.47
personality	3	1.40	strawberry	1	0.47	problem solving	1	0.47
mum	2	0.93	detective	1	0.47	psychology	1	0.47
car part	2	0.93	pilot test	1	0.47	puzzle	1	0.47
perspective	2	0.93	tv series	1	0.47	president republic	1	0.47
me	2	0.93	DNA	1	0.47	colour	1	0.47
letter	2	0.93	colors in nature	1	0.47	clock	1	0.47
bet coupon	2	0.93	world	1	0.47	looking for a needle in a haystack	1	0.47
hypocrite human	2	0.93	economy	1	0.47	number	1	0.47
head	2	0.93	idea	1	0.47	love	1	0.47
mood	2	0.93	the future	1	0.47	beloved	1	0.47
passing class	2	0.93	development	1	0.47	class	1	0.47
secret	2	0.93	mysterious human	1	0.47	question mark	1	0.47
liquid substance	2	0.93	security	1	0.47	water	1	0.47
x symbol	2	0.93	sun	1	0.47	suspicious	1	0.47
brother	1	0.47	teacher	1	0.47	swap	1	0.47
adaption	1	0.47	habit	1	0.47	telephone battery	1	0.47
agent	1	0.47	possibility	1	0.47	phone password	1	0.47
mind	1	0.47	two faces of man	1	0.47	horizon line	1	0.47
hour and minute hands	1	0.47	request	1	0.47	product	1	0.47
gold	1	0.47	black sea people	1	0.47	liar	1	0.47
mum's dinner	1	0.47	character	1	0.47	aging	1	0.47
car	1	0.47	characterless person	1	0.47	meal	1	0.47
car battery	1	0.47	indecision	1	0.47	path	1	0.47
factious human	1	0.47	fight	1	0.47	face	1	0.47

sunflower	1	0.47	melon seeds	1	0.47			
mirror	1	0.47	cake	1	0.47			
						total	214	100

When the metaphor frequency table in Table 19 is analysed, the most common metaphors developed were *human* (f=37), *emotion* (f=11), *chameleon* (f=8), *dollar* (f=5), *weather forecast* (f=5), *life* (f=5), *decision* (f=5), *foreigner* (f=5) and *hair* (f=4). It was observed that 115 different metaphors were developed for the concept of variable and 214 (53,50%) of the 400 students who were applied were able to create valid metaphors. In addition, it was observed that 13 (3,25%) students could create metaphors but left the explanation part starting with "because" blank, and 21 (5,25%) students could not express the common relationship between the subject of the metaphor and its source, that is, the metaphors they developed, and the explanation part were incompatible. In addition, 152 (38,00%) students left the item blank in which they were asked to develop a metaphor for the concept of variable.

Table 20. Distribution of Metaphors Developed for the Concept of Variable by Schools

	ĤSS		HSS		LSS		ĹSS	
	f	%	f	%	f	%	f	%
Valid Metaphor	72	64.29	68	50.75	44	41.90	30	61.22

When the frequencies of metaphor development according to schools are analyzed in Table 20, it is observed that 72 (64,29%) students in ĤSS, 68 (50,75%) students in HSS, 44 (41,90%) students in LSS and 30 (61,22%) students in ĹSS were able to create valid metaphors.

Table 21. Distribution of Metaphor Drawings for the Concept of Variable

	Student Using Metaphor Drawing		Student Not Using Metaphor Drawing		Total	
	f	%	f	%	f	%
Student	110	51.40	104	48.60	214	100

According to Table 21, 110 (51.40%) students who created valid metaphors for the concept of variable used metaphor drawings, while 104 (48.60%) students did not use metaphor drawings. The student metaphors created for the concept of variable were analyzed separately for each of the four secondary schools and were divided into conceptual categories through metaphor analyses.

Table 22. Conceptual Categories Related to the Concept of Variable

Category	Number of Metaphors (f)	Percentage (%)	Category	Number of Metaphors (f)	Percentage (%)
Variable Belonging to Live/Living	109	50.93	Two Option Variables	4	1.87
Inanimate/Inanimate Variable	51	23.83	Relating to the Infinite	2	0.93
Relating to the Unknown	31	14.49	Condition of Equation	1	0.47
Symbolic Notation	7	3.27	Using the Meaning of Similar	1	0.47
Negative Attitude	6	2.80	Other	2	0.93
			Total	214	100

In Table 22, the metaphors developed for the concept of variable were divided into 10 conceptual categories. The students developed the most metaphors in the category of “Variable Belonging to Living/Living” (50,93%; f=109). Afterwards, it was observed that students developed many metaphors in the categories of “Inanimate/Inanimate Variable” (23,83%; f=51) and “Relating to the Unknown” (14,49%; f=31), respectively. Below, the distribution of metaphors included in the conceptual categories related to the concept of variable according to socioeconomic status is given by creating frequency and percentage tables:

Table 23. Metaphors and Student Statements Developed in the Category of Variable Belonging to Live/Living

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
	Human (5), emotion (4), decision (3), perspective (2), hypocrite human (2),	Human (10), emotion (5), friend (3), chameleon (2), life (2), decision (1), me (1),	Human (7), chameleon (6), name (3), alive (1), strawberry	Human (8), hair (2), mind (1), face (1), thought (1),		

Variable Belonging to Live/Living	personality (2), foreigner (1), liar (1), brother (1), habit (1), life (1), individual (1), adaptation (1), Black Sea people (1), path (1), mother (1), effort (1), spoilsport kid (1), Buse (1), teacher (1), bad person (1)	development (1), request (1), mood (1), hair (1), thought (1), math teacher (1), beloved (1), sunflower (1), hour and minute hands (1), idea (1), characterless person (1)	(1), two faces of man (1), head (1), character (1), mood (1)	emotion (1), psychology (1), class (1), indecision (1), personality (1), aging (1)	109	50.93

According to Table 23, 46 different metaphors were developed by 109 students in the category of "Variable Belonging to Live/Living". In this category, the concept of variable was mostly associated with the metaphors of *human* (f=30), *emotion* (f=10) and *chameleon* (f=8). Some student statements are as follows:

AK35: "The variable is like the Black Sea people, because their feelings change very quickly."

AK32: "The variable is like an individual, because the numbers that replace those variables resemble that each individual is different."

DK17: "The variable is like an thought, because when you first see a person, you see them as a good person or a bad person. As you get to know that person, your thoughts change."

DK20: "The variable is like psychology, because people's psychology can change a lot during the day."

Table 24. Metaphors and Student Statements Developed in the Category of Inanimate/Inanimate Variable

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Inanimate/Inanimate Variable	Weather forecast (2), flag (1), economy (1), meal (1), stock exchange (1), dollar (1), liquid substance (1), rule (1), information (1), book page (1), phone password (1), car battery (1), pilot test (1), product (1), KPSS score (1), environment (1)	Dollar (3), bet coupon (2), colors in nature (1), mirror (1), telephone battery (1), water (1), gold (1), weather forecast (1), pastry (1), day (1), TV series (1)	Car part (2), passing class (2), mum's dinner (1), car (1), sun (1), cake (1), subject (1), school (1), color (1), liquid substance (1)	Day (2), weather forecast (2), world (1), number (1), life (1), clock (1)	51	23.83

According to Table 24, 39 different metaphors were developed by 51 students in the category of "Inanimate/Inanimate Variable". In this category, the concept of variable was mostly associated with the metaphors of *weather forecast* (f=5), *dollar* (f=4) and *day* (f=3). Some student statements are as follows:

AE34: "The variable is like weather forecast because the weather varies as sunny, cloudy and windy."

AE16: "The variable is like the dollar, because the dollar fluctuates a lot in our country."

AK9: "The variable is like meal, because if an ingredient changes, the result changes. (3,4) fried potatoes, (3,2) boiled potatoes."

CE5: "The variable is like cake, because we can change the ingredients whenever we want."

CE105: "The variable is like a liquid substance because like a liquid, it takes the shape of the container it is in."

Table 25. Metaphors and Student Statements Developed in the Category of Relating to the Unknown

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Relating to the Unknown	X symbol (2), human (2), future (1), agent (1), detective (1), question mark (1), DNA (1), corpse (1), secret (1), melon seeds (1), problem solving (1), indefinite work (1), foreigner (1), decision (1)	Human (3), security (1), mysterious human (1), secret (1), life (1), foreigner (1), dollar (1), spy (1), suspicious (1)	Emotion (1), person without identity (1)	Mum (1), thought (1)	31	14.49

According to Table 25, 23 different metaphors were developed by 31 students in the category of "Relating to the Unknown". In this category, *human* (f=5) metaphor was used the most. Some student statements are as follows:

AK65: "The variable is like DNA, because when there are reciprocal chains where DNA is not repaired, it is not known which one, A-T or S-G, cannot match."

BK104: "The variable is like a spy, because it takes effort to find out what it is."

BE90: "The variable is like a dollar, because you never know what will happen when."

DE28: "The variable is like a thought, because you cannot know what a person is thinking."

Table 26. Metaphors and Student Statements Developed in the Category of Symbolic Notation

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Symbolic Notation	Foreigner (2), uniqueness (1), human (1)	Factious human (1)	Letter (2)	-	7	3.27

According to Table 26, five different metaphors in the "Symbolic Notation" category were developed by seven students. In this category, *foreigner* (f=2) and *letter* (f=2) metaphors were mostly used. ĹSS students did not develop any metaphor in this category. Some student statements are as follows:

AE108: "The variable is like a human, because people are different because they are different, like x and y."

CE83: "The variable is like a letter because x, y, z are letters and variables are also letters."

BK75: "The variable is like factious human, because in math's, letters come between numbers and numbers are separated from each other."

Table 27. Metaphors and Student Statements Developed in the Negative Attitude Category

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Negative Attitude	Me (1)	-	LGS (1), leek (1), puzzle (1), hair (1), looking for a needle in a haystack (1)	-	6	2.80

According to Table 27, six different metaphors were developed in the "Negative Attitude" category. HSS and ĹSS students did not develop metaphors in this category. Some student statements are as follows:

CK41: "The variable is like a puzzle, because I try but I cannot find it."

CK46: "The variable is like hair, because I cannot find it even if we comb it, that is, even if we try to solve it."

CE9: "The variable is like looking for a needle in a haystack because it is very difficult to find."

CE19: "The variable is like leek, because I don't like it at all."

Table 28. Metaphors and Student Statements Developed in Other Categories

Category	ĤSS (f)	HSS (f)	LSS (f)	ĹSS (f)	f	%
Two Option Variables	-	President republic (1), fight (1), head (1), gender (1)	-	-	4	1.87
Relating to the Infinite	Possibility (1)	Horizon line (1)	-	-	2	0.93
Condition of Equation	-	Love (1)	-	-	1	0.47
Using the Meaning of Similar	-	Swap (1)	-	-	1	0.47
Other	-	-	Name (1)	ID number (1)	2	0.93

One student statement for each category given in Table 28 is given below respectively:

BE93: "The variable is like a fight, because either you are right or your opponent is right."

BE1: "The variable is like the horizon line, because they are endless like x and y."

BK14: "The variable is like love, because without them there is no equation, without love there is no life."

BE18: "The variable is like swap, because it means exchange."

CE36: "The variable is like a human name, because it is unique and they stand alone in questions like a name."

According to the metaphor explanations, the metaphors developed for the concept of variable were divided into six conceptual categories in ĤSS, eight in HSS, six in LSS and four in ĹSS. The categories of "Variable Belonging to Live/Living", "Inanimate/Inanimate Variable" and "Relating to the Unknown" are the common categories created in all four secondary schools.

Findings Related to the Second Research Problem

In this section, the findings related to the problem *"Do the metaphors and metaphor drawing ratios developed for the concepts of ordered pair and variable differ according to gender?"* are presented. Differentiation of students' metaphorical perceptions of ordered pair and variable concepts according to gender variable was analyzed.

Table 29. Distribution of Metaphors Related to the Concept of Ordered Pair by Gender

	Student Creating Metaphor		Student Who Cannot Create Metaphor		Total		Chi-Square		
	f	%	f	%	f	%	x^2	df	p
Female	88	43.35	115	56.65	203	100	3.278	1	.070
Male	68	34.52	129	65.48	197	100			
All	156	39.00	244	61,00	400	100			

According to Table 29, valid metaphors were created by 88 (43.35%) of 203 female students and 68 (34.52%) of 197 male students. There is no significant correlation between gender and the rate of metaphor development related to the concept of ordered pair (X^2 =3.278; p=.070>.05).

Table 30. Distribution of Metaphor Drawings Related to the Concept of Ordered Pair by Gender

	Student Using Metaphor Drawing		Student Not Using Metaphor Drawing		Total		Chi-Square		
	f	%	f	%	f	%	x^2	df	p
Female	54	61.36	34	38.64	88	100	0.184	1	.668
Male	44	64.71	24	35.29	68	100			
All	98	62.82	58	37.18	156	100			

According to Table 30, the drawings in the drawing box were created by 61.36% (f=54) of female students and 64.71% (f=44) of male students who created valid metaphors. There is no significant correlation between gender and the rate of using metaphor drawings related to the concept of ordered pair (X^2 =0.184; p=.668>.05).

Table 31. Distribution of Metaphors Related to the Concept of Variable by Gender

	Student Creating Metaphor		Student Who Cannot Create Metaphor		Total		Chi-Square		
	f	%	f	%	f	%	x^2	df	p
Female	127	62.56	76	37.44	203	100	13,605	1	.000
Male	87	44.16	110	55.84	197	100			
All	214	53.50	186	46.50	400	100			

According to Table 31, valid metaphors were created by 127 (62.56%) female students and 87 (44.16%) male students. There is a significant correlation between gender and the rate of metaphor development related to the concept of variable (X^2 =13.605; p=.000<.05).

Table 32. Distribution of Metaphor Drawings Related to the Concept of Variable by Gender

	Student Using Metaphor Drawing		Student Not Using Metaphor Drawing		Total		Chi-Square		
	f	%	f	%	f	%	x^2	df	p
Female	57	44.88	70	55.12	127	100	5,316	1	.021
Male	53	60.92	34	39.08	87	100			

All	110	51.40	104	48.60	214	100

According to Table 32, the drawings in the drawing box were created by 44.88% (f=57) of female students and 60.92% (f=53) of male students who created valid metaphors. There is a significant correlation between gender and the rate of using metaphor drawings related to the concept of variable (X^2 =5.316; p=.021<.05).

Findings Related to the Third Research Problem

In this section, the findings related to the problem *"Do the metaphors developed for the concepts of ordered pair and variable differ according to socioeconomic status?"* are presented. Differentiation of students' metaphorical perceptions of ordered pair and variable concepts according to socioeconomic status was analyzed.

Table 33. Comparison of Metaphor Rates Related to the Concept of Ordered Pair by Socioeconomic Status

	Student Creating Metaphor		Student Who Cannot Create Metaphor		Total		Chi-Square		
	f	%	f	%	f	%	x^2	df	p
High socioeconomic status	113	45.93	133	54.07	246	100	12,917	1	.000
Low socioeconomic status	43	27.92	111	72.08	154	100			
All	156	39.00	244	61,00	400	100			

According to Table 33, metaphors for the concept of ordered pair were developed by 45.93% of the students in schools with high socioeconomic status and 27.92% of the students in schools with low socioeconomic status. There is a significant correlation between the rate of metaphor development related to the concept of ordered pair and socioeconomic status (X^2 = 12.917, p= .000<.05).

Table 34. Comparison of Metaphor Rates Related to the Concept of Variable by Socioeconomic Status

	Student Creating Metaphor		Student Who Cannot Create Metaphor		Total		Chi-Square		
	f	%	f	%	f	%	x^2	df	p
High socioeconomic status	140	56.91	106	43.09	246	100	2,988	1	.084
Low socioeconomic status	74	48.05	80	51.95	154	100			
All	214	53.50	186	46.50	400	100			

According to Table 34, metaphors related to the concept of variable were developed by 56.91% of the students in schools with high socioeconomic status and 48.05% of the students in schools with low socioeconomic status. There is no significant correlation between socioeconomic status and the rate of creating metaphors for the concept of variable (X^2 =2.988, p= .084>.05).

DISCUSSION & CONCLUSION

In this study, students' perceptions of ordered pair and variable concepts were revealed and the change in the rate of metaphors developed for these concepts according to gender and socioeconomic status was analysed. Firstly, data on eighth grade students' metaphorical perceptions of these concepts were collected through MPF. A total of 86 metaphors for the concept of ordered pair were created by 156 (39.00%) students, and the most common metaphors were *friend*, *buddy*, *sibling*, *school desk*, and *twins*. The metaphors developed for the concept of ordered pair were grouped under 17 conceptual categories, taking into account the explanation part starting with "because", and the most common categories were "Sequentiality", "Togetherness", "Duality", "Relationship with Number Two", respectively. The ordered pair was the concept that students had the most difficulty in creating metaphors. With the metaphors of friend, buddy, twins and school desk, the students made associations with situations or objects that are associated with the name of the concept and contain sequential or binary features. It was observed that metaphors were created without taking into account the fact that the ordered pair specifies a point in the

coordinate system and its location features, and without considering that the point will be different when its abscissa and ordinate are changed. However, the fact that 98 (62.82%) students clarified the concept of ordered pair by means of drawing supports this result. This result is supported by the fact that there are studies in the literature that there are difficulties in expressing functions with ordered pair (Hatısaru & Erbaş, 2013; Tall & Bakar, 1991; Yıldırım, 2003). The concept of ordered pair has an important place in high school mathematics teaching. A good knowledge of the properties of the point in the analytic plane enables the understanding of cartesian product, relations and functions, limit, derivative and integral. Otherwise, it is obvious that there will be difficulties in learning subjects involving ordered pair representations (Çelik & Türkelli, 2018; Hatısaru & Çetinkaya, 2011). Ural (2012), in his study in which he determined the ability of students to transfer their function definition knowledge to various function representations, stated that errors were made in examining the graph as a set of ordered pairs. Hatısaru & Erbaş (2013) asked students to write the given dishes as ordered pair. It was determined that most of the students left this question blank. Afterwards, it was observed that most of the students gave wrong answers to the question of which of the relations given to the students with the list method was a function and they randomly formed ordered pairs. Moralı et al. (2004) examined the misconceptions or missing information that may occur in the abstract mathematics course and found that very few of the prospective teachers answered the question of finding the inverse of the conjunction of two relations whose elements are given explicitly as ordered pairs on a finite set correctly.

115 metaphors for the concept of variable were developed by 214 (53.50%) students. The most common metaphors developed by the students were *human*, *emotion*, *chameleon*, *dollar*, *weather forecast*, *life*, *decision* and *foreigner*. The metaphors developed for the concept of variable were grouped under 10 conceptual categories. It was observed that the students developed metaphors mostly in the category of "Variable Belonging to Live/Living". Students established a relationship between human, emotion and chameleon metaphors and things that are not fixed and differentiated. It was observed that students developed metaphors mostly in the category of "Inanimate/Inanimate Variable" in the second place. In this category, a constantly changing situation was emphasised with dollar and weather forecast metaphors. In general, instead of the mathematical meaning of the variable, a relationship was established with the word meaning. The studies in the literature, which show that there are difficulties in algebra learning due to different uses of mathematical symbols and letters (unknown, variable, parameter, constant) and not knowing the properties of the variable, are in parallel with this result (Akkan, 2009; Birgin & Demirören, 2020; Dede et al., 2002; Kar et al., 2011; Kaya, 2017; Küchemann, 1978). According to Arcavi and Schoenfeld (1988), algebra is based on variable properties, operations and relationships between variables. According to Birgin and Demirören (2020), a good understanding of the variables that form the basis of algebra, a good knowledge of their qualities and an understanding of the relationships between variables guarantee future mathematics learning. According to Kieran (1990), if the symbols used instead of variables or unknowns are interpreted as letters, some errors may occur. Usiskin (1988) states that *"Students think of the expression 6e as 6 apples rather than 6 times the number of apples (unknown). Here, the letter is the object or concept that is meant rather than the number of objects."* Erdem (2013) determined that 7th grade students could not create the coefficient relationship between variables. Şimşek and Soylu (2018) stated in their study that seventh-grade students ignored the variable and incorrectly constructed an equation suitable for a given problem. Birgin and Demirören (2020), in a study examining the achievement performance of secondary school students on algebraic expressions, stated that some students had the idea that the values of letter symbols increased according to the order in the alphabet. Katrancı and Yıldız (2022) examined the metaphorical perceptions of prospective secondary school mathematics teachers about the concept of algebra and stated that prospective teachers had a negative attitude towards algebra by developing many metaphors in the difficult and complex category. Çolak and Akıncı (2023) stated that eighth grade students had difficulty in forming mathematical discourse about linear equations.

When the rates of metaphor development according to gender were analysed, 43.35% of female students and 34.52% of male students were able to develop metaphors for the concept of ordered pair; 62.56% of female students and 44.16% of male students were able to develop metaphors for the concept of variable. It was observed that female students were able to develop metaphors for both concepts proportionally more than male students. In addition, a significant difference was found in favour of female students for the concept of variable. These results are in parallel with the studies in the literature. Şengül et al. (2014) examined secondary school students' metaphorical perceptions of the concept of "mathematics teacher" and found that female students produced more metaphors than male students. Doğan and Sönmez (2019) examined the metaphorical perceptions of fourth grade students towards the mathematics course and determined that female students developed more diverse and numerous metaphors than male students. Kebap and Çenberci (2020) examined secondary school students' metaphorical perceptions of the concept of "mathematics course" and "mathematics teacher" according to gender

and stated that female students generally produced more valid metaphors than male students. Çekirdekci (2020) examined the metaphorical perceptions of fourth grade primary school students towards mathematics course and stated that female students developed more metaphors than male students. Similarly, Sulhan et al. (2024) examined eighth grade students' metaphorical perceptions of LGS mathematics questions and found that female students developed more metaphors.When metaphor drawings were analysed according to gender, 61.36% of female students and 64.71% of male students who created metaphors for the concept of ordered pair used drawings. While 44,88% of female students and 60,92% of male students who developed metaphors for the concept of variable used drawings. It was determined that the rate of expressing the metaphors developed by male students using drawing was higher than that of female students. A significant difference was found in favour of male students regarding the concept of variable. In the literature, there are studies examining student metaphor drawings (Ada, 2013; Dönmez, 2017; Soydan, 2021; Sönmez & Yılmaz, 2023; Yücel-Cengiz & Ekici, 2019). Doğan & Sönmez (2019) examined the metaphorical perceptions of fourth grade students about mathematics through visuals and stated that female students used more drawings. Cansız et al. (2024) determined the metaphorical perceptions of seventh-grade students towards the concepts of ratio and proportion and stated that female students used more metaphor drawings related to these concepts. However, as can be seen in other studies examining metaphor drawings by gender (Benek & Akçay, 2018; Özcan & Demirel, 2019), there are differences between the results of this study and the studies in the literature. However, there are also studies in which metaphor drawings were examined but no differentiation was examined according to gender (Bozdoğan & Güven, 2021; Gülen & Dönmez, 2020; Ünalan, 2022).

The rates of metaphor development according to socioeconomic status were analysed for both concepts. Regarding the concept of ordered pair, 45.93% of metaphors were developed in schools with high socioeconomic status and 27.92% in schools with low socioeconomic status. Regarding the concept of variables, 56.91% of metaphors were developed in schools with high socioeconomic status and 48.05% in schools with low socioeconomic status. Students in schools with high socioeconomic status developed more metaphors for both concepts. However, a significant difference was found in favour of the schools with high socioeconomic status in creating metaphors for the concept of ordered pair. In literature, there are no studies in which the metaphor frequencies developed are analysed according to socioeconomic status. However, there are studies comparing student perceptions and conceptual categories according to socioeconomic status (Akbulut et al., 2017; Arık & Yılmaz, 2017). Özdemir (2012) examined the metaphorical school perceptions of high school students in terms of various variables and found that the metaphorical school perceptions of students from low-income families were positive at the highest level and that this perception tended to decrease with increasing income level. Çırak (2014) examined the metaphorical perceptions of secondary school teachers about the concept of ‘student’ and stated that teachers in schools with high socioeconomic environment had a more positive perception of students. These studies show that the social environment in which an individual lives and the economic opportunities he/she has will directly affect the quality of the education he/she receives, and it is expected to affect the way he/she perceives mathematical concepts and the meanings he/she attributes to them.

Some suggestions that will shed light on future studies are presented. It was observed that students had difficulty in developing metaphors for the concepts of ordered pair and variable. During the teaching of these concepts, using concrete examples appropriate to their qualities can provide effective learning. It was observed that students in schools with low socioeconomic status developed fewer metaphors. Mathematics education of students studying in disadvantaged schools should be qualified. This study was conducted with eighth grade students. It is important to examine the metaphorical perceptions of students from different grades and school levels about linear equations.

Implications

Metaphors are one of the most effective tools for revealing student perceptions. Students' perceptions of mathematical concepts are expected to guide their future learning. In this study, students' perceptions of the concepts of ordered pair and variable were examined through metaphors. It was determined that students had difficulty in creating metaphors for these concepts. It is important to present the concepts of ordered pair and variable in a more understandable way in the classroom environment. In addition, it is thought that explaining the concepts by using metaphors containing the properties of mathematical concepts can make learning more permanent. When analyzed by gender, it was determined that female students developed more metaphors than male students. The opposite situation was realized in metaphor drawings. Considering socioeconomic characteristics, it was determined that students with high socioeconomic characteristics were more successful in creating metaphors for the concepts of ordered pair and variable.

Limitations

The research data is limited to the students of four different secondary schools selected according to the maximum diversity sampling method in a province in the Black Sea Region in the 2021-2022 academic year. The research is limited to the metaphors developed by the students in these secondary schools. The research is limited to the question items in the interview forms.

Statements of Publication Ethics

I declare that we obey the principles of publication ethics. Ethical approval (number and date: 148722-25.03.2022) was taken from Tokat Gaziosmanpaşa University.

Conflict of Interest

There is no conflict of interest in this study

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Analyzing Academic Achievement and Overconfidence in Database Management Systems Course: A Case Study of Computer and Instructional Technology Education Students

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Abstract

Decision-making tends to be more accurate and of higher quality when there's a sensible harmony between self-confidence and actual capabilities. Overconfidence makes it difficult to set realistic goals in academic settings and increases the likelihood of facing failure. In this study, the academic achievements and overconfidence of students enrolled in the Database Management Systems course were examined. The research also aimed to determine whether there is a difference between midterm and final exams in terms of these variables. The participants were comprised of students enrolled in the Computer and Instructional Technologies Education department of a state university throughout the 2021-2022 academic year. The results indicated that approximately two-thirds of the students did not achieve satisfactory academic scores. Students struggled to accurately assess their exam performances, and a significant number of them overestimated their positions in both the midterm and final exams. Furthermore, there was no significant change between the midterm and final exams for any of the three factors.

Keywords: Academic Success, Computer and Instructional Technologies Education, Teacher Candidates, Database Management System, Overestimation, Overplacement

Veri Tabanı Yönetim Sistemi Dersindeki Akademik Başarı ve Aşırı Güvenin Analizi: Bilgisayar ve Öğretim Teknolojisi Eğitimi Öğrencileri Üzerine Bir Durum Çalışması

Öz

Karar verme, özgüven ile gerçek yetenek arasında mantıklı bir uyum olduğunda daha doğru ve yüksek kalitede olma eğilimindedir. Aşırı özgüven, akademik ortamlarda gerçekçi hedefler belirlemeyi zorlaştırır ve başarısızlıkla karşılaşma olasılığını artırır. Bu çalışmada Veri Tabanı Yönetim Sistemleri dersine kayıtlı öğrencilerin akademik başarıları ve aşırı güvenleri incelenerek, ara sınav ve final sınavları arasında bu değişkenlerde farklılık olup olmadığı analiz edilmiştir. Katılımcılar, 2021-2022 akademik yılında bir devlet üniversitesinin Bilgisayar ve Öğretim Teknolojileri Eğitimi bölümüne kayıtlı öğrencilerden oluşmaktadır. Sonuçlar, öğrencilerin yaklaşık üçte ikisinin akademik başarı puanlarının yeterli seviyede olmadığını göstermektedir. Öğrenciler, sınav performanslarını doğru bir şekilde değerlendirmekte zorlanmış ve birçoğu ara sınav ve finalde pozisyonlarını abartmıştır. Ayrıca, ara sınav ve final arasında her üç faktörde de anlamlı bir değişiklik olmadığı belirlenmiştir.

Anahtar kelimeler: Akademik Başarı, Bilgisayar ve Öğretim Teknolojileri Eğitimi,Öğretmen Adayları, Veri Tabanı Yönetim Sistemi, Aşırı Tahmin, Abartılı Konumlandırma

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INTRODUCTION

Overconfidence is often described as the misalignment of subjective probabilities. Research on overconfidence emphasizes the importance of individuals being aware of both their known and unknown knowledge. It generally assumes that when there's a sensible harmony between one's self-confidence and their actual capabilities, their decision-making tends to be more accurate and of higher quality (Paese & Sniezek, 1991).

Overconfidence often tricks individuals into believing they perform at a higher level than they actually do. Expressions like 'ignorant courage,' deeply embedded in Turkish culture for centuries, shed light on this notion through age-old proverbs (Somyürek ve Çelik, 2018). Delving into literature, overconfidence manifests in three distinct guises (Moore & Healy, 2008): overestimation, overplacement, and overprecision. Overestimation involves perceiving one's performance as superior to reality (Moore & Schatz, 2017). This tendency leads individuals to exaggerate the probability of success. Overplacement signifies an inflated belief in superiority over others (Moore & Healy, 2008). The third form, overprecision, denotes excessive trust in the absolute correctness of one's beliefs (Moore et al., 2015).

The literature on overconfidence reveals a common trend: individuals harbor an unwavering and often overly confident belief in their abilities. When someone lacks awareness of their limited expertise in decision-making and relies excessively on their judgment, errors in decision-making become inevitable. This tendency complicates setting realistic goals, fosters unfavorable assessments, and increases the likelihood of students facing failure. So, overconfidence poses an obstacle in academic achievement (Bol et al., 2005; Miller & Geraci, 2011). For instance, Hacker et al. (2000) discovered in their study involving ninety-nine undergraduate students that many overestimated their performance in upcoming exams, predicting scores 30% higher than their actual results. While some students tend to overly positively self-assess their performance, others exhibit contrasting behavior.

Erdemir and Somyürek (2023) summarize that various data collection methods are available for assessing overestimation, overplacement, and overprecision, with each method designed to suit specific measurement approaches. The literature underscores that inconsistent measurement of overconfidence often leads to methodological inaccuracies (Olsson, 2014; Schanbacher, 2013). Therefore, the use of precise instruments and analyses, aligned with the research context, is essential for accurately identifying overconfidence.

The Computer and Instructional Technologies Education undergraduate program integrates computer science and educational technology to prepare students with critical skills. A core component of this program, the Database Management Systems course, plays a crucial role in achieving the program’s objectives by providing comprehensive knowledge and skills. Douglas and Van Der Vyver (2004) emphasize the importance of this course in information systems undergraduate programs, highlighting its impact on graduates' success. As part of the Science, Technology, Engineering, and Mathematics (STEM) disciplines, courses like Database Management Systems and Programming often exhibit lower performance levels compared to other courses in the department. While experimental studies have examined the effects of instructional materials in e-learning (Douglas & Van Der Vyver, 2004) and mobile learning (Gezgin, 2019) on students' performance in these courses, there is a notable lack of research focusing solely on student performance without such interventions. Investigating this aspect could validate or challenge the observed trends in course performance. Furthermore, the development of appropriate measurement tools and the implementation of quantitative studies could yield reliable, valid, and generalizable assessments of academic achievement, thereby providing a solid foundation for future research findings.

Among the various factors influencing academic achievement, overconfidence emerges as a significant determinant. Research indicates that overconfidence can negatively impact performance across a diverse range of tasks (Erat et al., 2022; Hacker et al., 2008; Mooi, 2006; Nowell & Alston, 2007). While previous studies have extensively explored overconfidence, research specifically focused on the Database Management Systems course has primarily been experimental, examining the effects of open student modeling and social open student modeling on students' overconfidence (Somyürek et al., 2020). However, there is a noticeable paucity of studies that investigate this phenomenon without the influence of interventions. This study aims to address these gaps by examining the academic performance of students enrolled in the Computer and Instructional Technologies Education undergraduate program, particularly in the Database Management Systems course. It seeks to evaluate their performance in midterm and final examinations, as well as their levels of overconfidence. Additionally, the study aims to identify any differences between midterm and final exam outcomes concerning academic achievement and overconfidence.

Within this scope, the research will explore the following questions:

1. What is the distribution of students' academic achievement scores in the midterm and final exams?
2. Is there a significant difference in students' academic achievement scores between the midterm and final exams?
3. What is the distribution of students' overestimation in the midterm and final exams?
4. Is there a significant change in students' overestimation between the midterm and final exams?
5. What is the distribution of students' overplacement in the midterm and final exams?

Is there a significant change in students' overplacement between the midterm and final exams?

METHOD

Research Design

The survey model was used to examine academic achievement scores and overconfidence of students in the midterm and final exams, who enrolled in the Computer and Instructional Technologies Education undergraduate program of the Database Management Systems course. Additionally, a repeated measures design was employed to analyze any discrepancies between the midterm and final academic achievement scores and overconfidence.

Sample

The study group consisted of 17 students, comprising 5 male and 12 female students enrolled in the Computer and Instructional Technologies Education department of an Education Faculty at a state university during the academic year 2021-2022, who enrolled the Database Management Systems course.

Data Collection Tools and Procedure

In this study, we developed two academic achievement tests to assess students' performance and evaluate potential overconfidence in the Database Management System course. The first test consisted of ten multiple-choice questions covering topics taught up to the midterm, while the second test comprised 15 questions. Throughout the test development phase, we actively sought expert opinions to ensure the content validity and appropriateness of the questions. Adjustments were made based on these valuable insights.

Our collaboration with three experts played a crucial role in this process, and to gauge the accuracy with which the items captured the essence of the content domain, we calculated the Content Validity Index (CVI). The CVI, a measure of content validity, is computed through item CVI and total CVI. Item CVI reflects the appropriateness of each item based on experts' assessments, calculated as "Item CVI = Number of Positive Evaluations / Total Number of Experts." Total CVI, an aggregation of item CVIs across the entire test, is calculated as "Total CVI = Sum of Item CVIs / Total Number of Items." Notably, our consistently high Total CVI values for both the midterm and final achievement tests (above 0.80) indicate robust content validity. This suggests that the tests effectively measure the intended content domain, providing a reliable basis for evaluating students' understanding and performance in the Database Management System course.

To ensure that the test is perceived as relevant and appropriate, feedback has been collected for achievement tests developed by the same three experts. As a result of this feedback, it has been concluded that the developed measurement tools also have high face validity.After the test implementation, we conducted a comprehensive assessment of the test items' difficulty and discrimination. The difficulty levels of the items were determined using the Item Difficulty Index, as outlined by Sözbilir (2010). Items were classified into different categories based on their difficulty index: "Very Difficult" (0.00-0.19), "Difficult" (0.20-0.34), "Moderate" (0.35-0.65), "Easy" (0.65-0.79), and "Very Easy" (0.80-1.00), providing a nuanced understanding of the items' complexity.

Simultaneously, we employed the evaluation intervals presented by Özçelik (1992) to assess item discrimination. Items with a discrimination value below 0.19 were labeled as "Very Low," those within the range of 0.20-0.29 were categorized as "Needs Revision," items scoring between 0.30 and 0.39 were deemed "Good, Acceptable," and those surpassing 0.40 were characterized as "Very Good, Acceptable." This dual evaluation approach allows for a thorough examination of both difficulty and discrimination levels, providing valuable insights into the overall effectiveness of the test items.

Calculations reveal that the difficulty and discrimination indices for the midterm exam align with those shown in Table 1.

Table 1. Midterm Exam Difficulty and Discrimination Indices

QUESTIONS	DIFFICULTY INDEX	DISCRIMINATION INDEX
Q1	0,93	0,14
Q2	0,29	0,29
Q3	0	0
Q4	0,14	0,29
Q5	0,36	0,43
Q6	0,64	0,43
Q7	0,79	0,43
Q8	0	0
Q9	0,5	1
Q10	0,43	0,57

Upon assessing the difficulty levels and discriminative values of the midterm exam questions within these specified evaluation ranges, it was observed that questions 1, 3, and 8 were not suitable. Consequently, these questions were excluded from the achievement test.

A similar rigorous process was applied to ensure the validity and reliability of the academic achievement test used for the final exam. Table 2 showcases the difficulty and discriminative values of the final exam questions. As a result, questions 6, 9, 11, and 14 were excluded from the final assessment.

Table 2. Final Exam Difficulty and Discrimination Indices

QUESTIONS	DIFFICULTY INDEX	DISCRIMINATION INDEX
Q1	0,25	0,5
Q2	0,17	0,33
Q3	0,42	0,83
Q4	0,5	0,67
Q5	0,5	0,67
Q6	1	0
Q7	0,75	0,5
Q8	0,5	1
Q9	0,08	-0,17
Q10	0,33	0,67
Q11	0,83	-0,33
Q12	0,67	0,67
Q13	0,67	0,33
Q14	0,75	0,17
Q15	0,58	0,5

As a result, the academic achievement test tailored for the midterm comprises 7 questions, while the final exam's assessment includes 11 questions.

In order to determine students' overconfidence, additional questions assessing overestimation and overplacement were incorporated into the academic achievement tests prepared for both the midterm and final exams. Overestimation is characterized by an individual overestimating their actual performance, abilities, or success, displaying overconfidence in their knowledge (Moore & Healy, 2008). In this context, students were asked to predict whether they would correctly answer each question in either the midterm or final exam's achievement test. An illustrative sample question is provided in Figure 1.

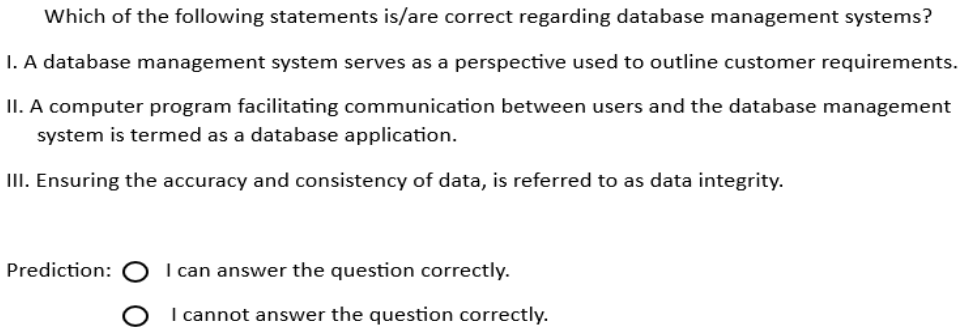

Figure 1. *An example question item from the academic achievement test and a sample question addressing overestimation*

Overplacement is characterized by an individual's belief that they outperform others and excel more than their peers (Moore & Healy, 2008). To measure overplacement, at the end of all questions in the academic achievement test for either the midterm or final exam, students were asked about their perceived level of success compared to their peers during the test (Figure 2).

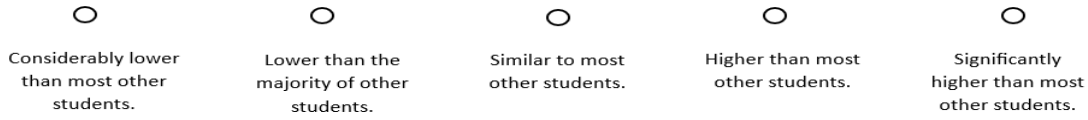

Figure 2. *Sample question for data collection regarding overplacement*

Subsequently, the same students were administered for the final exam, which included questions aimed at examining students' overestimations in a similar manner. Following this, at the conclusion of the exam, a question related to overplacement was presented to the students.

Data Analysis

To compute the academic achievement test scores of students in both the midterm and final exams, the remaining questions after item analysis were utilized. Maximum and minimum values that can be attained from the exams were calculated, then the students' scores from the midterm and final tests were transformed into standardized scores using the maximum-minimum normalization method. This transformation placed the achievement scores within a range of 0 to 1. With this method, the lowest possible achievement score (0) was normalized to a value of 0, while the highest possible score (100) was normalized to a value of 1. Scores approaching 1 indicate an increase in achievement, while scores closer to 0 signify a decrease in achievement.

Students' overconfidence was examined through overestimation and overplacement scores. To compute overestimation, a confusion matrix, depicted in Table 3, was initially established. In this matrix, 'a' represents the number of items where the participant confidently indicated they could answer correctly, depicting correct responses, while 'd' represents the number of items where the participant mistakenly believed they could answer correctly, depicting incorrect responses. Hence, 'a' and 'd' scores illustrate the participant's instances of correctly predicting their answers on the exam. 'c' represents the number of items where the participant confidently indicated they could not answer correctly but did so, while 'b' represents the number of items where the participant doubted their ability but answered correctly. In this scenario, 'c' and 'b' scores illustrate the instances where the participant made incorrect predictions.

Table 3. Confusion Matrix

Actual Performance	Student Estimation	
	I Can Solve/Know/Correct	I Can't Solve/Don't Know/Wrong
Correct	a	b
Wrong	c	d

The accuracy of knowledge monitoring is derived through the following formula based on the scores obtained in the confusion matrix.

- Knowledge Monitoring Assessment (KMA) = $\frac{(a+d)-(b+c)}{(a+b+c+d)}$

The computed score ranges between -1 and 1. As the score approaches 1, it indicates accurate predictions regarding one's own success, while nearing -1 signifies significantly low awareness regarding their performance in the exam. This score is utilized to evaluate overestimation.

To compute overplacement, students were asked to compare their success relative to other students using a 5-point Likert scale question. To determine the students' real placements, the midterm and final grades were categorized into 5 tiers. Subsequently, the difference between estimated and actual placements was calculated to derive overplacement. Negative values indicate insufficient placement, whereas positive values suggest overplacement.

Overplacement= Estimated Position - Actual Position (Larrick et al., 2007)

In order to answer the first, third, and fifth research questions of the study, descriptive statistics such as frequency and percentage were utilized. Prior to addressing the second, fourth, and sixth research questions, a normality test was conducted, indicating a normal distribution of scores for both the midterm and final exams. However, it was observed that the overestimation scores and overplacement scores for both midterm and final exams did not follow a normal distribution. As a result, the second research question was analyzed using the T-test for related samples, while the fourth and sixth research questions were scrutinized using the non-parametric Wilcoxon signed-rank test to investigate the change process. The analysis was performed using the SPSS 27.0 software.

Research Ethics

In this study, all ethical procedures have been followed. All participants have been informed about the purpose, process, and ethical rights of the research.

FINDINGS

This section presents the results derived from the analyses conducted in response to the research questions.

Regarding the first research question, the distribution of 'students' midterm and final grades' is illustrated in Figure 3.

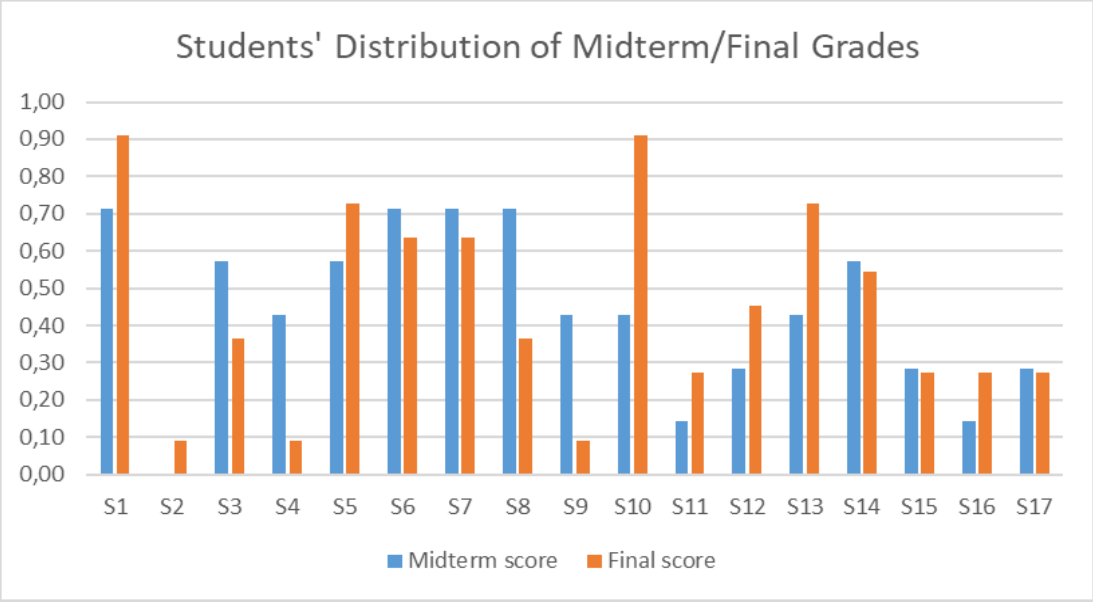

Figure 3. *Distribution of Students' Midterm/Final Grades*

Students' midterm scores ranged from 0 to 0.71, while their final scores ranged from 0.09 to 0.91. Four students achieved the highest midterm score of 0.71, whereas one student (S2) scored 0 in the midterm exam. In the final exam, two students attained the highest score of 0.91. Among the participants, eight students scored

higher in the final exam than in the midterm, while nine students performed better in the midterm exam compared to the final.

The analyses conducted to address the second research question, "Is there a significant change between students' midterm and final success scores?" are presented in Table 4.

Table 4. T-Test Results for Related Samples Regarding Changes in Students' Achievement Scores between Midterm and Final Exams

Midterm-Final Achievement Score	N	$\bar{X}$	S	sd	t	p
Midterm	17	.436	.221	16	.220	.829
Final	17	.448	.273			

Students' average scores in the midterms were $\bar{X}$ = 0.436, whereas after the final exam, the average increased to $\bar{X}$ = 0.448. However, this increase is not statistically significant (p > .05), indicating that there is similarity between midterm and final achievement. Additionally, the mean scores suggest that overall student performance in both midterm and final exams is generally low.

Regarding the third research question, the distribution of students' overestimations in the midterms and finals is presented in Figure 4.

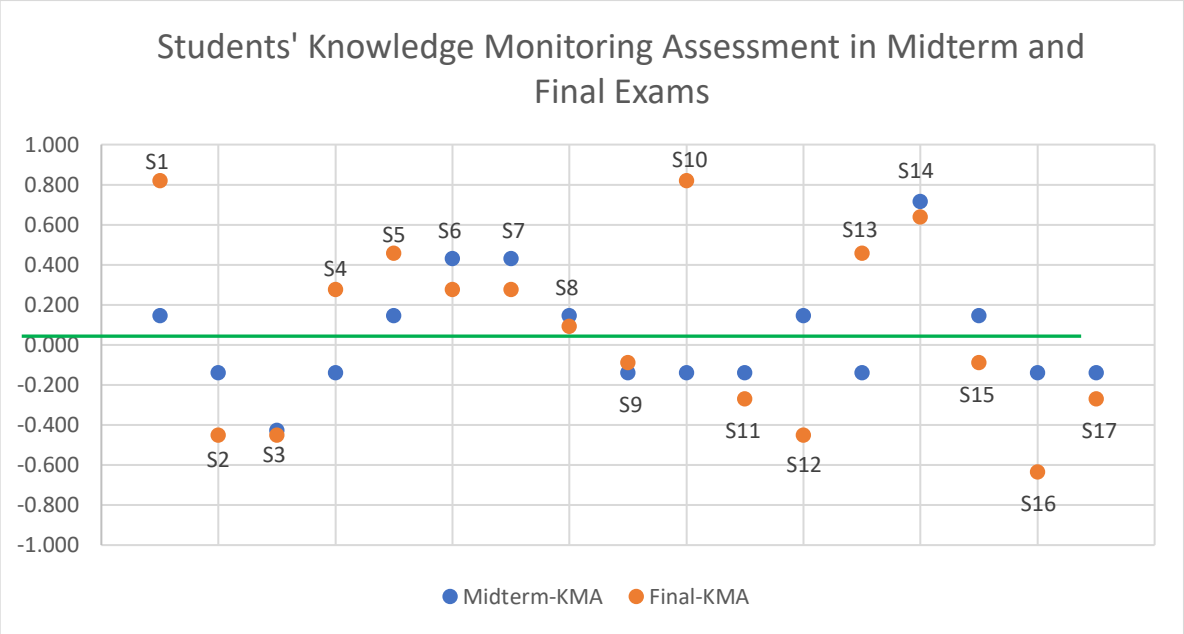

Figure 4. *Knowledge Monitoring Assessment in Students' Midterm/Final*

The optimum accuracy of students' knowledge monitoring occurs when their predicted performance matches their actual performance in both the midterm and final exams, resulting in a score of 1. Hence, as scores approach 1, it indicates more accurate predictions. The average accuracy of knowledge monitoring was 0.042 in the midterm and 0.08 in the final exam. These results suggest that students generally failed to accurately assess their level of knowledge. Upon examining the scores in the figure, it's evident that in the midterm, S14 made the most accurate prediction regarding their own success (0.714) and displayed considerable accuracy in their estimation. In the final exam, S1 (0.818) and S10 (0.818) were the students most accurately predicting their own success, signifying their heightened awareness in these respective exams. The students who accurately predicted their success in the final exam also achieved the highest scores. However, this wasn't the case for the midterm. Although the top 4 students in the midterm did not have the highest accuracy scores in knowledge monitoring, the student who followed these four had the highest accuracy score. S3 (-0.429) had the least accurate prediction in the midterm, while S16 (-0.636) had the least accurate prediction in the final exam. Upon reviewing the figure, it's noticeable that almost two-thirds of the students (f=12) had knowledge monitoring accuracy scores that didn't significantly differ between the midterm and final exams. If the knowledge monitoring accuracy score was above 0 in the midterm, it tended to be higher in the final, and vice versa. Additionally, 8 students scored above 0 in the midterm, while 9 students scored above 0 in the final exam.

Analyses examining whether there was a significant change between students' overestimations in the midterm and final exams are provided in Table 5 for the fourth research question.

Table 5. Wilcoxon Signed-Rank Test Results for Changes in Students' Overestimations Between Midterm and Final Exams

FinalKMA - MidtermKMA	n	Mean Rank	Sum of Ranks	z	p
Negative rank	11	7.32	80.5	.18*	0.85
Positive rank	6	12.08	72.5		
Equal	0				

* Based on negative ranks

Table 5 presents the results of the Wilcoxon signed-rank test regarding whether there is a significant change in students' accuracy of knowledge monitoring between the midterm and final exams. The analysis indicates that there is no significant difference between the accuracy of knowledge monitoring scores of students in their midterm and final exams ($z=0.18$, $p>.05$). However, considering the mean ranks and totals of the difference scores, it is evident that there are more negative ranks, implying that there is a higher number of students ($N=11$) whose accuracy of knowledge monitoring in the final exam is lower than in the midterm.

As part of the fifth research question, graphs depicting the distribution of students' overplacement in the midterm and final exams were created based on their estimated positions compared to their actual positions (Figure 5).

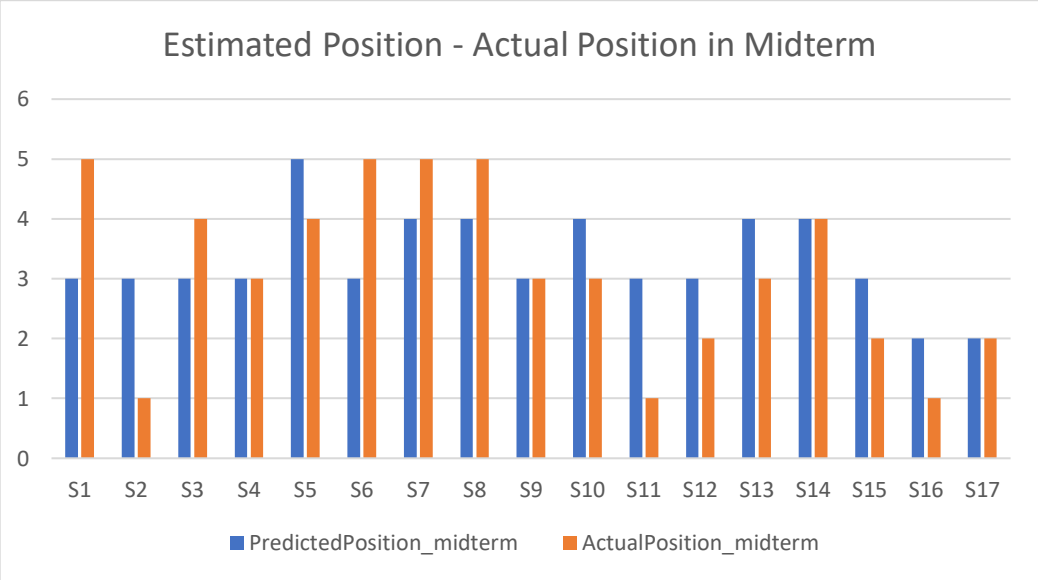

Figure 5. *Distribution of Students' Overplacement in the Midterm*

Figure 5 shows that 8 students overestimated their predicted positions in the midterm, indicating an overplacement, while 5 students underestimated their positions. Additionally, 4 students accurately predicted their positions, including S4, S9, S14, and S17. It is noticeable that other students showed a discrepancy of either 1 or 2 units between their predicted and actual positions.

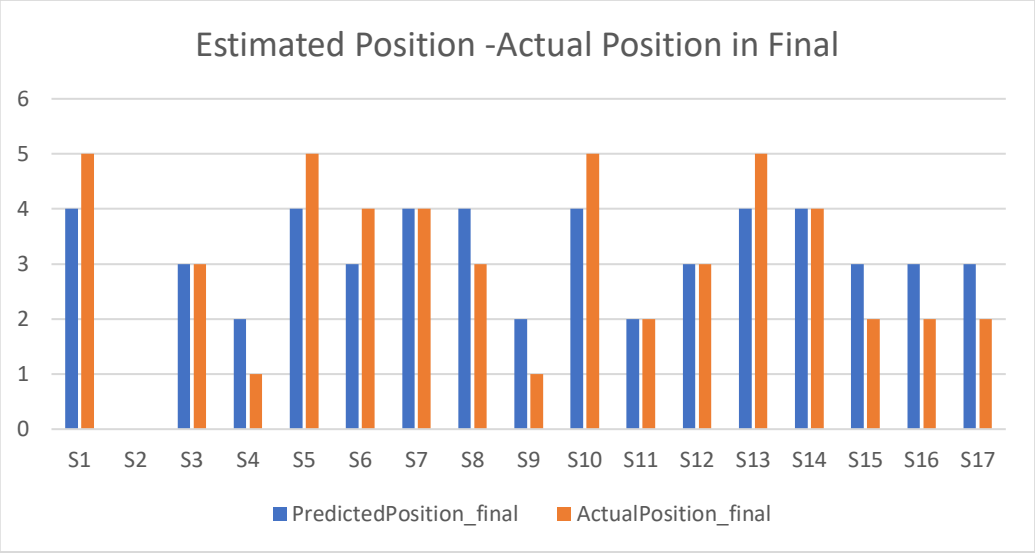

Figure 6. *Distribution of Students' Overplacement in the Final*

When examining Figure 6, it is observed that in the final, the estimated positions of 6 students are higher than the actual positions, indicating an exaggeration in their positioning, while 5 students underestimated their positions, and 5 students accurately estimated their positions. Since S2 did not answer the question about overplacement in the final, data from 16 students were examined. The students who made accurate estimations are S3, S7, S11, S12, and S14. A difference of 1 unit was observed between the estimated positions and actual positions of other students.

A collective analysis of both graphs reveals a fluctuation in differences between estimated and actual positions during the midterm (-2, 1, 0, 1, and 2). However, these differences narrowed down to 1, 0, and -1 in the final. In essence, compared to their peers, participants did not exhibit substantial deviations of -2 or 2 when situating themselves in the final, indicating a more accurate assessment. Furthermore, S1 and S6 consistently misjudged their positions in both the midterm and final exams, whereas S15 and S16 consistently overolaced their positions across both assessments. On the other hand, students S4, S9, and S17 accurately positioned themselves solely in the midterm, while S3, S7, S11, and S12 demonstrated accurate positioning only in the final. Remarkably, S14 was the sole student who correctly positioned themselves in both exams. Detailed outcomes of the Wilcoxon Signed-Rank Test, investigating significant changes between students' overplacement in the midterm and final exams, are presented in Table 6.

Optimal positioning of students would yield a score of 0, meaning the estimated positions in both the midterm and final would match the actual positions. Consequently, as scores approach 0, it indicates a more successful estimation. For the Wilcoxon Signed-Rank Test analysis, absolute differences between participants' estimated and actual positions were considered. This was crucial as a difference score of -2 or 2 equally signifies a 2-unit deviation from the actual position, revealing positive shifts irrespective of whether it was -2 in the midterm and 0 in the final, or 2 in the midterm and 0 in the final.

Table 6. Wilcoxon Signed-Rank Test Results Regarding Overplacement Changes in Midterm and Final Exams.

FinalOP - MidtermOP	n	Mean Rank	Sum of Ranks	z	p
Negative rank	6	5,25	31.50	1.15*	.248
Pozitive rank	3	4,50	13.50		
Equal	7				

* Based on negative ranks

The results of the Wilcoxon test analysis indicate that there is no significant difference between students' overplacement in the midterm and final exams ($z=1.155$, $p>.05$). However, considering the rank sums and means of difference scores, it is observed that there are more negative ranks, indicating a higher number of students with overplacement scores lower in the final than in the midterm. This suggests a favorable improvement towards reduced overplacement. The difference between students' estimated positions in the midterm and final exams compared to their actual positions is presented in Figure 7.

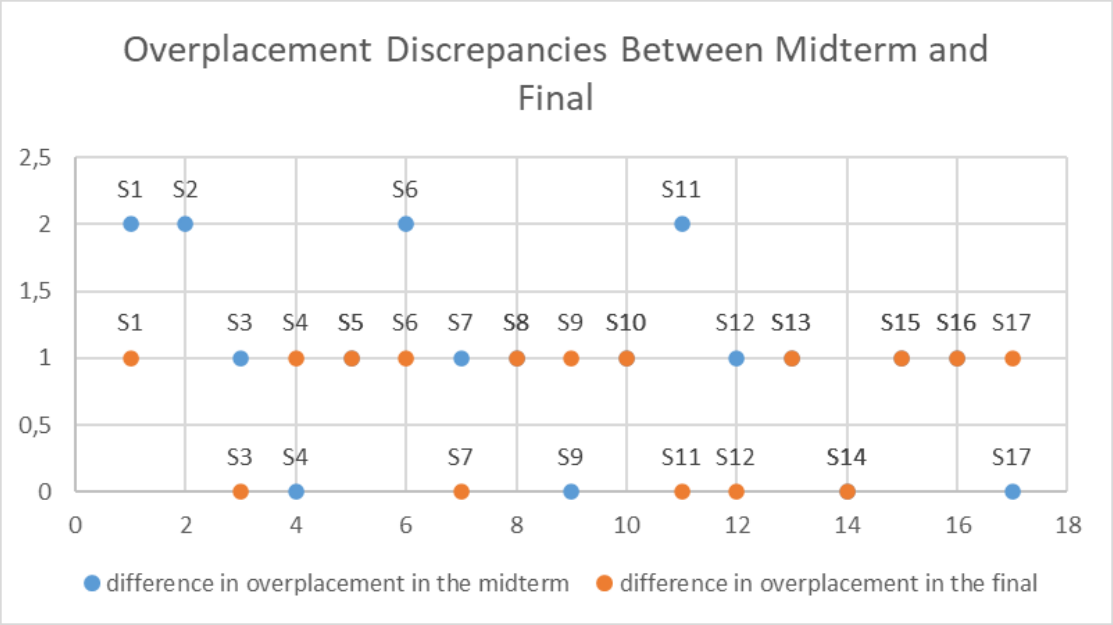

Figure 7. *Distribution of Overplacement Discrepancies Between Midterm and Final Exams Among Students*

Figure 7 illustrates an interesting trend: while 2-unit exaggeration was present in 4 students during the midterm, it completely vanished in the final assessments. The most frequent disparity observed consistently across both midterm and final exams was a 1-unit difference. Moreover, it's worth noting that 5 students accurately positioned themselves in the final exam, whereas 3 students did so during the midterm.

DISCUSSION & CONCLUSION

This study delved into the academic performance and overconfidence of undergraduate students enrolled in the Computer and Instructional Technologies Education program. It specifically scrutinized their performance in the Database Management Systems course during both the midterm and final exams, aiming to explore potential differences in academic achievement and overconfidence levels between the two assessments. It's essential to note that the study employed a convenient sampling approach to select second-year students of Computer and Instructional Technologies Education at a state university. While convenient sampling can be practical and efficient, it may introduce selection bias, limiting the generalizability of the findings to a broader population. The use of a non-randomized sampling method might result in a sample that does not fully represent the diversity of students in similar programs at different institutions.

Additionally, this sampling approach may not account for variations in student backgrounds, prior knowledge, or learning styles, which could impact the external validity of the study. It is crucial to recognize that the specific characteristics of the selected sample may influence the study's outcomes and limit the extent to which the findings can be applied to a more diverse student population.

To overcome this limitation in future research, it is recommended to adopt a more robust sampling strategy, such as random sampling. This approach would not only contribute to a more rigorous study design but also bolster the generalizability of the results. By incorporating random sampling, researchers can ensure a more representative selection of participants, thus offering a broader and more comprehensive understanding of the intricate relationship between academic performance, overconfidence, and the structure of courses in Database Management Systems education. Findings of the study revealed a range in students' academic scores, from 0 to 0.71 during the midterm and 0.09 to 0.91 in the final exam. Notably, roughly a third of the students (N=4) achieved scores of 0.7 and above in both exams, indicating a notable level of success. However, concerning performance, 9 students scored below 0.4 in the final exam, while 6 students did so in the midterm, signaling a lower academic performance level. Scores for other students ranged between 0.4 and 0.7. The class's average score was 0.436 for the midterm and slightly increased to 0.449 in the final exam. These results suggest a generally low average academic achievement for the class, with approximately two-thirds falling short of a satisfactory level. Furthermore, there was no statistically crucial difference found between students' academic performance in the midterm and final exams, indicating a parallel performance level between the two assessments.

Tailoring database systems to meet the ever-evolving market demands is a complex endeavor, calling for the collaborative efforts of experts from diverse backgrounds (Poščić et al., 2012). Given the pivotal role that database systems play in the successful implementation of information systems (Etemad & Küpçü, 2018; Morien, 2006), it's not surprising that virtually all computer-related programs necessitate at least one course dedicated to database systems (Nagataki et al., 2013). However, the teaching of database analysis and design proves challenging due to its abstract and intricate nature (Connolly & Begg, 2007; Murray & Guimaraes, 2009). Studies consistently report that many students struggle to grasp the fundamental concepts of databases (Hamzah et al., 2019). Notably, Folorunso and Akinwale (2010) highlighted a significant deficiency in students' performance in SQL, an integral part of database courses, indicating a lack of understanding about its significance. In essence, the outcomes of our study echo the findings across international literature, shedding light on students' academic achievements in database management systems courses.

Students' low academic achievement scores are believed to be influenced by the structure of the course. The Database Management Systems course is designed to encompass both theoretical and hands-on elements, aiming to instill the following proficiencies in students:

- Defining the core concepts of databases and database management systems.

- Elucidating the functionalities inherent in database management systems.

-Executing the sequential stages of database creation (encompassing requirement analysis, conceptual, logical, and physical modeling).

- Proficiency in querying, modifying, adding, and removing data using the SQL language.

- Competence in establishing and administrating databases within a database management system.

Students engaging in the process of designing a database for an information system must adeptly employ problem-solving and analytical skills during the requirement analysis phase and subsequent conceptual modeling through the creation of entity-relationship diagrams. Logical modeling marks the stage where data relationships, structures, and constraints within the database are defined, governed by specific rules and principles crucially applied across varied contexts. Meanwhile, physical modeling involves the creation of databases using specific management systems such as MSSQL, MySQL, Oracle, enabling querying, implementing database structures like triggers, stored procedures, and indexes to ensure data integrity, performance optimization, and security enhancement. Within the curriculum, students delve into Structural Query Language (SQL) to craft databases, execute queries, and construct these essential database structures. Crafting effective SQL queries necessitates a deep understanding of command functionalities, coupled with the ability to employ these commands in the right sequence and context. Ultimately, the Database Management Systems course offers a comprehensive fusion of theoretical knowledge and hands-on applications in database design, querying, and management, encompassing a broad spectrum of conceptual, operational, and high-level skills. The complexity of learning arises from the demand to employ these multifaceted skills, resulting in increased effort from students.

Moreover, Database Management Systems run parallel processes to Introduction to Programming/Computer Science courses, equipping students with analogous proficiencies. For example, processes in requirement analysis and conceptual modeling mirror those in analysis and design stages in programming. A meticulous and error-free execution of logical modeling becomes pivotal for program-database interaction and precise data processing. Programmers must adeptly wield SQL to facilitate seamless interaction between their applications and databases. Hence, the Database Management Systems course and programming courses share a direct connection, covering realms of analysis, database creation, and SQL query writing. Additionally, both courses integrate akin cognitive and metacognitive processes and foster analytical, algorithmic, and problem-solving skills. Considering these interconnected aspects, it's obvious that these courses are intricately entwined. A review of studies on Introduction to Programming courses in global literature reveals a recurrent trend of low performance (Bennedsen & Caspersen, 2007; Watson & Li, 2014). Watson and Li's (2014), meta-analysis consolidating fifty years of research on Introduction to Programming courses unveils a consistent global failure rate (33.3%). Moderator analysis highlights minor variations in pass rates influenced by class level, country, and class size.

Drawing from the insights gained findings related to academic success, a beneficial recommendation for educational enhancements emerges. Offering supplementary resources and activities to assist students facing challenges can play a pivotal role in closing the academic performance gap. Furthermore, integrating practical

scenarios and real-world applications into lessons is considered advantageous for refining students' proficiency in crafting effective SQL queries.

In this study, we delved into not just the academic achievements of students but also their overconfidence in exam performance. Overconfidence occurs when an individual believes in their knowledge and abilities to a greater extent than they truly possess It can take forms such as overestimation, overplacement and overprecision (Moore & Healy, 2008). Our aim was to explore students' overestimation and overplacement. To analyze students' overestimation, we employed knowledge monitoring accuracy scores, a widely used method by Tobias and Everson (2002), that measures the gap between students' actual performance and their perceived confidence levels. Those who accurately evaluate their knowledge are thought to excel in filling gaps, staying updated, and adapting to new scenarios. Therefore, this trait, closely linked to overconfidence, is considered both a metacognitive skill and an influence on the learning process. For students, an optimal knowledge monitoring accuracy score of 1 indicates a perfect alignment between their anticipated and actual performance in both midterm and final exams. Conversely, a score of -1 implies no correlation between predicted and actual outcomes. On average, students scored 0.042 in knowledge monitoring accuracy for the midterm and 0.08 for the final exam. These findings indicate that most students struggled to accurately gauge their exam performances. As expected, those who best predicted their final exam success were the highest achievers. However, among the top scorers in the midterm, the student with the second-highest grade displayed the best knowledge monitoring accuracy. Several researchers noted that individuals with lesser abilities tend to exhibit more overconfidence (Miller & Gerraci, 2011; Kruger & Dunning, 1999). This suggests that as proficiency grows, overconfidence diminishes and accuracy in self-assessment increases. The observation that the highest achievers were also the most accurate predictors supports this notion.

In exploring our fourth research question concerning significant differences in students' knowledge monitoring accuracy scores between the midterm and final exams, our findings from the Wilcoxon signed-rank test indicated no statistically significant difference ($z=0.18$, $p>.05$). This suggests that relying solely on students to predict their performance question by question may fall short in effectively boosting their awareness. However, it is important to note that while the statistical analysis did not reveal a significant change, we acknowledge the need for a nuanced interpretation of the results.

Upon closer examination of the mean ranks and totals of the difference scores, we observed a trend wherein more negative ranks were prevalent in the final exam. This suggests that a relatively larger group of students ($N=11$) exhibited lower accuracy of knowledge monitoring in the final exam compared to the midterm. Despite the lack of statistical significance, this observation encourages a deeper exploration of the potential implications of these variations, indicating trends in students' knowledge monitoring accuracy that require careful consideration. Future studies could explore these patterns more comprehensively to contribute to our understanding of students' awareness of their own knowledge.

It is also noteworthy that approximately two-thirds of the students ($n=12$) demonstrated consistent knowledge monitoring accuracy scores between the midterm and final exams. Further analysis revealed interesting patterns – if a student had a positive knowledge monitoring accuracy score in the midterm, they tended to maintain a higher score in the final exam, and vice versa. A positive score, in this context, signifies a higher proportion of accurate estimations compared to inaccuracies, even if the individual isn't entirely sure about the correctness of specific answers. Conversely, a negative score indicates less than 50% awareness of the correct answers.

In light of the findings on overconfidence, it is recommended that incorporating activities or assessments focused on enhancing students' self-assessment skills into the curriculum would be beneficial for educational improvements. Moreover, implementing feedback mechanisms to assist students in aligning their perceived confidence with their actual performance could significantly contribute to fostering awareness.

The fifth segment of the research delved into the peculiarities of students' overplacement discrepancies between their midterm and final assessments. There are more students whose estimated positions are higher than their actual standings in both midterm and final exams. However, an intriguing shift emerged—there was a noteworthy uptick in students accurately predicting their positions for the final exam, accompanied by a decline in overestimation tendencies. Interestingly, nearly a third of the students demonstrated a marked improvement in their ability to predict their class rank during the final evaluation compared to their earlier predictions in the midterm. Nevertheless, the investigation concluded that there existed no significant discrepancy between students' overplacement tendencies from the midterm to the final assessments. Yet, upon deeper analysis, it became evident that a predominant number of discrepancy scores leaned towards the negative end. This pointed to a scenario where more students in the final assessment had overplacement scores lower than those observed during the

midterm. This shift implies a positive trajectory in reducing overestimation tendencies. Intriguingly, the absence of any instances where students exhibited a two-unit overplacement in the final assessment, a phenomenon observed in four students during the midterm, lent further support to this observation. The timing of grade releases post-midterm might have provided students a clearer perspective to realistically gauge their performance compared to their peers, contributing to a decrease in overplacement tendencies in the final assessment. Studies in educational psychology have revealed that when students are able to compare their progress with that of their classmates, it tends to refine their self-evaluations regarding their class standings (Somyürek and Brusilovsky, 2015). This echoes the findings from existing literature in this domain.

The disclosure of midterm grades, albeit to a small extent, is seen as having the potential to slightly enhance students' awareness of their class standings, leading to more realistic self-assessments and potentially reducing tendencies for overplacement. Providing students with comparative feedback on their performance relative to their peers in educational settings is considered a valuable step in addressing the challenge of overplacement.

To assist students exhibiting high overconfidence and low academic success in Database Management Course, future research should delve deeper into the underlying reasons for this phenomenon. Moreover, exploring how success and overconfidence are influenced by factors, whether they are independent of or dependent on the subject matter—such as learners' personality traits and achievement goal orientations—, is considered valuable. Developing intervention strategies based on these insights is also deemed beneficial.

Statements of Publication Ethics

In this study, the principles of publication ethics have been adhered to, and the ethical permission for the research has been approved by the Ethics Committee of Ankara Gazi University Institute of Educational Sciences with the document number E-77082166-302.08.01-664509 on May 26, 2023.

Researchers' Contribution Rate

All authors have equally contributed to this work.

Conflict of Interest

There is no conflict of interest in this study.

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Teacher Practices and Student Understandings in 2D Drawings of 3D Shapes

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Abstract

Geometry holds a pivotal position within the realm of mathematics, yet many students struggle to grasp its concepts, posing challenges for their teachers. In the Republic of Türkiye, the Ministry of National Education has recently recommended the adoption of constructivist approaches to teach geometry. To gauge the efficacy of this instructional approach in actual classrooms, we investigated the practices of Turkish middle school mathematics teachers and their students' experiences in constructing two-dimensional drawings of three-dimensional geometrical shapes during regular lessons. The study involved four teachers from two schools and 199 students aged 12 to 14 years. Multiple data sources, including lesson observations, student worksheets and interviews with teachers and students, were utilized to gain insights into student understandings and whether the pedagogical practices they encountered were associated with this. Based on these findings, we argue that teachers may require additional support for their classrooms to transition into student-centred environments to permit students to actively engage in enriching mathematical exercises, exercise agency, and have opportunities to utilize provided manipulatives and digital tools.

Keywords: Constructivist Approaches, Geometry Education, Middle School Mathematics, Student Experiences, Three-Dimensional Geometrical Shapes, Two-Dimensional Drawings

Öğretmen Uygulamaları ve Öğrenci Anlayışları: 3B Şekillerin 2B Çizimleri Üzerine Bir İnceleme

Öz

Geometri, matematik alanında önemli bir konumu kaplamakla birlikte, birçok öğrenci geometrik kavramları anlamakta zorlanmaktadır, bu da öğretmenler için zorluklar doğurmaktadır. Türkiye Cumhuriyeti Milli Eğitim Bakanlığı, geometriyi öğretmek için yapılandırmacı yaklaşımların benimsenmesini önermiştir. Bu çalışmada, bu öğretim yaklaşımının sınıflardaki etkinliğini değerlendirmek amacıyla, Türk ortaokulu matematik öğretmenlerinin uygulamaları ve düzenli derslerde öğrencilerinin üç boyutlu geometrik şekillerin iki boyutlu çizimlerini oluştururken yaşadıkları deneyimler araştırılmıştır. Çalışmaya iki okuldan dört öğretmen ve 12-14 yaş arasındaki 199 öğrenci katılmıştır. Ders gözlemleri, öğrenci çalışma kağıtları ve öğretmenler ve öğrencilerle yapılan görüşmeler gibi çeşitli veri kaynakları, öğrenci anlayışlarına ve bu anlayışların ilişkilendirildiği pedagojik uygulamalara dair içgörüler elde etmek için kullanılmıştır. Bu bulgulara dayanarak, öğretmenlerin sınıflarında öğrenci odaklı ortamlara geçebilmeleri için ek desteklere ihtiyaç duyabilecekleri savunulmaktadır. Bu, öğrencilere matematiksel alıştırmalara etkin bir şekilde katılmalarına, etki alanı oluşturmalarına ve sağlanan manipülatifleri ve dijital araçları kullanma fırsatlarına sahip olmalarına izin vermek için gereklidir.

Anahtar kelimeler: Yapılandırmacı Yaklaşımlar, Geometri Eğitimi, Ortaokul Matematiği, Öğrenci Deneyimleri, Üç Boyutlu Geometrik Şekiller, İki Boyutlu Çizimler

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INTRODUCTION

Learning about three-dimensional (3D) shapes is widely recognized as a valuable way to enhance students' reasoning and spatial skills, enabling them to compare, manipulate and transform mental images to solve problems (e.g., Battista, 2007). Hence, geometry education programs at the national level, including those in the United States (Common Core State Standards Initiative, 2023), England (Department for Education, 2021), and Türkiye (Ministry of National Education [MoNE], 2024), emphasize the understanding of 3D shapes. However, research suggests that mastering this aspect of geometry poses significant challenges for students and their teachers in middle school (Bakó, 2003; Pittalis & Christou, 2013). This difficulty is reflected in national and international exam results from multiple countries, where students often exhibit suboptimal performance in questions related to the understanding pertaining to characteristics of shapes in both two and three dimensions (Brown et al., 1988; Department for Education, 2019; National Centre for Education Statistics, 2011, 2018; OECD, 2019; Standards and Testing Agency (STA), 2019a, 2019b).

This is not just a recent phenomenon. Over the past three decades, numerous studies have consistently revealed that students typically perform lower than anticipated in geometry, indicating an ongoing challenge (Alghadari et al., 2020; Bhagat & Chang, 2015; Clements, 2003; Clements & Battista, 1992). This situation appears to be stagnant or even deteriorating.

Our crucial aspect of middle school geometry that has been particularly challenging for students is the task of drawing 2D representations of 3D shapes. This difficulty has been observed across multiple countries and persists despite years of research efforts (Cooper & Sweller, 1989; Kali & Orion, 1996; Widder & Gorsky, 2013). Existing research highlights several difficulties students encounter when learning to draw 2D representations of 3D shapes. Studies have consistently shown that students often struggle with mentally visualizing 3D shapes from 2D diagrams, which hinders their ability to draw accurate representations (Pittalis & Christou, 2013). Many students treat 2D representations as if they were themselves 2D, leading to poor performance on coding and decoding tasks (Pittalis & Christou, 2013). Additionally, students may lack the necessary visualization skills to mentally manipulate and perceive 3D shapes based on their 2D representations (Kali & Orion, 1996). These difficulties often result in errors related to improper visualization, incorrect reasoning about cube properties, or both (Fujita et al., 2017).

Students have also been found to face challenges in understanding the conventions and techniques of drawing 2D representations of 3D shapes. They can struggle with using standard tools like isometric drawing paper or fail to grasp the geometrical properties and nets of 3D shapes (Pittalis & Christou, 2013), leading to misconceptions and errors in their drawings.

Recent research has built on this to try and understand the factors that might lead to these difficulties in representing 3D shapes in 2D. Fujita et al.'s (2017) results aligned closely with the four types of student behaviour identified by Pittalis and Christou (2013): attempting to answer questions, responding intuitively or by using the visual data, judging questions as if they were two-dimensional, and being aware of the 3D representation but failing to provide the correct response. These problems can persist in more advanced 3D geometry, as when Fujita et al. (2017) asked students to calculate the diagonal length of a shape drawn inside a cube, common errors included highlighting improper visualization, improper reasoning about cube properties, or a combination of both as the primary causes of the incorrect responses. Overall, the existing research suggests that challenges faced by students when grasping 2D representations of 3D shapes stem from issues with visualization, conceptual understanding, and familiarity with conventions and techniques.

Teachers' beliefs significantly influence the way they conduct their classrooms, and investigating their beliefs regarding teaching about 2D representations of 3D shapes is important to build a full view of geometry teaching and learning (Cross, 2009; Kuzniak & Rauscher, 2011). Existing research suggests that teachers often express a lack of understanding of 3D geometry and perceive it as a challenging topic to teach (see Bakó, 2003; Christou et al., 2006; Parzysz, 1988). Consequently, some teachers avoid teaching it altogether or resort to directed teaching methods rather than student-centered practices (Bakó, 2003). This widespread overall avoidance and instructional approach has been implicated in the difficulties that students face in visualizing 3D shapes from their 2D drawings (Christou et al., 2006; Widder & Gorsky, 2013). When teachers lack a strong understanding of 3D geometry or confidence in teaching it, they may struggle to guide students effectively in developing the necessary visualization skills.

Consequently, our study aims to build upon this prior research that has examined students' understanding and teachers' beliefs related to 2D drawings of 3D shapes in middle school settings to establish possible connections between students' performance and teachers' instructional practices. By relating the two, we hope to gain a deeper understanding of the challenges students face in visualizing 3D shapes from 2D representations and what teachers can do to help them. Thus, the findings from this study will further inform the development of strategies to promote student-centered, conceptually rich learning experiences in geometry classrooms in Türkiye.

Geometry Education in the Researched Context

In Türkiye, the teaching and learning of geometry, particularly 2D and 3D shapes, is a key component of the middle school curriculum. Government policy outlines specific objectives that students are expected to achieve within a limited number (4 to 6) of class hours (Ministry of National Education, 2024), including drawing the orthogonal views (from the top, front, left and right) of 3D shapes constructed from unit cubes, and constructing an isometric drawing corresponding to given orthogonal drawings from the top, front, left, and right (the use of an isometric paper is suggested).

Students' performance is subsequently assessed through a national examination conducted at the conclusion of each academic year.

Both students and teachers have expressed dissatisfaction with the perceived difficulty of the test questions in the national assessment, resulting in poor performance that falls below expectations. Consequently, it appears that the current system is not functioning as intended. Studies have revealed that mathematics teachers in Türkiye tend to adopt a teaching-to-test approach and steer clear of approaches that place students at the forefront (Doruk, 2014; Karaagac & Threlfall, 2004; Saralar-Aras, 2022), which can be attributed to the evaluation system that judges teacher effectiveness based on students' outcomes (Konan & Yılmaz, 2017, 2018). Despite Turkish mathematics teachers expressing belief in the effectiveness of the updated Turkish mathematics curriculum and their reported support for the emphasis on student-centred activities and technology integration, these practices are challenging to observe in natural classroom contexts (Bayrakdar-Çiftçi et al., 2013; Tekalmaz, 2019; Zengin, 2023). Research indicates that Türkiye, like many countries, advocates for a constructivist approach to geometry education. However, the extent to which this approach has been enacted/implemented in Turkish classrooms and its influences/impact on teaching practices and learning outcomes in the teaching of 3D shapes remain unclear.

Constructivism in Türkiye's Mathematics Classrooms

Constructivism has had a significant impact on how mathematics is taught worldwide. Although not without its critics (e.g. Kirschner et al., 2006), many believe that teaching mathematics should not be considered as transfer from teachers to students of mathematical relations, rules, and symbols. Instead, finding a correct answer in mathematics is interpreted as a method emphasising logical thinking, reasoning, and critical problem-solving over rote memorization of algorithms (Simon & Schifter, 1991). Students are seen as learning how to develop a mathematical theory, assess its mathematical correctness, and discover values, processes, and data (Schrifter & Fosnot, 1993). Built upon the notion that students should actively participate in creating mathematics, constructivism tries to help students develop their own ideas through interactions with their classmates, their culture, and tangible objects (Brooks & Brooks, 1999). Constructivism encourages students to apply mathematics to real-world situations because it links mathematics to everyday life (Fosnot & Perry, 1996).

In Türkiye, the new curriculum's emphasis on constructivism, its theoretical significance and purpose are still debated. In some Turkish policy documents, constructivism is often associated with a student-centered approach to education. This means that the focus is placed on addressing the requirements, interests, and capabilities of the students; moreover, instruction is tailored to individual or group needs. In others, constructivism often emphasizes the importance of integrating learning with real-world situations. Learning experiences that are relevant and meaningful to students are believed to enhance understanding and retention of information. However, one undeniable issue with its implementation in the classroom is that it was prescribed independently of other fundamental elements of the educational system. The readiness and suitability of other agents, such as teachers and learning environments for a constructivist mathematics approach, were not considered (Gür & Çelik, 2009). Teachers and schools were insufficiently prepared to incorporate it and achieve the desired outcomes, and numerous studies have found that teachers have difficulties in setting up constructivist learning settings in Turkish classrooms (e.g. Bayraktaroglu, 2011; Cengizhan & Koç, 2017). For example, applying a constructivist approach in the assessment required much more time than teachers had available (Tuncel & Kazu, 2019).

Moreover, the new constructivist curriculum recommends (almost mandates) that technology is used to teach 3D shapes, changing the resources teachers use to teach and their students use to learn in relatively radical ways. Thus, it could be argued that altering the national education curriculum by drawing inspiration from other

countries without carrying out in-depth research that explores constructivism in Türkiye is unlikely to be successful. Even more so, if in-service teachers are not given the necessary support to understand and adopt new practices with new resources, they may struggle to effectively incorporate these changes into their teaching.

Consequently, a key focus of our study on the relationship between classroom practices and student understanding of middle school geometry was to explore the extent that recommended constructivist approaches with new technologies were in use in the classrooms.

Originality of the Study

The originality of this study lies in its nuanced exploration of the relationship between teacher practices and student understandings in the context of middle school geometry education in Türkiye. Focusing specifically on the implementation of constructivist approaches recommended by the Ministry of National Education, the study delves into the intricacies of how these pedagogical strategies manifest in actual classrooms. By employing a multi-case study design with a diverse set of teachers and students, the research adds depth to the understanding of the challenges students face in constructing two-dimensional drawings of three-dimensional geometrical shapes. The incorporation of national exam-based questions in the assessment tools enhances the study's relevance and provides insights into the practical implications of classroom practices on students' performance in standardized assessments. Furthermore, the examination of the use of manipulatives and digital technologies, along with the identification of underlying difficulties faced by students, contributes to the broader discourse on effective geometry education. In essence, this study brings a novel perspective to the examination of geometry instruction by intricately examining the interplay between pedagogy, student experiences, and learning outcomes within the unique educational landscape of Türkiye.

The Significance of the Study

The significance of the study lies in its contribution to the understanding of the challenges and potential improvements in middle school geometry education, specifically focusing on the representation of three-dimensional (3D) shapes through two-dimensional (2D) drawings. The following points highlight the significance of the study:

Firstly, the study is conducted in the context of Türkiye, where the Ministry of National Education has recommended the adoption of constructivist approaches in teaching geometry. By investigating the actual practices in middle school mathematics classrooms, the study provides insights into the alignment between recommended approaches and the reality of instruction. The findings can inform educational policies, suggesting potential areas for improvement in implementing constructivist methods. Secondly, understanding the challenges students face in accurately representing 3D shapes in 2D drawings is crucial for enhancing geometry instruction. The study identifies specific errors and underlying difficulties, such as mental visualization and drawing translation. This knowledge can guide curriculum development, teacher training programs, and the creation of resources that address these challenges, ultimately improving students' geometric reasoning and representation skills.

Furthermore, the study explores the extent to which recommended constructivist approaches with new technologies are actually in use in the classrooms. By highlighting any disparities between policy recommendations and actual instructional practices, the study contributes to bridging the gap between educational policies and their implementation. This insight is valuable for education stakeholders, including policymakers, administrators, and curriculum developers. Moreover, the findings of the study indicate that teachers may require additional support to transition their classrooms into student-centered environments that align with constructivist principles. This emphasizes the need for targeted professional development programs for mathematics teachers. Insights into the specific challenges and instructional gaps can guide the design of effective training initiatives, empowering teachers to implement more student-centered and technology-integrated practices.

In addition to these, the study highlights the underutilization of digital technologies in geometry instruction despite their recognized potential. This information can guide efforts to optimize the integration of technology tools, such as 3D geometry software, into the classroom. Recommendations for incorporating dynamic software for constructing and manipulating polycubes can contribute to more effective technology integration strategies. Last but not least, the emphasis on the need for student engagement with manipulatives and the challenges associated with a rule-based, exam-focused pedagogy points towards the importance of creating student-centered learning environments. The study advocates for a shift in instructional practices that allow students to actively engage in enriching mathematical exercises, exercise agency, and utilize provided manipulatives and digital tools.

In conclusion, the significance of this study lies in its potential to inform educational policies, improve instructional practices, and contribute to the professional development of teachers in Türkiye and potentially in other contexts facing similar challenges in middle school geometry education. The findings have practical

implications for creating more effective, student-centered, and technology-enhanced learning experiences in the realm of geometry.

METHOD

The study employed a multi-case study approach to investigate the instructional practices of mathematics teachers and the corresponding learning outcomes of their students in relation to representations of three-dimensional (3D) shapes. Two public middle schools and two teachers from each school participated. Geometry education, particularly the representation of three-dimensional shapes through two-dimensional drawings, is known to be a complex area of study. By adopting an explorative approach, the research aims to delve deeply into the multifaceted challenges faced by both teachers and students in this specific aspect of geometry. The explorative nature allows for a nuanced understanding of the intricacies involved.

Research Design

A multi-case study as described by Yin (2009) is well-suited for understanding the pedagogical practices employed by middle school mathematics teachers. This approach enables the researchers to observe, analyze, and compare the practices of different teachers in distinct contexts; it allows for the identification of commonalities and variations in instructional strategies, shedding light on the ways teachers approach the teaching of 3D shape representations (Aberdeen, 2013; Yin, 2009). Moreover, this design enables the collection of rich qualitative data through various sources such as lesson observations, student worksheets, and interviews (Yin et al., 2012). This depth of data allows for a thorough analysis of the complexities inherent in teaching and learning geometry, providing a comprehensive picture of the phenomena under investigation. Thus, this study aimed to address the following research questions to gain insights into the students' performance in representing 3D shapes, the underlying errors, and the pedagogical practices employed in the classroom:

How do students perform when they are tasked with representing 3D shapes, and what specific errors do they make?

What are the underlying misunderstandings or difficulties that contribute to these errors?

What are the pedagogical practices employed in the classroom, and how do they align with the recommended constructivist approach? How might these practices be related to students' performance?

The first question sought to assess the overall performance of students in accurately depicting 3D shapes and identify the specific errors they encountered during this process. By examining the underlying factors that led to the observed errors, the second question intended to identify the specific misunderstandings or challenges students face when working with representations of 3D shapes. Finally, the third question strived to investigate the instructional strategies and approaches teachers use in teaching 3D shape representations, specifically focusing on their alignment with the constructivist approach. Furthermore, it sought to explore the potential relationship between these pedagogical practices and students' performance outcomes. By addressing these research questions, the study aimed to provide valuable insights into the performance, errors, underlying difficulties, and instructional practices related to representing 3D shapes.

Context and Participants

Each school consisted of three to four grade-seventh classes, with an average of 25 to 30 students per classroom. The schools were selected based on their possession of the necessary tools and technology to support the study. All participating students, their parents and teachers provided informed consent before their involvement in the study. The student sample comprised 199 students, including 107 girls and 92 boys, within the age range of 12 to 14 years. Students answered worksheet questions derived from national assessments (section 2.2) and were observed within their respective classrooms. 16 students from this sample (8 girls and 8 boys) took part in an artefact-based interview, enabling an in-depth exploration of their thoughts on the lessons, as well as their thinking processes and solution strategies. They were randomly selected from those who had correctly answered a minimum of two out of ten worksheet questions, ensuring sufficient knowledge to respond to the interview questions, but beyond that, were not stratified by score.

The four teachers involved in the study are referred to pseudonymously as Mr Aras, Ms Ayaz, Ms Onay, and Ms Semin. Their experience of middle school mathematics teaching ranged between 4 to 13 years.

Data Collection

The research employed several methods to generate data, including lesson observations, student worksheets, and artefact-based interviews. The following sections provide an explanation of the methods and the corresponding instruments used.

Lesson Observations

A total of 16 lessons, with four classes each having four lessons, were observed by the first author during regular mathematics classes. The focus of the observations was on the teaching of orthogonal and isometric drawings of cube representations. Before the target lessons, the researcher attended four hours of the teachers' lessons to establish familiarity with both teachers and their students. During the target lessons, the researcher occupied a seat in the rear of the classroom, documenting observations through field notes every 5 minutes. The field notes were structured using an observation protocol with descriptive and reflective observation fields (Creswell, 2007), capturing information about the classroom environment, student and teacher actions. Additionally, the instructional materials employed in the lessons, such as presentations, activity sheets, and pages from books, were gathered and documented.

Students' Works

After the final lesson, students completed a worksheet in two further forty minutes lessons. The worksheet was based on national exam questions and consisted of five orthogonal and five isometric drawings. Orthogonal drawings required students to create four drawings that encompassed four views: top, front, left, and right on a given isometric representation of a cube. In isometric drawing tasks, students were prompted to generate a single isometric representation from given top, front, left, and right views. Sample questions from each type, along with possible correct answers, are provided in Figures 1 and 2. They are the third questions from five and are considered to have medium levels of difficulty.

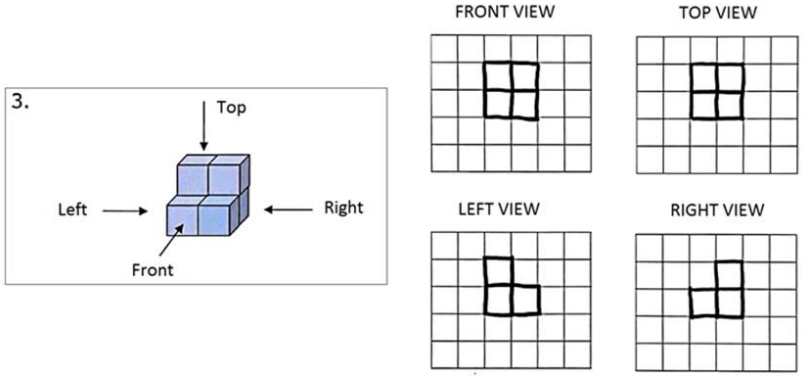


Figure 1. *Q-3 in orthogonal drawings and its possible correct answer*

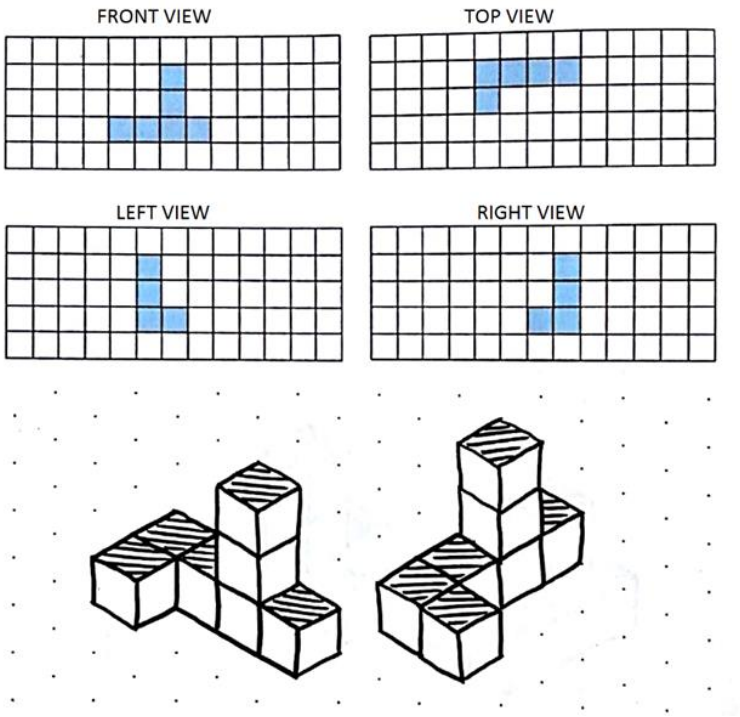


Figure 2. *Q-3 in isometric drawings and its two possible correct answers*

This worksheet had been previously piloted with the students of the same age and necessary modifications had been made to ensure clarity of the questions. The use of national exam questions as the foundation for the

worksheet in the study investigating teacher practices and student understandings in 2D drawings of 3D shapes is justified for multiple reasons. Firstly, it ensures alignment with the national curriculum, reflecting the educational objectives set by Türkiye's education authorities. By assessing students' proficiency in representing 3D shapes, the study evaluates core skills outlined in the curriculum. The questions' consistency in difficulty level and format allows for valid comparisons between students, classes, and schools, providing a standardized assessment. Additionally, the policy relevance is heightened as the study explores the effectiveness of current instructional approaches in preparing students for assessments mandated by the education system. The use of national exam questions establishes a link between classroom practices, student understanding, and broader educational standards, providing insights into how well students meet national expectations. While practical and accessible, researchers should remain mindful of potential limitations, such as the influence of exam-oriented content on instructional practices.

Interviews

Individual interviews were conducted to explore students' perspectives on the lessons and their understanding of the subject matter. They took place after the completion of the worksheets and lasted between 15 and 30 minutes. Interviews had two phases. In the first phase, students were asked about their opinions and experiences regarding 2D representations of 3D shapes, including their perceived difficulty and suggested improvements. They were also asked to explain what they had learned about 3D shapes and how they applied the knowledge during the lessons. Questions (translated) asked included:

- "For the last four lessons, you have been working on 2D representations of 3D shapes. Was this topic more difficult compared to other topics in mathematics? Let's assume a scale where one is "too easy", and ten is "too difficult." Where would you place this topic on the scale?
- You mentioned that you find it difficult to learn this topic. Why do you think it is challenging? What changes do you think could make this topic easier?
- If you were to explain what you have learnt about 3D shapes to someone who has not studied this unit yet, what would you say?
- What advice would you give to the next year's class regarding the relationship between the left and right views of the same 3D shape? How did you use this information during the past lessons?"

The second phase aimed to understand students' reasoning behind their incorrect answers on the worksheets. Interview questions were based on the completed worksheets, and students were asked to explain their methods and strategies. In addition to audio recording, notes taken during the interviews included any relevant actions or gestures (e.g., pointing to a specific part of a shape).

Data Analysis

Observations and interviews

A thematic coding strategy was employed to analyze the observations and interviews, aiming to identify patterns in data and report significant findings (Taylor & Ussher, 2001). The analysis process followed the recommended steps by Marshall and Rossman (2011), which involved organizing and coding the data, establishing themes, assessing comprehension and exploring other interpretations and compiling the study findings.

Each interview transcript was carefully reviewed, analyzed and integrated with the data from lesson observations. To ensure a comprehensive understanding, each transcript was read multiple times. Initial coding was performed to capture significant statements and ideas. These codes were then grouped into broader categories, which were refined into themes. During this process, peer debriefing sessions were conducted to review and verify the codes and themes. Member checks were also employed, where participants reviewed the findings to confirm their accuracy and relevance. That is to say, to enhance validity, peer evaluation and member checks were utilized. The researcher was mindful of the potential reactivity, where participants may exhibit different behaviors due to being observed. Table 1 showcases themes, codes and subcodes derived from the study.

Table 1. Themes, Codes and Subcodes of the Study

Themes	Codes	Subcodes
Student difficulties	Visualization	
	Drawing	
Teaching practices	Use of manipulatives	Teacher use
		Student use
	Use of technology	Teacher use
		Student use
	Exam-focused pedagogy	

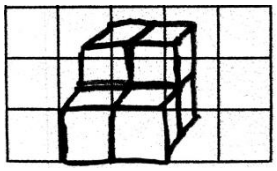
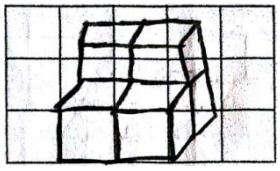
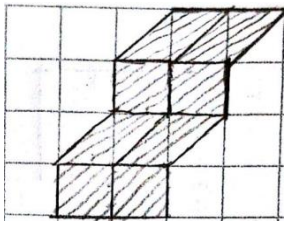
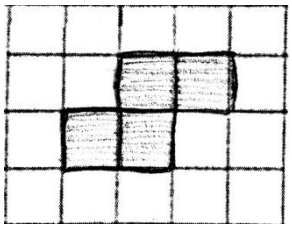
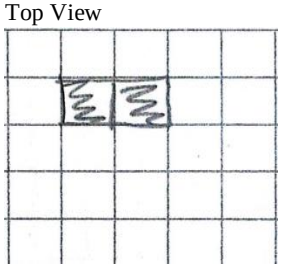
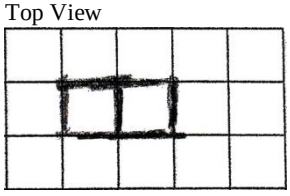
Students' Works

Regarding the students' work, a rubric was developed for each question, outlining all possible correct drawings. The researchers then coded the completed worksheets. No points were assigned for incorrect or missing answers. For each correct aspect of an item (e.g., front, top, left, and right views), one point was given. Therefore, both orthogonal and isometric drawing questions were scored out of 4, resulting in a maximum score of 20. Additionally, the worksheets underwent coding to identify the nature of the errors, which are described and exemplified in Figures 3 and 4. The coding scheme was informed by Fujita et al.'s (2017) and Pittalis and Christou's (2013) codes and modified to suit orthogonal and isometric polycube drawings. The relationship between the codes adopted in this study and these earlier ones is given below, where the codes in brackets indicate the one that would be the one assigned by Pittlis and Christou (2013) first and Fujita et al. (2017) second.

- E1: Redrawing the given shape as the front or a part of it as a side view (judging the 3D shapes as if they were two-dimensional/ two-dimensional)
- E2: Drawing cubes at the back to another column (being aware of the 3D representation but unable to provide the correct answer/implicit conventional)
- E3: Drawing the part only at the very front of the shape (answering based on intuition or using visual data /intuitive)
- E4: Swapping the left and right views (answering based on intuition or using visual data/intuitive)
- E5: Drawing the view upside down (answering based on intuition or using visual data /intuitive)
- E6: Redrawing the provided shapes (judging the 3D shapes as if they were two-dimensional/ two-dimensional)
- E7: Attempting to combine orthogonal views side by side (answering based on intuition or using visual data /intuitive)
- E8: Drawing only one view at a time instead of combining all views (answering based on intuition or using visual data /intuitive)
- E9: Encountering difficulties in establishing links between different components of the shape (being aware of the 3D representation but unable to provide the correct answer /implicit conventional)

An error coding scheme was employed to describe the prevalent errors made by students.

Figure 3 (orthogonal) and Figure 4 (isometric) provide a definition of the error along with two example responses that illustrate it (from Question 3 on both worksheets.).

Description	Example student mistakes	
Redrawing the given shape as the front or as a part of it as a side view (E1)	Front View 	Front View 
Drawing the cubes at the back onto another column (E2)	Front View 	Front View 
Drawing only the part at the very front of the shape (E3)	Top View 	Top View 
Swapping the left and right views (E4)	Left View	Left View

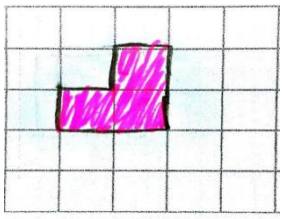
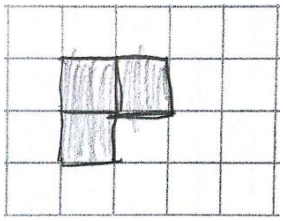
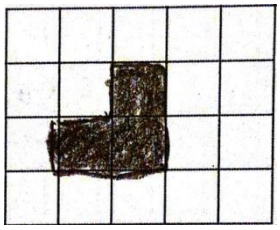
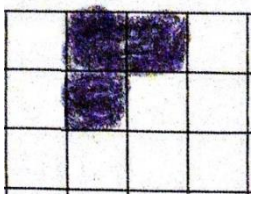
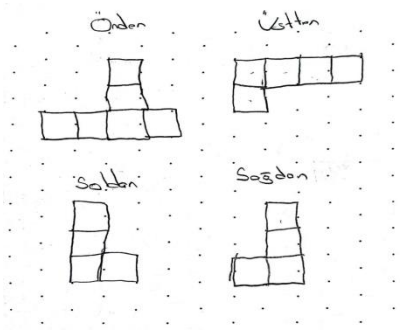
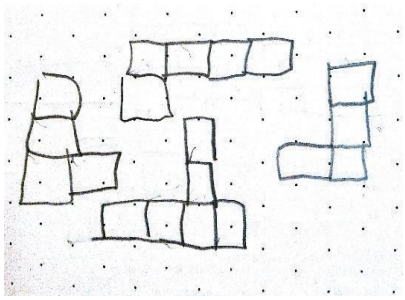
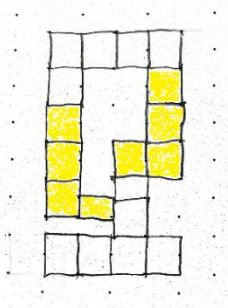
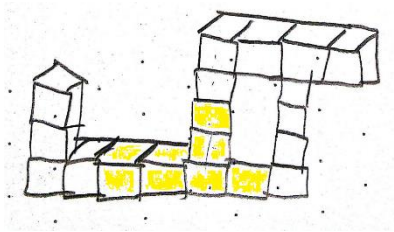
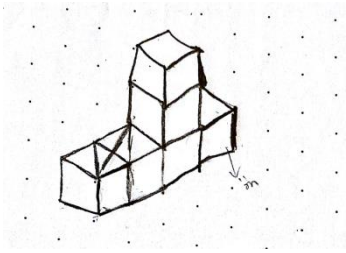
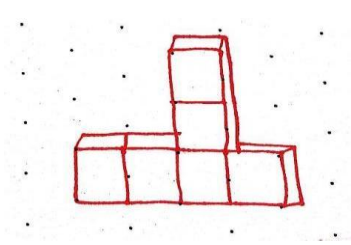
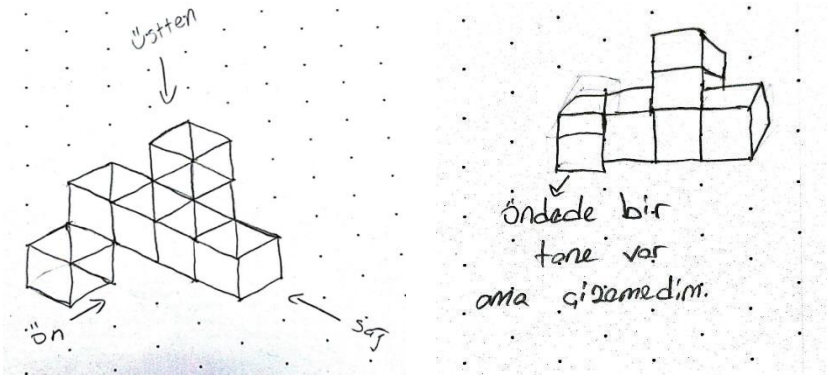
Drawing the view upside down (E5)	 Left View 	 Left View 

Figure 3. *Orthogonal drawing errors*

Description	Example Student Mistakes	
Redrawing the provided shapes (E6)		
Attempting to combine the orthogonal views side by side (E7)		
Drawing only one view at a time instead of combining all views (E8)		

Encountering difficulties in establishing links between different components of the shape (E9)



[a]Önde de bir tane var ama çizemedim (Turkish). = There is one more (cube) in the front but I couldn't draw it (English).

Figure 4. *Isometric drawing errors and linking problems*

A second coder independently coded 20 worksheets selected randomly. The agreement between the coders was assessed, and a very high level of agreement was found (Kappa=0.9, p<.001). Furthermore, an ANOVA was conducted to examine the effect of question type (orthogonal and isometric) on test performance. Detailed results of this analysis are reported in the Results section.

Research Ethics

This study was conducted within the guidelines of the University of Nottingham's Code of Research Conduct and Research Ethics and the School of Education in particular which has adopted Revised Ethical Guidelines for Educational Research (BERA, 2011). Before the submission of the ethics documents, the first researcher needed to obtain a Disclosure and Barring Service (DBS) check to have access to schools and received it with F0104171462 reference number. All information collected was anonymised, confidential and only available to the researcher and her supervisors. Pseudonyms were used throughout the studies to replace teachers' and students' real names.

Particular ethical issues related to the study and ethical permission numbers from the University of Nottingham are noted at the end of the article.

FINDINGS

The findings are organized into three sections. The initial section provides an analysis of students' performance on worksheets, examining their errors when generating orthogonal and isometric drawings of 3D shapes. Subsequently, challenges inherent in the task, potentially contributing to these errors, are outlined. Lastly, an account is provided concerning existing classroom practices that may have influenced the students' misunderstandings and difficulties.

Student Performance and Errors

Question 1: How do students perform when they are tasked with representing 3D shapes, and what specific errors do they make?

An ANOVA was conducted to examine the effect of question type (orthogonal and isometric) on test performance, as shown in Table 2. This analysis revealed a single significant effect of question type: $F(1,198)=265.255$, $p<.001$, $\eta_p^2 = .574$. Specifically, students demonstrated higher performance on orthogonal drawings.

Table 2. Test Scores for Orthogonal and Isometric Drawing

	Orthogonal drawing (/20)		Isometric drawing (/20)	
n	*M*	*SD*	*M*	*SD*
199	11.92	6.31	5.27	5.78

Table 3 and Table 4 provide a detailed breakdown of these errors, including the number and percentages of each error type for orthogonal and isometric drawings. The "students" column denotes the number of students who exhibited each error (e.g., 50 students answered Q1 incorrectly). It should be noted that the sum of the number

of errors may not equal the total number of students who made these errors (e.g., 61 ≠ 50 for the Q1), as students could make multiple types of errors per question.

Table 3. Number of Errors for Orthogonal Drawing Questions by Error Type and Question

	Students	E1	E2	E3	E4	E5
Q1	50	29	0	20	N/A	12
Q2	124	26	38	56	N/A	20
Q3	106	22	13	47	25	5
Q4	117	13	37	74	7	6
Q5	151	15	45	29	15	34
Total		105	133	246	47	77

Table 4. Number of Errors for Isometric Drawing Questions by Error Type and Question

	Students	E6	E7	E8	E9
Q1	56	20	0	22	17
Q2	136	31	33	43	34
Q3	131	32	18	55	33
Q4	115	32	24	41	27
Q5	155	29	39	30	39
		144	114	191	150

These tables demonstrate that, as intended, the difficulty level increased with each subsequent question. Generally, Question 1 had the fewest errors, and by Question 5, most of the students could not answer it correctly. Furthermore, no single question was uniquely associated with a specific error type.

For orthogonal drawings, the most common error involved drawing only the front view of the shape, accounting for 40% of all coded errors. On the other hand, drawing an upside-down view constituted only 8% of the errors. In contrast, errors in isometric drawings were more evenly distributed among the four coded error types.

Challenges in Tasks Leading to Errors

This section addresses the challenges inherent in the task that may contribute to the errors discussed in Section 3.1, highlighting their connection to students' difficulties. Generally, it is evident that many students encountered difficulties in recognizing, imagining, and constructing 2D representations of 3D shapes. Over 2/3rds of the interviewed students expressed trouble understanding the topic, rating its difficulty between five and ten on a ten-point scale. For instance, a student stated, "*Well, seven. It is not as difficult as ten, but I have to admit that I still find it pretty challenging."* Moreover, those few students who considered it not difficult demonstrated ambivalence during interviews. One student remarked, "I'm *giving it a two. I am bad at mathematics. I think I couldn't answer most of the worksheet questions correctly. I rarely provide correct answers to my maths teachers, but I believe '3D shapes' is an easy topic for others.*". Consequently, it appears that students generally perceive this topic as demanding.

Analysis of the interviews and students' worksheets revealed two major difficulties underpinning these challenges: 1) mental visualization of cube constructions (experienced by all students) and 2) drawing the visualized shape onto paper (encountered by approximately half of the students).

Mental visualization: All interviewed students reported finding the mental simulation of 3D shapes challenging, struggling to integrate separate views to construct a 3D form in their minds. This challenge was particularly associated with E1, where students redrew the given shape as the front or a part of it as a side view, indicating students were trying to interpret the 3D shape as if it were a two-dimensional representation. Figure 5 illustrates a typical example of a student struggling to mentally combine orthogonal drawings into a single shape resulting in an mistaken drawing which was coded as E8. These sketches demonstrate that their primary struggle lay in mental visualization. Students emphasized the need to visualize the shape before attempting to draw it. Without this mental visualization step, they could not produce the correct response.

"*I just couldn't visualize them [orthogonal drawings] together, you know? Each orthogonal view forms its own shape, but merging them into a single shape is really hard for me.*"

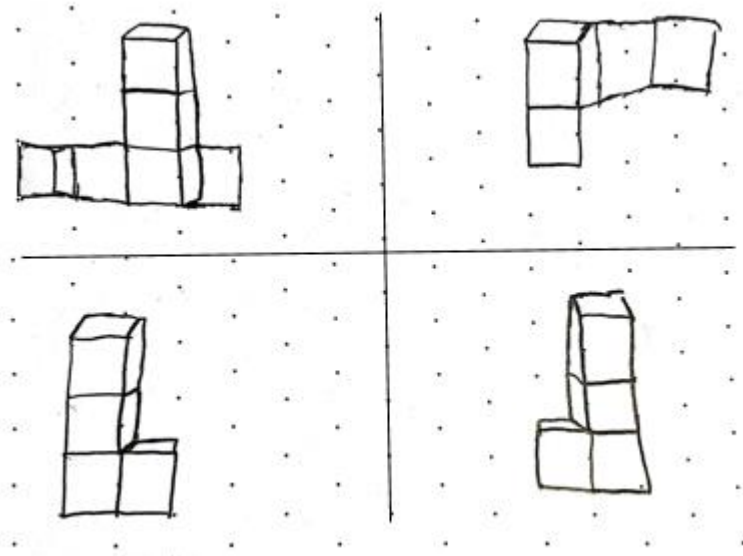


Figure 5. *Sample student drawing for the Q-3 in isometric drawings (E8)*

Drawing the visualized shape on paper: During observed lessons, many students found it challenging to transfer their mental visualizations onto paper. Half of the interviewed students shared similar experiences, noting that while they could visualize the shape in their minds, they encountered difficulties in accurately representing it on paper, and this challenge underpinned a number of errors (E3, E4, E5, E7 and E8).

The following quotation exemplifies an episode from one of the interviews.

"*Researcher: Please talk through how you decided where and how many cubes to draw in this question [Figure 6].*

Student: Hımm… I wanted to draw… Four, five, six… [Counts the cubes previously drawn onto the worksheet.] Seven cubes, but I only drew six cubes.

Researcher: Where should the seventh cube be?

Student: In front of this one [Points to the cube on the far left], but when I draw it, it seems like it is on that cube, not in front of it.

Researcher: I see. Will the shape be complete once you draw it?

Student: Yes, but I don't know how.

Researcher: How many units is the height of this shape?

Student: Three [Points to each cube].

Researcher: I believe what you imagined is perfectly correct, but the drawing is slightly slanted, making it difficult to interpret the shape's intended height. Sometimes, it can be challenging to accurately depict what we visualized. … Let's start from the beginning and work through it step by step together."

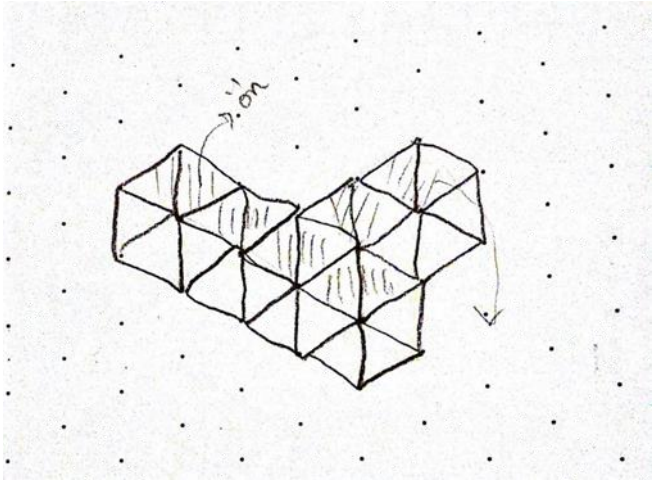


Figure 6. *Sample student drawing for the Q-3 in isometric drawings (E8)*

Figure 6 showcases the quoted student's drawing for Question 3 in isometric drawings, reflecting the student's accurate mental description and shape despite potential evaluation issues raised by mathematics teachers

due to the missing cube and incorrect use of isometric paper. This episode is just one example from many, highlighting drawing difficulty as the second primary reason for students' erroneous responses. Taken together Figure 5 and Figure 6 also illustrate how the same error (E8) could challenge in visualization or drawing (or both).

Table 5 illustrates the relationship between students' difficulties and observed errors. Some errors are presented in both sections as they were deemed to relate to difficulties in both drawing and visualization.

Table 5. Errors and Possible Related Difficulties

Visualization	Drawing	Both
Orth – E1 - Redrawing the given shape as the front or as a part of it as a side view	Orth – E4 - Swapping the left and right views	Iso – E7 - Attempting to combine the orthogonal views side by side
Orth – E2 - Drawing the cubes at the back onto another column	Orth – E5 - Drawing the view upside down	Iso – E8 - Drawing only one view at a time instead of combining all views
Orth – E3 - Drawing the part only at the very front of the shape	Iso – E9 - Encountering difficulties in establishing links between different components of the shapes	
Iso – E6 - Redrawing the provided shapes		

In summary, two underpinning challenges encountered by students in the task were mental visualization and translation of that visualization into a drawing. It is important to note that these difficulties are intertwined since students need to visualize and draw simultaneously, and this can be iterative: as students draw, they may change their visualization. However, if a student fails to produce any drawing, it remains unclear whether the student successfully visualized the structure but could not translate it onto paper.

Current Pedagogy and its Relationship to any Difficulties and Misunderstandings

This section begins by briefly describing the main features observed during the lessons. It then examines three key aspects of the pedagogy employed and their potential relationships to the difficulties and misunderstandings experienced by students, as well as the extent to which a constructivist approach was adopted.

All the teachers in this study independently devised their lesson plans, drawing examples from diverse sources, yet adhering to similar lesson structures. Each lesson began by emphasizing previous experiences and competencies. While two teachers (Mr Aras and Ms Onay) summarised previous class content, the others (Ms Ayaz and Ms Semin) checked homework assignments. The teachers then introduced the subject using their chosen examples from external textbooks (Mr Aras and Ms Onay) or the MoNE's suggested workbook questions (Ms Semin and Ms Ayaz).

During the lessons, students were allotted time to tackle particular questions before the teachers demonstrated their own approach by drawing the correct representation on the board. While students were working on their sketches, teachers employed various techniques. For instance, one teacher (Ms Ayaz) used physical manipulatives such as cubes to build 3D shapes on the teacher's desk, while others (Mr Aras and Ms Onay) provided hints and suggestions as they walked around. Afterwards, all teachers invited students to draw on the board, either from volunteers or being selected by the teacher. It was notable that fewer students volunteered to create isometric drawings compared to orthogonal drawings. The teachers outlined a plan for drawing the correct representation and allowed students time to copy it into their notebooks or activity sheets.

In addition to exercises, teachers employed various methods to illustrate essential aspects of the content. Some teachers (Mr Aras and Ms Onay) repeatedly listed steps for making drawings, while others (Ms Semin and Ms Ayaz) advised students to observe their teachers' hand movements during the drawing process.

Lessons concluded with a summary of the covered material using various methods. Mr Aras and Ms Onay used resources provided by the MoNE, such as multiple-choice questions in digital education platforms or overview videos. Ms Semin and Ms Ayaz assigned additional homework from different sources. Particularly, Ms Ayaz consistently displayed a sense of urgency in finishing the planned questions, often assigning the remaining questions as homework. Conversely, Ms Semin frequently managed to cover her intended questions and, as a result, assigned supplementary homework from various external sources after providing a summary of the topics covered in the class. All teachers followed the progression from orthogonal to isometric drawing, aligning with the MoNE's curriculum order; teachers could have chosen to reorder it.

Turning now from this description, three prominent features of the lessons appear to be associated with the subsequent difficulties experienced by students and the extent to which constructivist practices were enacted.

The first feature is the use of manipulatives. Although all teachers acknowledged the value of concrete manipulatives, they predominantly used them themselves, limiting students' opportunities to construct their own models. For instance, Ms Ayaz used cubes measuring 10cm on each edge to construct a three-dimensional shape on her desk. Then, she drew orthogonal views of this cube construction on the classroom board, expecting the students to replicate these drawings. Consequently, the students found themselves reproducing the teacher's renderings rather than transforming the physical cube into a visual representation, arguably missing a vital step that was overlooked in this instructional approach. Only one out of the observed 16 classes involved students creating 3D shapes themselves. This finding from the lesson observations was corroborated by the student interviews, which confirmed they rarely got to use manipulatives themselves in any lesson. This lack of hands-on experience likely contributed to students' difficulties in focusing on the parts of the shapes (e.g., left view and top view) to construct a polycube and resulted in frequent errors, such as swapping left and right views (E 4) or drawing views upside down (E5).

The second feature is a limited and somewhat exam-focused pedagogy, despite teachers' intentions to adopt a constructivist approach. Lessons relied on memorization of rules rather than providing worked examples or encouraging problem-solving by students. Teachers often focussed on drawing only one view at a time to teach the rules, leading to errors such as drawing only one view/drawing views one by one (error 8) or swapping left and right views (error 4), which were so frequent. Students had limited opportunity to observe shapes and develop drawn solutions for themselves. This practice was observed multiple times. During the interviews, students reported that teaching was mainly didactic and that they had a very tight program to cover due to the MoNE's middle school exam. Teachers used the MoNE's past exam questions within their lessons, intending to boost the students' enthusiasm and highlight the topic's relevance for test success. Additionally, teachers (Ms Onay and Mr Aras) often used challenging questions from external sources to motivate students, but these questions proved to be excessively difficult, discouraging student participation. For example, Mr Aras found an external source and circulated copies of two pages from the source to his students. These questions involved orthogonal views of given polycubical shapes, but many had shapes that included more than twice the number of cubes compared to the questions on the MoNE exam. They were frequently so difficult for the students that almost none of them were willing to answer questions when asked.

The last feature pertains to the use of digital technologies. The ministry expects teachers to foster meaningful student learning through constructivist pedagogy and technology integration. Although three teachers (Ms Ayaz, Ms Onay and Mr Aras) acknowledged the potential effectiveness of 3D geometry software packages mentioning in the pre-lesson interviews, they rarely encouraged students to use such technologies. This limited use of technology may have contributed to errors related to redrawing the given shape as the front or as a part of it as a side view (E1), incorrectly positioning parts of shapes (E2) or drawing the part only at the very front of the shape (E3). Dynamic software that allows students to construct and manipulate polycubes could potentially address these visualization difficulties.

Teachers routinely employed video presentations and question sets accessed through the MoNE's EBA Moodle platform and a smartboard to display the solutions to these questions. However, when both teacher and students answered questions on the board, it was treated as a conventional board, and no use was made of its interactive and dynamic features. Considering how beneficial digital technologies can be for geometry learning, it is plausible that more extensive and intensive integration could help ameliorate some of the challenges students encounter in visualizing three-dimensional shapes (section 3.2).

Overall, the observed pedagogical practices, including limited student engagement with manipulatives, a rule-based approach, and underutilization of digital technologies, appear to be associated with the difficulties and misunderstandings experienced by students. These practices deviated from the constructivist approach teachers claimed to embrace.

DISCUSSION AND CONCLUSION

The present study addressed Turkish middle school students' understanding of the drawing of 2D representations of 3D shapes and how existing teaching practices influenced their comprehension. The findings indicated that students' overall performance in drawing 2D representations of 3D shapes was lower than the expectations of both teachers and the National Ministry. Specifically, the average scores on a national assessment-based worksheet were 43%, with many students (n=42) answering all questions incorrectly and only a few (n=8) answering all questions correctly. These results align with previous research conducted in multiple countries over

several decades, such as the studies by Christou et al. (2006), Doorman et al. (2020), Parzysz (1988), and Widder and Gorsky (2013), which also reported low achievement levels in this domain.

The study revealed that students faced greater difficulty generating correct isometric drawings (60% correct) than orthogonal drawings (29% correct). This observation aligns with Cooper and Sweller (1989), who identified similar challenges with isometric drawings and attributed them to the difficulty of simultaneously holding multiple components of a polycube in mind to create an isometric drawing. In contrast, when producing orthogonal drawings, students could decompose a polycube and concentrate on one view at a time

An in-depth analysis of the data identified several common errors in both orthogonal and isometric drawings. While coding the worksheets, the study incorporated error types reported in previous studies regarding 2D representations of 3D shapes (Fujita et al., 2017; Pittalis & Christou, 2013). Although the error categories aligned with those in the reviewed studies, the study provided a more precise characterization of error types, for orthogonal and isometric polycube drawings. The detailed categorization of error types offers numerous benefits, including aiding teachers in recognizing these errors and developing effective solutions.

The main difficulties underlying these errors were identified as mental visualizations of 3D shapes and accurately drawing shapes based on these visualizations. "Visualizing a 3D shape from its orthogonal drawings and vice versa" was found to be the primary challenge for students in both orthogonal and isometric drawings of polycubes. This finding is consistent with previous studies that identified similar challenges in various other 2D representations of 3D shapes (Fujita et al., 2017; Parzysz, 1988), thereby indicating that students find isometric drawings more challenging than orthogonal ones. The difficulty lies in the cognitive process of decoding and accurately coding the spatial relationships and dimensions of the shape onto the 2D representation. Isometric drawings require more mental manipulation and visualization to accurately depict the shape's three-dimensional properties in a two-dimensional format. This complexity can result in more errors and inaccuracies compared to orthogonal drawings, where the step-by-step construction of each separate view allows for a more structured approach to represent the shape.

Additionally, many students struggled to accurately draw shapes that they had successfully visualized. Interviews with students confirmed that they frequently visualized shapes correctly but encountered difficulties translating those mental images onto paper. As a result, much erasing and incomplete answers were found, which occurs with findings from other studies (Bishop, 2008). Regarding isometric drawings, while most students could correctly draw the front views of shapes, the responses for other views varied, often resulting in more incorrect answers. The difficulty in isometric drawing may stem from students' lack of familiarity with the oblique convention. This involves depicting the front view of the cube as a square but drawing it with a parallelogram, while the rest of the illustration is shifted from the front.

The third research question examined whether pedagogical practices that students encounter may be related to student performance. It focused on examining whether the teaching practices were, as the Ministry intended, more constructivist in approach and included more technological integration. The findings indicated that three main practices played a role in this regard: teacher-centred pedagogy, exam-focused instruction and limited utilization of classroom technologies. The study uncovered that teachers dominated the use of tools and manipulatives, offering students limited opportunities to interact with concrete materials and develop their understanding autonomously. These findings confirmed the results (e.g. Christou et al., 2006; Widder & Gorsky, 2013), which suggest that visualizing 3D shapes from their 2D images poses obstacles not only for students' learning but also for teachers' instructional approaches.

Furthermore, the findings also shed light on a deficiency in teacher motivation to instruct the topic without an exam-oriented approach. Numerous studies have noted the perceived difficulty of teaching 3D shapes among middle school mathematics teachers, leading them to either neglect this topic or rely on direct instruction rather than student-centred activities (e.g., Bakó, 2003; Kooloos et al., 2022). The participating teachers were aware of the MoNE suggested constructivist approaches; they easily described them and discussed the benefits. However, finding the instances where these approaches were effectively implemented in their classrooms was challenging. The observation revealed that all four teachers incorporated previous national exam questions into their lesson plans. Additionally, the available technology was predominantly used to display videos and assessments provided by the Ministry of National Education at the conclusion of their classes. This practice persisted despite MoNE's recommendation to integrate dynamic geometry software packages into mathematics lessons (MoNE, 2018). No observed teachers allowed students to use dynamic geometry programs on their tablets to imagine and visualize 2D representations of 3D shapes in any of the lessons. The emphasis primarily revolved around memorization and rote application of rules and strategies with the hope of ensuring better and quicker performance of their students in national exams. Consequently, this study confirms that of earlier studies such as Bayrakdar-Çiftçi et al. (2013)

and Tekalmaz (2019), which found that teachers' belief in the efficacy of the revised approach in theory was not reflected in their actual teaching practices.

Implications

The authors are currently developing lessons that offer various depictions of shapes, encompassing prototypes of tangibles such as plastic and moving prisms, as well as constructions on a dynamic geometry tool, to assist students in developing their visualization skills required to visualize these shapes. Considering this, the solution of interacting with real and dynamic 3D models is consistent with best practice advocated elsewhere (Gutierrez, 1996; Hankeln, 2020; Kohen & Orenstein, 2021). Moreover, the most common errors identified in this study will be incorporated into these lessons and introduced to students as "designed mistakes" to be resolved, following the approach employed by Evans and Swan (2014).

The results of this study offer helpful information for teachers, teacher educators, programme developers and policymakers concerning the teaching and learning of cube representations in Türkiye and potentially beyond. Firstly, such research in an authentic educational setting could contribute to enhancing self-awareness among both students and teachers regarding their instructional practices. During the debrief discussions, all participating teachers provided insightful comments about their teaching practices, which can contribute to reflective process and encourage them to challenge their current approaches (Saralar et al., 2018; Balgalmış et al., 2014). Secondly, the findings underscored the importance of incorporating technology courses into teacher education programmes and providing practical activities that enhance teachers' understanding, build their confidence, and offer examples for future lessons (Hegedus & Otálora, 2022; Zengin, 2023). Furthermore, policymakers can be encouraged to ensure that teachers are aware of and benefit from recent study results, such as those provided by the Ministry of National Education. Finally, on a positive note, the circumstances presented by the Techology-supported Learning Scenarios Project to innovate mathematics instruction in Türkiye provides a conducive situation for addressing these challenges (MoNE, 2023).

Limitations and Further Research

The study has some limitations that should be acknowledged. Firstly, its sample size was relatively small, as it was limited to two schools and four teachers. However, despite this limited sample, the schools and teachers involved can be considered typical, and the results are consistent with others that have explored different areas of the mathematics (e.g., Kaya et al., 2016), but the caution should be exercised when applying these findings more broadly.

Additionally, although this study did not provide immediate solutions for the problems reported, future research could benefit from adopting design-based research approaches to develop resources in collaboration with teachers. These approaches could support them in implementing these resources with constructivist approaches during lessons. Techniques such as using theoretical and empirical insights (as seen in Haj-Yahya, 2022) and integrating digital technologies (Huang et al., 2023; Tzafilkou et al., 2023) could enhance the development of sources aimed at helping teachers understand and address students' errors effectively.

Furthermore, the study revealed a lack of meaningful contexts in the tasks designed by teachers, which may have hindered students' engagement and understanding. However, meaningful contexts could provide students with a purpose for the tasks designed by the teachers and support teachers in building on students' intuitions. To address this, future research could explore constructivist options that leverage students' prior experiences, and their informal reasoning. For example, investigating how students' understanding of real world contexts about buildings and different perspectives, such as shading in different projections (e.g., shade created by the sun in parallel projection and by lamps in central projection as discussed by Doorman et al., 2020), influences their learning could provide valuable insights, and could be a fruitful direction for further research. Examining the effectiveness of these contextually rich approaches in real classroom settings could offer significant benefits for enhancing mathematics instruction and student engagement.

Statements of Publication Ethics

This study was conducted within the guidelines of the University of Nottingham's Code of Research Conduct and Research Ethics and the School of Education in particular which has adopted Revised Ethical Guidelines for Educational Research (BERA, 2011). Before the submission of the ethics documents, the first researcher needed to obtain a Disclosure and Barring Service (DBS) check to have access to schools and received it with F0104171462 reference number. Ethics was received on October 19th, Ref: 2017.64.

Researchers' Contribution Rate

Both authors equally contributed to this research by designing, analyzing data, and writing.

Authors	Literature review	Method	Data Collection	Data Analysis	Results	Conclusion
İpek SARALAR-ARAS	☒	☒	☒	☒	☒	☒
Shaaron AINSWORTH	☒	☒	☐	☒	☒	☒

Conflict of Interest

The authors have no conflicts or competing interests to declare.

Availability of Data and Materials

The datasets generated during and/or analyzed during the current study are available from the University of Nottingham's Data Repository, doi: http://doi.org/10.17639/nott.7323.

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Opinions of the Administrators and Teachers on the Mandatory Rotation of School Administrators

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Abstract

The aim of this study is to determine the views of administrators and teachers on the mandatory rotation of administrators. The research utilized the phenomenological method, which is a qualitative approach. The research group comprised ten administrators (principals and vice principals) and ten teachers working in public secondary schools in Bolu city center in the second semester of the academic year 2022-2023 and were selected through an appropriate sampling method. The research data were collected using a semi-structured interview form prepared by the researcher. The obtained data were analysed by descriptive analysis and the data were shown with frequencies according to the repetition status. The research findings revealed that administrators and teachers hold both positive and negative views regarding implementing mandatory rotation. Furthermore, administrators and teachers expressed a belief in the overall effectiveness of mandatory rotation. However, administrators do not perceive rotation as effective concerning aspects such as the administrator evaluation form (Annex-2) and time constraints, while teachers do not perceive rotation as effective regarding the duration of rotation and issues such as interviews and objectivity. In the context of these results, suggestions were made such as the continuation of the mandatory rotation applied to administrators by taking into account the opinions of administrators and teachers, and the revision of the EK-2 evaluation form in line with the opinions received.

Keywords: Administrators, mandatory rotation, school, teachers

Okul Yöneticilerinin Zorunlu Rotasyonuna İlişkin Yönetici ve Öğretmen Görüşleri

Öz

Bu araştırmanın amacı yöneticilerin zorunlu rotasyon uygulamasına yönelik yönetici ve öğretmen görüşlerini belirlemektir. Araştırmada nitel yöntemler arasında yer alan olgu bilim (fenomoloji) yöntemi kullanılmıştır. Araştırmanın çalışma grubunu 2022-2023 eğitim öğretim yılının ikinci döneminde Bolu il merkezinde kamuya bağlı ortaokullarda görev yapan ve uygun örnekleme yöntemi ile seçilen on yönetici (müdür-müdür yardımcısı) ve on öğretmen oluşturmuştur. Araştırma verileri araştırmacı tarafından oluşturulmuş yarı yapılandırılmış görüşme formu ile toplanmıştır. Elde edilen veriler betimsel analiz ile çözümlenmiş, veriler tekrar etme durumuna göre frekanslarla gösterilmiştir. Araştırma sonucunda gerek yöneticilerin gerekse de öğretmenlerin zorunlu rotasyonun uygulanmasına yönelik olumlu ve olumsuz görüşleri olduğu sonucuna ulaşılmıştır. İlaveten yönetici ve öğretmenlerin zorunlu rotasyonu büyük oranda etkili buldukları ancak yöneticilerin EK-2 yönetici değerlendirme formu, süre kısıtlaması gibi konularda, öğretmenlerin ise rotasyon süresinin yanında mülakat, objektiflik gibi konularda yöneticilere uygulanan rotasyonu etkili bulmadıkları sonucuna ulaşılmıştır. Bu sonuçlar bağlamında yöneticilere uygulanan zorunlu rotasyonun yönetici ve öğretmen görüşleri bağlamında yeniden düzenlenerek devam etmesi, EK-2 değerlendirme formunun gelen görüşler bağlamında revize edilmesi gibi önerilerde bulunulmuştur.

Anahtar kelimeler: Yöneticiler, zorunlu rotasyon, okul, öğretmen

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INTRODUCTION

In today's world, education is one of the most important indicators of a country's level of development (Karakütük, 2016). In this educational process, schools (Arabacı & Sağlam, 2012) and educational administrators play an important role in increasing the effectiveness of schools (Aktepe, 2014; Balcı, 1993). School administrators play an important role in the motivation and capacity of teachers working in schools, school climate, and school environment, and play an important role in the quality of school outcomes (Pont, Nusche, & Moorman, 2008). It is clear that school administrators have duties to achieve the goals of schools.

In Turkiye, regulations for the appointment and transfer of school administrators have changed over time, and they play an important role in the development of schools. The most recent of these regulations is the *"Regulation on the Selection and Assignment of Administrators to Educational Institutions Affiliated with the Ministry of National Education"* (Resmi Gazete-Official Gazette, 2021), which came into effect in February 2021 and is still in effect. The regulation addresses numerous topics, such as the requirements for selecting administrative teachers, the written examination and its topics, evaluation, continuation and termination of administration, and reassignment. It is believed that it is important to address the issue of administrative teacher reassignment (rotation) in a separate section under these titles. For principals, the regulation states:

"*Principals who have completed a four-year term in the same title in the educational institution in which they serve may apply for transfer to the same or another educational institution, and principals who have completed their eight-year term in the same educational institution in the same title may apply for transfer to another educational institution*." (Resmi Gazete-Official Gazette, 2021; Chapter Five)

Similarly, for deputy and assistant principals:

"*Assistant principals and head assistant principals who have completed their four-year term in the same title in the educational institution in which they serve shall be assigned to the same or another educational institution, and assistant principals and head assistant principals who have completed their eight-year term in the same educational institution in the same educational institution in which they serve may apply to be transferred as head assistant principals or assistant principal*." (Resmi Gazete-Official Gazette, 2021; Chapter Five)

and mandatory transfer (rotation) is indicated. It was decided that evaluations will be made according to certain criteria (trainings, length of service, academic and professional experience, institution development experience, school change experience, rewards and penalties, etc.) in Annex-2 "Administrator Evaluation Form". (Resmi Gazete-Official Gazette, 2021; Chapter Five).

According to Turkish Language Association the main reason for rotation defined as "*transfer*" (Turkish Language Association [TDK], 2023) is that the long-term work of administrators in the same school causes various problems (Yılmaz, Altınkurt, Karakoese & Erol, 2012), with rotation, productivity is positively increased and monotony in the school is reduced. It is seen to have an idea (Arabacı & Sağlam, 2012). However, it is clear that rotation has both negative and positive effects on administrators. For example, in the study conducted by Tonbul and Sağıroğlu (2012), it was found that rotation contributes to professional development, and creates an opportunity for change by increasing motivation, but also has negative effects such as adaptation problems, material and moral problems, and a decrease in motivation. Also, Yılmaz et al. (2012) concluded in their study on administrators and teachers that teachers and administrators have positive and negative opinions about mandatory rotation applicable to administrators. As can be seen, the obligatory transfer (rotation) of administrative employees affects not only administrative employees but also many other people, especially teachers working in schools.

When examining the relevant literature, it is clear that different studies have been conducted at different times (Aktepe, 2014; Arabacı & Sağlam, 2012; Erdoğan, 2022; Mutlusoy, 2019; Özdoğan, 2023; Üstün & Aslan, 2021; Yılmaz et al., 2012). However, it goes without saying that the studies dealing with the opinions of administrators and teachers regarding the mandatory rotation of administrators have been limited recently. For this reason, this study aims not only to contribute to the literature but also to provide suggestions to the relevant decision-makers and to make rotation more effective.

Purpose of the Study

The aim of this study is to reveal the views of administrators and teachers on the mandatory rotation of school administrators. Thus, it is aimed to draw the attention of the relevant decision makers on the more effective implementation of the mandatory rotation by revealing the views of both administrators and teachers regarding

the mandatory rotation applied to administrators. In order to achieve this aim, the following questions were asked to the participants;

For administrators;

1- How would you rate the contribution of mandatory rotation to your professional development as an administrator? What would you say about the positive and negative aspects? And from where?

2- How would you rate the contribution of mandatory rotation to the development of the schools where you work (student success, physical development of the school, professional development of teachers, etc.)? What would you say about the positive and negative aspects? And from where?

3- Do you think mandatory rotation is effective? What are your suggestions if you think it is not effective enough? Do you agree with it?

For teachers;

1- How do you evaluate the contribution of mandatory rotation to the professional development of administrators? What would you say about the positive and negative aspects? And from where?

2- How would you evaluate the contribution of mandatory rotation for administrators to school development (student success, school physical development, teacher professional development, etc.)? What would you say about the positive and negative aspects? And from where?

3- Do you think the mandatory rotation for administrators is effective? What suggestions do you have if you think it is not effective enough? Do you agree with it?

METHOD

Research Design

In this study, which aims to uncover the views of administrators and teachers regarding the mandatory rotation of school administrators, the phenomenological method, one of the qualitative research methods, was used. Özdemir (2010) defines qualitative research as one of the methods of knowledge production that people have developed in order to unravel their secrets and find out the details of the social systems they have shaped with their own efforts. The phenemological approach, on the other hand, is an emotional, effective approach that is mostly considered appropriate for studying human experiences (Merriam, 2015). In other words, phenomenological design is defined as a design that reveals the common meanings of the lived experiences of several individuals towards a phenomenon or a specific concept. The aim of phenomenology is to understand in detail the experiences of people who have experienced a particular phenomenon in depth (Creswell, 2018). In the current study, the phenomenology method was used since it was aimed to examine the views of administrators and teachers on the mandatory rotation of administrators in depth and to reveal their real thoughts.

Study Group

In the second semester of the academic year 2022-2023, ten administrators (principals or deputy principals) working in public independent secondary schools in the central district of Bolu and ten teachers working in these schools formed the study group of the research. To achieve the objective of the study, care was taken to ensure that the administrators participating in the study had changed in the past year or were expected to change within a year. Care was also taken to ensure that faculty working in these schools tended to be in different branches so that they could more realistically represent their views on rotation. Since the number of administrators who meet these conditions is limited in the central district of Bolu, the study used the random sampling method, which is one of the non-random sampling methods. While Büyüköztürk (2011) explains the random sampling method as a method that gives time and financial advantage to those who conduct the study, Ekiz (2009) defines it as a method that facilitates the inclusion of people or groups who participate in the study by reaching them. The convenience sampling method made it easier to reach the administrators and teachers who met these conditions, thus providing both time and financial advantages for the study. The demographic characteristics of the administrators and teachers participating in the study are shown in Table 1.

Table 1. Demographic Characteristics of the Participants

Administrator						Teacher				
Participant	Gender	Mission	Total tenure in management	Total work time at school	Education level	Participant	Gender	Branch	Total term of duty	Education Level
A1	Male	Principal	17 yr	8 yr	Master's degree	T1	Male	English	22 yr	Bachelor
A2	Male	Principal	8 yr	4 yr	Master's degree	T2	Male	PE	20 yr	Bachelor
A3	Male	Principal	17 yr	1 yr	Bachelor	T3	Female	Math	29 yr	Bachelor
A4	Male	Principal	11 yr	1 yr	Master's degree	T4	Female	Science	17 yr	Bachelor
A5	Male	Assistant Principal	6 yr	1 yr	Bachelor	T5	Male	Turkish	11 yr	Bachelor
A6	Female	Assistant Principal	8 yr	8 yr	Bachelor	T6	Female	Music	16 yr	Bachelor
A7	Male	Assistant Principal	8 yr	8 yr	Bachelor	T7	Female	Technology and Design	22 yr	Bachelor
A8	Male	Assistant Principal	8 yr	8 yr	Bachelor	T8	Female	Turkish	15 yr	Bachelor
A9	Female	Assistant Principal	8 yr	8 yr	Bachelor	T9	Female	Social Sciences	16 yr	Bachelor
A10	Male	Assistant Principal	4 yr	4 yr	Bachelor	T10	Female	English	11 yr	Bachelor

Table 1 shows that 10 of the participants are administrators (principals/vice principals) and 10 are teachers. 8 of the administrators are male and 2 of them are female; 4 of them are principals and 6 of them are vice principals; In terms of total administrative service time, 2 of them had 17 years, 1 of them had 11 years, 5 of them had 8 years, 1 of them had 6 years, and 1 of them had 4 years; In terms of total school service time, 5 of them had 8 years, 2 of them had 4 years, and 3 of them had 1 year; In terms of educational level, 3 of them have a master's degree and 6 of them have a bachelor's degree. Again, Table 1 shows that 3 of the teachers were male and 7 were female; 2 of them worked as English teachers, 2 of them worked as Turkish teachers, and 1 of them worked as a teacher in other subjects (physical education, mathematics, science, social studies, music, technology, and design); 2 had 11 years, 2 had 16 years, 2 had 22 years, and the others had different lengths of service (15, 17, 20, 29 years); it was assumed that the educational level of all teachers was at the bachelor's degree level.

Data Collection Tool

For the study, a semi-structured interview form was created by the researcher to elicit the opinions of administrators and teachers about the mandatory rotation of school administrators. The first part of the form contained questions about the demographic characteristics of both administrators and teachers. The second part of the questionnaire contained three questions for administrators and teachers designed to elicit the opinions of administrators and teachers about the mandatory rotation of school administrators. In order to ensure the validity and reliability of the questions, the questions in the form were created by the researcher by reviewing the literature, and expert opinions were obtained from three experts in the field, two of whom were doctors and one of whom had the title of doctoral lecturer. It was observed that the experts generally agreed with the scope of the questions and made minor suggestions regarding the content of the questions, and the forms were finalized in line with these suggestions. In this way, internal validity was ensured. The interview questions were applied to two administrators and three teachers who were not included in the study sample and it was seen that the research questions were clear and appropriate for the purpose. In the study, the aim was to compare the obtained findings to increase credibility, and for this reason, the obtained data were interpreted by another researcher. The data obtained were compared with each other and found to be generally compatible. The data showing differences were re-evaluated by the researchers and a consensus was reached and harmony was achieved. In this way, it was seen that the data

obtained within the scope of the study were largely consistent with each other and it was understood that the data were valid and reliable. The approval of the Ethics Committee of Bolu Abant İzzet Baysal College Human Research Ethics Committee in Social Sciences dated 02/03/2023 and 2023/2 (Protocol No. 2023/98) was obtained for the collection of the data. Following the forms prepared, the data were collected by the researcher himself, taking into account the voluntary nature of the participants. The data were collected in written form by the researcher, and it was found that the average interview time was 20 minutes. The written data were read back to the participants after the interview and the data were approved by the participants.

Data Analysis

In the present study, a descriptive analysis was conducted aiming to determine the views of administrators and teachers about the mandatory rotation of school administrators. According to Yıldırım and Şimşek (2011), one-to-one quotes are often used in descriptive analysis because the views are fully revealed. The data obtained about the participants' views were presented with frequencies, and finally, the opinions of administrators and teachers were presented and interpreted in an unbiased manner. Administrators participating in the study were coded *"A1, A2, A3..."* and teachers were coded *"T1, T2, T3..."* to ensure the confidentiality of the participants and to allow them to present their views more objectively. In presenting the results, frequencies were given but not completed to 100 because a participant may have more than one thought.

FINDINGS

In this section of the study, the results are placed in the context of the data obtained and the comments are placed in the context of the results.

The first sub-problem of the study includes the positive or negative opinions of administrators and teachers regarding the contribution of the mandatory rotation for administrators to the professional development of administrators.

Table 2. Contribution of the Mandatory Rotation to Administrators' Professional Development

Opinions of the Administrators	f	Opinions of the teachers	f
I think it is positive. Because,		I think it is positive. Because,	
it provides a new energy, synergy and start. (A2, A4, A5, A7, A8, A9, A10)	7	It increases professional development and experience. (T2, T5, T6, T8, T10)	5
It allows students to get to know schools with different cultures. (A4, A7, A8)	3	It provides new energy, synergy and start. (T1, T2, T7, T8)	4
It offers the opportunity to work in different schools. (A4, A7)	2	It prevents power poisoning, mobbing and over-possession. (T1, T2, T5, T7)	4
It prevents excessive ownership of the school. (A8, A10)	2	It provides the opportunity to work with students with different opportunities. (T4, T5, T6, T9)	4
Experiences are also transferred to different schools. (A6, A8)	2	I think it is negative. Because,	
Administrators who do not do their job well are eliminated. (A7)	1	The change in habits can cause problems. (T4, T8, T10)	3
I think it is negative. Because,		The administrator may have adaptation issues. (T4, T10)	2
It creates adaptation issues. (A2, A5, A6, A9, A10)	5	It does not affect. Because,	
Change in the work environment creates problems (A2, A5, A6, A9)	4	I don't think it contributes. (T3)	1
It disrupts the established order. (A7)	1		
It reduces productivity by causing stress. (A9)	1		
It does not affect. Because,			
I don't think it contributes. (A1, A3)	2		

Table 2 shows the opinions of administrators and teachers about the professional development of administrators in the mandatory rotation for administrators. It can be seen that the opinions of both administrators and teachers are grouped into three sub-dimensions: positive, negative, and uninfluenced. The positive opinions of administrators were *"It provides new energy, synergy, and a fresh start."* (f=7), and the negative opinions were *"It creates an adaptation problem."* (f=5); the most frequently expressed views were *"It increases professional*

development/experience." (f=5) among teachers' positive opinions and *"The change in habits may cause problems."* (f=3) among negative opinions. In addition, it was found that the administrators (f=2) and teachers (f=1) in the sub-dimension that do not have an impact believed that *"I do not think it contributes."*. In examining Table 2, it was found that the rotation of administrators and teachers have different views on the professional development of administrators. In the table, it is considered important that administrators and teachers hold the view that mandatory rotation generally contributes positively to administrators' professional development. This result is due in part to the fact that administrators create new synergies at the school where they go and have the opportunity to share their experiences. On the other hand, it was found that administrators and teachers also believe that administrators will encounter problems such as adaptation difficulties in the school they attend. This could be because each institution has a different culture.

The following examples can be given as direct views of the participants; *".... I think it will be beneficial considering that it will be a new beginning, a new enthusiasm. It can add a new energy."* (A2), *"Working in different schools provides the opportunity to work with students of different socioeconomic backgrounds and achievement levels... I think it develops the person professionally."* (T4), *"When we enter an atmosphere that is different from a familiar and familiar environment or culture, it can take a long time to decipher the environment..."* (A5), *"... Change is difficult. It can be difficult to get used to the new administrator, and for him to get used to us."* (T10), *"I don't think it contributes because I think that whatever he/she does here, he/she will do the same things at the school I go to." (T3).*

The second sub-question of the survey included the positive or negative opinions of administrators and teachers regarding the contribution of the mandatory rotation for administrators to the development of schools (student success, physical development of the school, professional development of teachers, etc.).

In terms of student success;

Table 3. Contribution of Mandatory Rotation to Student Success in Terms of Student Success

Opinions of the Administrators	f	Opinions of the Teachers	f
It makes a positive contribution. Because,		It makes a positive contribution. Because,	
He/she conveys his/her experience. (A1, A3, A4, A6, A7, A9)	6	He/she can increase success with his/her different style. (T4, T7, T9)	3
Change brings success. (A3)	1	The cultural structure has a positive effect on the student. (T7, T8)	2
It increases their motivation. (A4)	1	Innovation increases student success. (T10)	1
Positive communication can be established. (A9)	1	It makes a negative contribution. Because,	
It may increase social, and athletic success. (A5)	1	It decreases success due to adaptation problems. (T2, T8)	2
It makes a negative contribution. Because,		His/her sense of discipline may be different. (T5)	1
He/she may have adaptation problems with students and parents. (A1, A6, A7)	3	They may not be able to do what they want to do because the opportunities are different. (T10)	1
He/she may have incomplete knowledge and experience. (A4, A6)	2	If it is unsuccessful, it also reduces the student success of the school where it comes from. (T4)	1
He/she may not be able to transfer his/her student-oriented experience to the other school. (A6, A10)	2	It makes an indirect contribution. Because,	
Change can cause stress for the administrator. (A6)	1	Student success depends on the teacher. (T1, T6)	2
He/she may need time. (A8)	1	The administrator can contribute to the fields of his/her branch. (T3)	1
He/she may not work due to the possibility of leaving the work. (A8)	1		
It does not affect. Because,			
It has no direct effect. (A2)	1		

Table 3 shows the principals' opinions about the success of mandatory rotation among administrators. When the table is analyzed, it is seen that administrators and teachers have different opinions about the situation. It is understood that the positive views of the administrators are "*He/She transfers his/her experience*" (f=6), the negative views are "*He/She may have adaptation problems with students and parents*." (f=3), and the negative views are "*It has no direct effect.*" (f=1). On the other hand, it was concluded that the most frequently expressed opinions of teachers were "*He/She can increase success with his/her different style*" (f=3) in their positive opinions, "*It decreases success due to adaptation problems*" (f=2) in their negative opinions, and "*The success of the student depends on the teacher*" (f=2) in their opinions that it contributes indirectly. When examining Table 3, it is clear

that administrators and teachers view the situation differently and that there are differences between their views. The reason for this is that administrators and teachers view events from different perspectives.

The following examples can direct the view of the participants*; "...Experience is transferred. When an administrator stays in one place for 8 years, interpersonal relationships can weaken, as I am sure you understand. This change also has a positive impact on student success..."* (A3), *"If the new administrator is disciplined and values social activities, this style can have a positive impact on students and increase their success."* (A8), *"... The administrator does not know the student or the parents. This situation can harm student achievement."* (A7*), "If the new administrator's sense of discipline is not the same as the outgoing administrator, it can negatively impact student success." (T5), "It's indirect. Because teacher success is more effective. If a comfortable environment is created for the teacher, the teacher's success will increase and so will the students."* (T6).

In terms of the physical development of the school;

Table 4. The Contribution of Mandatory Rotation to The Physical Development of the School

Opinions of the administrators	f	Opinions of the teachers	f
It makes a positive contribution. Because,		It makes a positive contribution. Because	
He/she finds the opportunity to see the negativities. (A1, A3, A8, A9)	4	He/she can offer new possibilities/ideas. (T1, T3, T4, T5, T6, T7, T9)	7
Experience is transferred. (A1, A4, A7, A8)	4	He/she can reflect on his/her experience. (T6, T9)	2
He/she can introduce innovations. (A2, A3)	2	He/she sees deficiencies better. (T8)	1
He/she can use the financial resources of the school better. (A8)	1	He/she may pay attention to advertising. (T8)	1
He/she can receive more contributions from the Directorate of National Education. (A8)	1	It makes a negative contribution. Because;	
It makes a negative contribution. Because;		The incoming administrator may be passive compared to the one leaving. (T1, T7, T9)	3
His/her socio-economic status cannot reveal anything new at a different school. (A4, A7, A10)	3	Expectations of success can cause stress. (T4)	1
He/she becomes stagnant because he/she knows he/she will transfer again. (A2)	1	It does not affect. Because,	
He/she may not get parental support. (A7)	1	I don't think it will have any effect. (T2, T10)	2
He/she may not find team support for physical development. (A7)	1		
He/she may have difficulty breaking stereotypes. (A9)	1		
It does not affect. Because,			
I don't think it will contribute. (A5)	1		
I don't think the assistant principal will have any impact. (A6)	1		

The opinions of administrators and teachers about the contribution of the mandatory rotation applicable to administrators to the physical development of schools are presented in Table 4. In reviewing the table, it was noted that the opinions of administrators and teachers were grouped under the subheadings of *"positive," "negative," and "has no impact."* The following opinions were expressed under the subheading *"Makes a Positive Contribution" among administrators. "He/she finds the opportunity to see the negativities."* (f=4) makes a negative contribution under the subheading *"Socioeconomic status cannot show anything new at a different school."* (f=3). In the teacher section, *"He makes a positive contribution"* under the subheading *"Can provide new opportunities/ideas"* (f=7). *"The new administrator can be passive compared to the one leaving."* (f=3) was the most opinions expressed. The following opinions were expressed under the subheading *"Has no impact"* in the administrator section, *"I do not think it will contribute."* (f=1) and *"I do not think the assistant principal will have any impact."* (f=1). It was observed that teachers also held the following view, *"I do not think it will have any effect."* (f=3) It is thought-provoking that the number of teachers who think that mandatory rotation will not have any effect on the physical development of schools, however, is not so high among administrators. The reason is that some administrators do not care much about the physical development of schools.

The following examples can be given as the direct opinions of the participants*; "New administrators can see physical deficiencies better from different perspectives. The newcomer can make the innovations that the previous administrators did not tackle."* (A3), *"... He can develop his studies at the school he comes from. He can pass on his experience... " (A8), "... He sees the deficits better, he can give importance to the appearance for*

advertising." (T8), "... A meticulous administrator can help the school especially in terms of cleanliness and order. He can make sure that the ceremonies are conducted properly. He can transfer his experience from the school he comes from to the school..." (T6), "If the socioeconomic status of the schools is low, it limits our options." (A4), "I do not think it will be too much. Because nobody asks, neither the teachers nor the administrators. There are a lot of expectations, but no support or very little." (T10).

In terms of teachers' professional development;

Table 5. Contribution of the Mandatory Rotation to Teachers' Professional Development

Opinions of the administrators	f	Opinions of the teachers	f
It makes a positive contribution. Because,		It makes a positive contribution. Because,	
It can contribute to their success by communicating better with teachers. (A4, A5, A8)	3	It can create a new energy in the teacher. (T4, T5, T7)	3
Thanks to his/her experience, he/she can lighten the workload of teachers. (A6, A9)	2	It can support in-service or postgraduate education. (T1, T10)	2
It affects the teacher positively because it provides change. (A3, A10)	2	He/she can support events or projects. (T4, T10)	2
It can demonstrate a positive school culture. (A4)	1	If he/she is equipped, it can contribute to the teacher. (T2)	1
It can add a different perspective to the teachers' board. (A3)	1	It makes a negative contribution. Because;	
It can support in-service or postgraduate education. (A4)	1	It may take time to get used to/adapt. (T1, T4, T9)	3
It can increase the teacher's sense of belonging to the school. (A8)	1	If he/she is not equipped, it may cause conflicts at school. (T2, T4, T9)	3
It makes a negative contribution. Because;		If he is too idealistic, he can push the teacher too hard. (T4)	1
It takes time to get used to/adapt. (A4, A7, A10)	3	He may not involve teachers in decision making. (T9)	1
The departure of an administrator who has good relations with the teachers may affect the teacher negatively. (A4, A5, A7)	3	It does not affect. Because,	
The new administrator may put pressure on the teachers. (A9)	1	I don't think it has any effect. (T3, T6, T8)	3
It does not affect. Because,			
I don't think it has any effect. (A1, A2)	2		

Table 5 presents the views of administrators and teachers on the impact of mandatory rotation for administrators on teacher development. Looking at the table, it is clear that the views of administrators and teachers differ in positive, negative, and no impact. The administrators expressed their positive views as follows*: "They can contribute to their success by communicating better with teachers."* (f=3), the negative opinions are, *"It may take time to get used to/adapt." (f=3) For positive opinions, teachers expressed the following: "It can create a new energy among teachers." (f=3), negative opinions, "It may take time to get used to/adapt."* (f=3). In addition, both administrators (f=2) and teachers (f=3) expressed the opinion, *"I do not think it will have any impact,"* under the heading of "*Has no impact."* Looking at the table, it is clear that administrators and teachers have different but generally similar opinions. Especially in the positive opinions: positive communication, synergy, and creating variety; in the negative opinions, adaptation problems are expressed. Therefore, it can be concluded that mandatory rotation among administrators has a similar effect on administrators and teachers in terms of the contribution of teacher training.

The following views can be cited as examples of direct views to participants; *"In this sense, if the administrator is good in terms of leadership and communication, he can increase the success of teachers by increasing their affiliation with the school. When the relationship is balanced, success in the school increases. That contributes to that." (A8) The new or outgoing administrator can fire the teachers who are against him. That can create synergy."* (T5*), "I do not think it does much for the teachers. If only someone who knows the job comes in, it can reduce the teacher's workload." (A6), "It's negative for the school we left. We know each other... In the school we go to, it is difficult to know each other. Therefore, I think it harms the teacher's professional development", (A7), "If the administrator is unqualified, it can lead to conflicts in the school..." (T2), "I do not think it has any impact. Teaching is a matter of conscience. How effective can an administrator be...? "(T3).*

The third sub-problem of the study captures opinions about the effectiveness of mandatory rotation for administrators.

Table 6. Effectiveness of the Mandatory Rotation

Opinions of the administrators	f	Opinions of the teachers	f
I find it effective. (A2, A3, A4, A5, A7, A9, A10)	7	I find it effective. (T1, T2, T4, T5, T6, T7) T9, T10)	8
Insufficient, Because;		Insufficient, Because;	
I consider the Annex-2 evaluation form insufficient .(A1, A2, A3, A4, A6, A8, A9)	7	Rotation time should be shorter. (T2, T3, T5, T8, T10)	5
There is a time limit. (A1, A3, A5, A6, A7)	5	There should be no interview. (T2)	1
It creates uncertainty. (A1, A3)	2	The interview should be objective. (T8)	1
The administrator does not feel safe. (A1)	1	Teachers should also be consulted. (T8)	1
There should be no interview. (A1)	1		
The parent-teacher association should do an evaluation. (A2)	1		
The administrator may go to a school he/she does not want. (A6)	1		
The principal must choose the vice principal himself/herself. (A6)	1		
The Interview should be more objective. (A6)	1		

The third subproblem, the last subproblem of the study, includes the opinions of administrators and teachers about the effectiveness of mandatory rotation (Table 6). The table shows that among the administrators (f=7) and teachers (f=8), in addition to the participants who expressed the opinion "I find it effective" regarding the mandatory rotation applied to administrators, there are also participants who do not find it effective or deficient in various aspects. For example, It is assumed that teachers also have opinions about the negative aspects of mandatory rotation, such as *"I find the evaluation form in Annex 2 inadequate."* (f=7), *"There is a time limit."* (f=5) *"The rotation period should be shorter"* (f=5). It is considered important that administrators seriously express the shortcomings of the Annex-2 evaluation form. This is because it can be interpreted that expressing the inadequacies in the Annex-2 evaluation form, which is an important criterion in the initial reassignment of administrators, will decrease the work motivation of administrators.

The following examples can be given for the direct views of the participants; "*Effective. It is nice to have a period of change. However, it is problematic to change from center to district. It would be better if the rotation period was 5+5... The requirement that the granting of the pension must be within the last four years in the document Annex -2 creates a problem... Also, awarding points for social sports activities in Annex -2 is problematic. In this case, working at a large school leads to affirmative action. Because in large schools, the student or teacher is more likely to get a degree in social or artistic competitions." (A3), "It is not effective at all. It's not good to go to a school you do not want. If the principal is not satisfied, he cannot be successful. The principal should choose the assistant principal himself. The rotation period should be increased to 12 years. Annex 2 is needed. If I have improved, I should get my points. Administrative review needs to be continued. Interviews should be objective…"* (A6), *"I think it is effective. Because some administrators feel that I have the title deed. But that needs to change..." (A9), "Effective. Because it is positive in terms of innovation, reducing monotony, and sharing experiences. But for it to be more effective, the duration of the rotation should be 5 years." (T5), "... The executive gets the opportunity to see what he or she can and cannot do based on the rotation. A leader has the right to work in both advantaged schools and a school that is disadvantaged in terms of parents, students, and environment." (T6), "The rotation period is too long. The rotation should be in 4 or 5 years. Teachers should also be consulted when the manager is transferred. There should be an objective interview for managers. But unfortunately, I do not think that is the case."*

DISCUSSION & CONCLUSION

The first sub-problem of the study includes the opinions of administrators and teachers about the professional development of administrators in the context of the mandatory rotation for administrators. The administrators expressed the positive opinion that "it provides a new energy, synergy and start", while they expressed the negative opinion that "it creates adaptation problems". Teachers expressed the most negative opinion, "Changing habits can create problems," in contrast to the positive opinion, "Increases professional development/experience." It was found that administrators and teachers had different views on this issue (see Table 2). Tonbul and Sağıroğlu (2012) concluded in their study that in addition to the positive opinion of administrators

that mandatory rotation provides an opportunity for change and personal and professional development, there were also negative views such as the deterioration of the existing established order, which are similar to the results of the current study. In their study, Yılmaz et al. (2012) concluded that mandatory faculty rotation adds dynamism to the organization and provides leaders with an opportunity for change. In the same study, administrators and teachers supported the research findings by concluding that mandatory rotation would cause adaptation problems. When examining the relevant literature, it was found that there are several studies (Arabacı & Sağlam, 2012; Kurtulmuş, Gündaş & Ardıç, 2012) that support the current research findings. Considering that the concept of educational administration is the process of managing educational organizations and using resources efficiently through cooperation and solidarity among members (Bridge, 2003), it is clear that the professional development of school administrators is very important for schools. From this point of view, it can be said that a mandatory rotation practice applied to managers by authorities will contribute a lot to the professional development of managers, even if the negative aspects are seen. As it is understood from the opinions of teachers and administrators, administrator rotation creates positive synergy and energy in schools, increases development and experience, creates the opportunity to get to know different environments, and prevents negativities such as excessive ownership of the school. With rotation, administrators have the opportunity to apply their experiences in different schools, which can be considered as an important opportunity especially for schools that have problems in academic achievement, physical equipment, and communication with teachers. In addition, although not in every school, administrators who have been working in the same school for many years are likely to have problems with both teachers and parents due to their excessive ownership of the school. For these reasons, it can be said that administrators and teachers have generally positive opinions about the professional development of administrators due to the mandatory rotation of administrators.

The second sub-problem of the study includes the opinions of administrators and teachers regarding the contribution of the mandatory rotation applicable to administrators to the development of schools (student success, physical development of the school, professional development of teachers, etc.). It was found that administrators have positive opinions, such as the contribution of mandatory rotation to student success, the transfer of experience and the ability to see the negative aspects of the physical development of the school, and the contribution of teachers to the professional development of teachers by creating good communication for professional development. On the other hand, the negative opinions of administrators were also frequently expressed, such as the difficulty of matching mandatory rotations to student achievement and professional development, and the difficulty of administrators introducing innovations in a school with a different socioeconomic situation. Teachers often commented that mandatory rotation for administrators increases success with their different styles for student success, provides new opportunities and ideas for the physical development of the school, and creates a new energy among teachers for professional development. On the other hand, it was found that teachers have a negative opinion of student success and teacher professional development due to the mandatory rotation that applies to administrators, that the administrator has adaptation problems, and that the administrator may be passive in terms of physical development. In addition, it was found that there are participants who believe that mandatory rotation between administrators and teachers will have different effects on school development (student achievement, school physical development and teacher professional development) (see Table 2, 3, 4). When examining the relevant literature, it is clear that there are several studies (Arabacı & Sağlam, 2012; Tonbul & Sağıroğlu, 2012) that are similar to the findings of this study. It is known that school administrators are one of the most important actors in creating an effective school (Konan, Bozanoğlu, & Çetin, 2017). Nowadays, school administrators are expected to have different behaviors, and it can be seen that they have various duties and responsibilities, such as having a vision, creating a suitable learning and teaching environment in the school, giving importance to professional development, and improving interpersonal communication and cooperation (Balcı, 2013). In addition, school administrators are believed to have an impact on the physical development of the school (Babaoğlan, Nalbant, & Çelik, 2017). The physical facilities of schools can be one of the reasons that cause differences in performance between schools by negatively affecting the quality of education (Önder, 2016). For this reason, it can be said that administrators should focus on their physical development as well as student and teacher success. As can be seen, school administrators can contribute positively or negatively to the school in any way. In this respect, the fact that administrators and teachers working in schools have different characteristics may be the reason why administrators and teachers have different views on the mandatory rotation applied to administrators. Because each administrator's personal characteristics, goals, objectives, vision, etc. can be different, and this can shape their actions at school. These actions may affect teachers, students, parents and other personnel in the school differently, and may lead to different views on the contribution of mandatory rotation to the development of schools.

The third sub-problem of the study was the views of administrators and teachers on the effectiveness of the mandatory rotation applied to administrators. As a result of the study, it is seen that there are participants who find rotation effective among administrators and teachers, as well as participants who find it incomplete or insufficient in terms of effectiveness. Administrators criticized the effectiveness of the mandatory rotation for reasons such as the inadequacy of the Annex-2 form in which administrators are evaluated, the time limitations of the rotation and the uncertainty it creates. It was also observed that some teachers expressed negative opinions about the effectiveness of the mandatory rotation of administrators due to reasons such as rotation period and interview. When the related literature is examined, it is seen that there are different studies supporting the results of the research. Tonbul and Sağıroğlu (2012) pointed out shortcomings of the Annex-2 form in their study related to the mandatory rotation of administrators, schedule, family integrity, accounting, and transportation problems. In turn, Üstün and Arslan (2021) concluded in their study that administrators consider the Annex-2 form to be "exploitable, expandable, and unfair." When examining the relevant literature, one finds that there are several studies (Yılmaz et al., 2012; Özdoğan, 2023) that support the findings of the study. Fink and Brayman (2006) admit that the effectiveness of school leaders decreases after they have worked at their school for 6 or 7 years. It can be interpreted that these results support the opinions of both administrators and teachers who see rotation as effective.

As a result of the study, suggestions were made for practitioners such as the continuation of the mandatory rotation applied to administrators by reorganizing it in the context of administrator and teacher opinions, revising the Annex-2 evaluation form regarding the opinions received, and re-evaluating the interview. For the researchers, it was suggested that similar studies should be conducted at other levels of education and in different provinces due to the possibility of different results.

Statements of Publication Ethics

In this study, the study ethics were complied with and the data were collected from Bolu Abant İzzet Baysal University It was collected with the permission of the Human Research Ethics Committee in Social Sciences dated 02.03.2023 and protocol number 2023/98.

Conflict of Interest

There is no conflict of interest in the article.

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Evaluation of Pre-Service Teachers' Views on the Reality Shock of the Teaching Practicum Course

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Abstract

The purpose of this research is to evaluate the process of the teaching practicum course, where students in the elementary education department gain their initial professional experiences in primary schools affiliated with the Ministry of National Education, in the context of the expectation of reality shock. Additionally, the study aims to raise awareness among pre-service teachers regarding the reality shock they may encounter in the early years of their profession. The study group of this research consists of students enrolled in the Primary School Teaching program at İnönü University during the 2022-2023 academic year who have taken the Teaching Practicum I course. The participants include 6 females and 6 males, totaling 12 individuals who agreed to participate in the interviews. Research data were obtained using a semi-structured interview form consisting of 7 questions. The results of the research reveal that pre-service teachers experience role ambiguity in the teaching practicum course. They face challenges in selecting and implementing appropriate methods and techniques, preparing suitable materials for the course content, course planning, effective classroom management, effective communication, transitioning from theory to practice, handling class size and physical conditions, determining appropriate behavior towards special needs students, considering individual and developmental differences of students in conducting courses, and communicating with students with different mother tongues. Additionally, some pre-service teachers reported difficulties in their interactions with supervising teachers. Some pre-service teachers did not encounter issues in delivering theoretical and practical knowledge to students during the teaching practicum course. They resolved problems related to classroom management through the experiences gained during the internship and observations. Furthermore, they developed self-confidence and competence in class discipline and management over time, exhibited socio-cultural development, fostered positive attitudes towards the qualities of the profession, and acknowledged the contribution of subject knowledge courses, particularly acknowledging the preparation provided by professional knowledge courses for entering the profession and their utility in professional development.

Keywords: Reality shock, expectation of reality shock, pre-service teacher, elementary education

Öğretmenlik Uygulaması Dersinin Gerçeklik Şoku Bağlamında Öğretmen Adaylarının Görüşlerine Göre Değerlendirilmesi

Öz

Bu araştırmanın amacı sınıf öğretmenliği bölümünde öğrenim gören öğrencilerin Millî Eğitim Bakanlığına bağlı ilkokullarda ilk mesleki deneyimlerini edindikleri öğretmenlik uygulaması dersi sürecinin gerçeklik şoku beklentisi bağlamında değerlendirmek ve bununla birlikte öğretmen adaylarının mesleğin ilk yıllarında karşılaşabilecekleri gerçeklik şokuna ilişkin farkındalık oluşturmaktır. Bu araştırmanın çalışma grubu; 2022-2023 eğitim öğretim yılında İnönü Üniversitesi Sınıf Öğretmenliği programında öğrenim gören ve öğretmenlik uygulaması I dersini alan öğrencilerden oluşmaktadır. Katılımcılar 6 kadın ve 6 erkek olmak üzere görüşmeye katılmayı kabul eden 12 kişiden oluşmaktadır. Araştırma verileri 7 sorudan oluşan yarı yapılandırılmış görüşme formu ile elde edilmiştir. Araştırma sonucuna göre, öğretmen adaylarının, öğretmenlik uygulaması dersinde rol karmaşası yaşadıkları, uygun yöntem ve tekniği hem seçmede hem de kullanmada, ders içeriğine uygun materyal hazırlamada, dersi planlamada, etkili sınıf yönetimi ve etkili iletişim kurmada, teoriden pratiğe geçişte, sınıf mevcudu ve sınıfın sahip olduğu fiziksel koşullar, özel öğrencilere nasıl davranılması gerektiği, öğrencilerin bireysel ve gelişimsel farklılıklarını göz önünde bulundurarak dersi nasıl yürütecekleri ve farklı anadile sahip öğrenciler ile nasıl iletişim kuracakları konusunda ve bazı adayların uygulama öğretmenleri ile sorunlar yaşadıkları ortaya konulmuştur. Bazı öğretmen adaylarının öğretmenlik uygulaması dersinde kuramsal ve pratik bilgileri öğrencilere aktarmada sorun yaşamadıkları, sınıf yönetimi ile ilgili yaşadıkları problemleri staj sürecinde kazandıkları deneyim ve yaptıkları gözlem ile çözdüklerini, kendilerini sınıf disiplini ve yönetimi konusunda geliştirdikleri, süreç içerisinde öz güven kazandıkları ve öz yeterliklerinin geliştiği, sosyokültürel açıdan gelişim gösterdikleri ve mesleğin niteliklerine ilişkin olumlu tutum geliştirdikleri, alan bilgisi derslerinin kendilerine katkı sağladığı özellikle meslek bilgisi derslerinin onları mesleğe hazırladığı ve mesleki gelişimleri açısından faydalı olduğu sonucuna ulaşılmıştır.

Anahtar Sözcükler: Gerçeklik şoku, gerçeklik şoku beklentisi, öğretmen adayı, sınıf öğretmenliği

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INTRODUCTION

Teaching, which focuses on achieving desired behaviors in education, is inherently a profession where ideals and expectations are significant and high. The profession of teaching, which requires a considerable level of social, cognitive, and affective knowledge, skills, and competence, is addressed through theoretical and applied courses in general knowledge, subject-specific knowledge, and pedagogy in teacher training institutions, namely education faculties. Teaching practicum emerges as the most concrete course with a practical focus in the process of teacher preparation. Within this course, activities such as "observing field-specific special teaching methods and techniques, conducting micro-teaching practices using field-specific special teaching methods and techniques, independently planning a course, developing activities and materials related to the course, preparing instructional environments, classroom management, and assessment and evaluation" are included. The aim here is to impart fundamental skills required by the teaching profession, thereby minimizing potential challenges in the early years of the profession. Indeed, each individual forms ideals and expectations at varying levels related to the profession they are educated in. The discrepancy between the ideals and expectations formed during vocational education and their complete realization in the professional working environment is a challenge experienced by employees in their early years. Teachers who experience that their ideals and expectations do not entirely align with the reality of their professional life in the early years of their careers may encounter this challenge more prominently. In the literature, these challenges are expressed as "reality shock."

The concept of reality shock, initially rooted in Hughes' studies (1958), was introduced to the literature by Kramer (1974). Kramer (1974) utilized the concept of reality shock, meaning intense surprise and disappointment regarding unforeseen situations in the early stages of a profession, to express the inconsistency between the expectations of a recent graduate and the reality of professional life. This term has been applied in various studies across professions, including accountants (Carcello et al., 1991; Dean, Ferris, Konstans 1988), newly employed white-collar workers (Ogawa, 2005; Kodama, 2017), IT professionals (Dhar, 2013), and librarians (Oud, 2008). Additionally, studies on reality shock have addressed professions such as nursing (Choe, Lee, 2016; Duchscher, 2009; Kramer, 1974) and teaching (Dicke et al., 2015; Kim & Cho, 2014; Marso & Pigge, 1987; Shaw, 2018; Veenman, 1984). Similar to other professional groups, prospective teachers also develop certain attitudes and expectations towards their profession before entering employment. Expectations related to career plans, working conditions, and the characteristics of the profession sometimes do not align with the expectations of the institution, leading employees, including pre-service teachers, to experience reality shock. The concept of reality shock, as defined by Veenman (1984), refers to the collapse of the training and professional ideals of novice teachers in the face of the reality of the practical environment before their actual service begins. The term reality shock is used to express the difficulties experienced by teachers in the early years of their profession, particularly those who have recently entered the education sector (Correa et al. 2015). This is because teachers, in the initial years of their profession, often face various challenges such as creating a positive reputation in the institution where they work, organizing and preparing new courses, and adapting to an entirely new role as an adult, professional, and educator (Gaede, 1978). During the early years of their careers, teachers frequently strive to get to know their students, acquire effective classroom management skills in the real classroom setting, and learn the policies and procedures of the institution they work for. In this process, new teachers may realize that their expectations about the profession may not align with the reality they experience (Dean et al. 1984). They become aware that there are both known and unknown aspects of the institution they work for (Caires et al. 2010; Newman & Johnson, 1994). Consequently, a teacher who perceives that their expectations and desires differ from the reality of the institution they serve may undergo a reality shock. Botha and Rens (2018) define reality shock as the gap between the theoretical knowledge learned during teacher training and the actual realities they face in the first years of their teaching profession.

Müller-Fohrbrodt and colleagues explained the concept of reality shock through five indicators ranging from problem perception to leaving the teaching profession (Veenman, 1984). Kramer (Carroll, 2007) also addressed reality shock in four stages. The process begins with the *honeymoon stage*, where individuals see the best aspects of their job, and continues with the *shock stage* where the differences between being a student and entering professional life become apparent. The recent graduate, who reorganizes their views on working life and regains balance, is in the *recovery stage*. When the individual embraces the unique culture and expectations of the workplace, develops new expectations, resolves conflicts, and aligns with the reality of the organization, they are in the *resolution stage*. In a study with information technology personnel, Dhar (2013) modeled reality shock using five components. The first component is the *fake title*, where the employee believes the job assigned to

them is superior to the job profile. The second component is *salary disparity, a significant shock when the employee learns their actual salary compared to the organization's predetermined salary.* The third component is access to benefits, where the employee, unable to *access benefits* due to excessive workload and inadequate staff, faces the reality, experiences a sense of insecurity, and develops a negative impression about the organization. The fourth component is the clash with the *dominant culture*, where the employee, witnessing an exaggerated cultural image upon entering the organization and facing contrary experiences, realizes the determinative features of the actual culture. The fifth component is disillusionment, where the employee, realizing that the organization's promised bright future and career goals cannot be achieved, feels deceived and confronts *limitations in professional development*. As per Moir's (1999) assessment of reality shock in the teaching profession, the initial year of a practicing teacher is marked by an emotional engagement with the profession—an unforeseen period of heightened excitement and anxiety known as the *expectation stage*. During this stage, teachers confront unexpected situations and challenges, expending considerable energy and experiencing fatigue due to the demanding workload. Subsequently, they enter the *survival stage*, wherein they grapple with the challenges of adapting to the demands of the profession. Following this, *disillusionment* sets in, characterized by an intense experience of reality shock, during which one's self-esteem diminishes. With the start of the holidays, the new teacher, finding opportunities for rest and socialization, enters the *recovery stage. In the reflection stage*, the novice teacher evaluates successes and failures experienced during the academic year, considers changes in teaching strategies, curriculum, and classroom management for the next year, and forms new expectations for the future, returning to the *Expectation stage*.

Literature on research related to education has aimed to provide a comprehensive perspective on the causes of reality shock, the problems it poses, and the coping mechanisms preferred by new teachers (Chen, 2018). Proposals for programs addressing the professional development, learning needs, and reduction of reality shock for novice teachers have been put forward (Shaw, 2018). Additionally, there have been efforts to prevent or minimize reality shock through training programs, particularly in classroom management (Dicke et al. 2015). Various studies have explored adaptation problems (Öztürk & Yıldırım, 2013), difficulties (Yanık et al. 2016), social, cultural, and professional issues (Başar & Doğan, 2015) experienced by new teachers in the early years of their profession, alongside the reality shock they undergo (Botha & Rens, 2018; Jesus & Paixao, 1996), its causes (Akan & Başar, 2022), emotional exhaustion in the context of reality shock, constructivist perspectives (Voss & Kunter, 2020), changes in professional perceptions (Power, 1981), and reality shock related to burnout (Friedman, 2000). Furthermore, studies have delved into reality shock experienced due to exam-focused education (Wang, 2016) and the effects of working under different conditions and at different levels on reality shock (Marso & Pigge, 1986). The relationship between the expectations of pre-service teachers (Koşar, 2018) and socio-emotional experiences during teaching practicum (Caires et al. 2009), attitudes toward the teaching profession concerning reality shock (Gürler, 2020), and how age and gender (Demir et al., 2018) influence the expectation of reality shock in the first year of the profession, as well as how motivation and perceptions of teaching competence affect the encountered reality shock (Kim & Cho, 2014), have also been explored.

Purpose of the Research

The aim of this research is to assess the process of teacher practicum, where students in the primary education teaching program gain their initial professional experiences in primary schools affiliated with the Ministry of National Education, within the context of the expectation of reality shock. Additionally, the study aims to foster awareness among prospective teachers regarding the reality shock they may encounter in the early years of their teaching careers. In the service of the research question, the sub-problems were identified as follows:

1. How do pre-service teachers experience the transition from student to teacher within the context of teaching practicum?
2. In what situations do teacher candidates have difficulty in teaching practicum?
3. Which of the skills do pre-service teachers need to develop in order to practice the teaching profession?
4. To what extent can pre-service teachers apply what they learned during their undergraduate education within the scope of teaching practicum?

5. To what extent does undergraduate education prepare pre-service teachers for the profession?
6. What should the ideal undergraduate education program be like to avoid reality shock in the first years of the teaching profession?

Research Importance

Newly initiated teachers may lack sufficient knowledge about the requirements of the institution and the classroom. The inconsistency between theoretical knowledge acquired in teacher training and the reality of teaching, coupled with the differentiation of expectations after entering the profession, can lead to the experience of reality shock. Considering the conditions in Turkey, the professional conditions encountered in primary school teaching undergraduate education may vary. Therefore, to minimize reality shock, pre-service education should not only provide theoretical knowledge but also heavily incorporate practical courses, and prospective teachers should be prepared with consideration for the realities of the teaching profession. In this context, the experiences gained in the teaching practicum course will provide crucial insights into the reality shock that prospective primary school teachers may face in the early years of their profession. When reviewing the literature, limited research on the expectations related to reality shock among pre-service teachers is observed. This qualitative study, aimed at determining the expectations of pre-service teachers regarding reality shock, is expected to contribute to the literature, the teaching profession, and institutions that train teachers.

METHOD

Research Design

This research, aiming to describe the experiences of pre-service teachers during the teaching practicum from a participant perspective, was conducted using a phenomenological design. The phenomenological design focuses on phenomena that are not entirely unfamiliar but lack a deep and detailed understanding. Phenomenology provides a suitable research framework for investigating phenomena that are not entirely foreign to us but at the same time not fully comprehended (Creswell, 2017; Yıldırım and Şimşek, 2018). In this study, phenomenology was chosen to deeply describe the teaching practicum process from the perspective of pre-service teachers in the context of reality shock expectations.

Study Group

In this research, the purposive sampling method was employed, specifically using the criterion sampling technique. In criterion sampling, criteria are prepared by the researcher, or a pre-established criterion list can be utilized (Büyüköztürk et al., 2018). The study group of this research consists of students enrolled in the Primary School Teaching program at İnönü University during the 2022-2023 academic year who have taken the Teaching Practicum I course. The participants include 6 females and 6 males, totaling 12 individuals who agreed to participate in the interviews.

Data Collection Tool

Research data were obtained using a semi-structured interview form consisting of 7 questions. The questions in the semi-structured interview were prepared in advance, aiming for participants to narrate the reality they perceive with their own thoughts (Merriam, 2018). To prepare the interview form, the literature in the field was first reviewed. The questions were then presented to an expert group consisting of 2 academicians in the field of educational management, and a pre-application was conducted with 3 students from the Department of Primary School Teaching. After the application, the questions were re-examined by the researcher, and adjustments were made. The final version of the interview form was obtained by consulting an expert group consisting of 4 academicians from the departments of educational management and primary school teaching. Some question examples:

1. Based on your experiences in the teaching practicum, how would you describe your transition from student to teacher?
2. During your teaching practicum, have you ever encountered a situation where you felt you had difficulty with education?
3. In teaching practicum, have you ever had any problems with
   a) the school administration, your colleagues and your practice teacher

b) in implementing classroom activities

c) classroom management.? Explain.

4. As a teacher candidate, to what extent does undergraduate education prepare you for the teaching profession? Explain.

Data Collection

Initially, online interviews were conducted as a trial with 4 students who took the Teaching Practicum I course and were studying in the primary school teaching department. The interviews were planned to last a maximum of 20 minutes. The comprehensibility of the questions directed to the participants in the interviews was evaluated, and necessary adjustments were made to the interview form by the researchers. The interviews were conducted in the online environment during the 2022-2023 spring semester and recorded. Participants were informed before the interviews started that they would be recorded, and these recordings would be used only for scientific research purposes. The recorded interviews were later transcribed into written form by two researchers.

Data Analysis

In the scope of the research, content analysis was employed to reach concepts and relationships that were not previously perceived through an in-depth examination and to clarify the obtained data (Yıldırım and Şimşek, 2015). During content analysis, the collected data were transcribed into written form, and the participating pre-service teachers were coded as K1, K2, K3, K4. The analysis of the data followed an inductive coding approach. Codes were organized into categories and themes by the researcher and a subject matter expert. The interpretation of the findings included references to codes and direct participant expressions.

Validity and Reliability

In qualitative research, the accuracy of results, credibility, and the adequacy of researchers are crucial criteria to ensure that the findings are valid and reliable (Krefting, 1991). In this study, participant validation was employed to ensure credibility, which is a condition for internal validity. Participant validation involves reaching out to some of the individuals from whom the data were obtained to receive feedback on the findings (Başkale, 2016). Confirmation was obtained from participants to verify the extent to which the reported findings reflected their own thoughts. Moreover, an examination of the research design, data collection, and analysis sections was conducted by two researchers who are experts in qualitative research methods. Purposive sampling based on specific criteria was used to ensure the transferability of the results to similar situations, and the study group was thoroughly introduced. To ensure the replicability of the research under similar conditions, the method was detailed. The results of the research were exemplified with direct participant expressions, demonstrating the confirmability of the findings. Additionally, the procedures and processes applied in the research were detailed, and the objectives, aims, and significance of the research were clearly stated.

Research Ethics

The approval of Fırat University Social Sciences and Humanities Research Ethics Committee was obtained for ethical compliance with the research procedures on the date of 21.03.2023 issued with 15255.

FINDINGS

In this section, the findings have been organized into tables and interpreted.

Findings Regarding the Implementation Process Theme

The findings related to the implementation process theme are presented in Table 1.

Table 1. Findings on the Transition Shock Expectations of Pre-service Teachers in the Implementation Process Theme

	Theme: Implementation Process				
	Sub-theme (Category)				
	Teaching Environment	Course Preparation	Student	Classroom Management	Practice Teacher
Codes	• *Practice Opportunity* • *Classroom size* • *Ability to use technology* • *Knowledge transfer* • *Physical conditions* • *Instructional methods and techniques* • *Providing guidance*	• *Preparing materials* • *Planning*	• *Individual variances* • *Developmental characteristics* • *Special students* • *Different mother tongue*	• *Effective Classroom Management* • *Ensuring classroom discipline* • *Communication skills* • *Authority* • *Motivation* • *Attracting attention*	• *Occupational role model* • *Conventional approach* • *Compatibility with the practice teacher* • *Mentorship*

The first theme created within the scope of the research is the theme of the teaching practicum process, which focuses on the practical aspect of the pre-service teachers' teaching practicum course in the school. As a result of data analysis, five subcategories related to the theme of the teaching practicum process have been identified. These categories include the teaching environment, course preparation, students, classroom management, and the practice teacher.

Pre-service teachers mentioned facing challenges in the teaching environment category due to issues related to class size and the physical conditions of the classroom, expressing the need to improve themselves in using technology. Additionally, they indicated that the practicum process provides opportunities to apply the knowledge they have acquired, and guiding their own students alters the nature of the learning process and the role of the teacher. However, concerning instructional methods and techniques, they generally reported difficulties in both selecting and using appropriate methods and techniques in the teaching practicum course. They emphasized the necessity of planning undergraduate education from the perspective of these qualities. Furthermore, some pre-service teachers expressed difficulties in conveying theory-based knowledge acquired during their undergraduate education to students during the teaching practicum. Conversely, some pre-service teachers stated that they encountered no issues in transmitting theoretical and practical knowledge to students, mentioning that what they learned facilitated their ease during the implementation phase. Here are some participant opinions related to the teaching environment category:

K8: "...I wanted to stick with the same method, but it wasn't effective; different techniques needed to be tried. However, you can't predict which of these techniques will work."

K6: "..... Especially in classroom education programs, there is a need for a curriculum that emphasizes beautiful writing, combined classes, music, art, preparing digital materials, effective use of technology, and scientific research methods."

K2: "I became more successful in applying what I learned in classes where we were taught practically and constantly made materials. For example, in the first reading and writing class, I didn't have difficulty making materials during my internship and could come up with ideas for materials."

K3: "The courses I learned contributed significantly to my application. Especially, my knowledge on the initial reading and writing subjects was very helpful in the application phase. Therefore, I could apply almost everything I learned."

According to the data gathered under the category of course preparation, only one participant mentioned facing difficulty in preparing appropriate materials for the course, while another participant expressed challenges in selecting and preparing a course plan. A participant's perspective related to the course preparation category is as follows:

K3: "I struggled a bit in preparing suitable materials."

K11: "I have difficulty in selecting and preparing a plan that aligns with the learning outcomes of the course."

Based on the data gathered under the student category, prospective teachers, during their teaching practicum, indicated challenges in how to interact with special needs students, considering individual and developmental differences of students, and managing communication with students who have different mother tongues. Some participants, who faced problems with students during the later stages of the teaching practicum, expressed that they resolved these issues by taking into account the developmental characteristics. Some participant views related to the student category are as follows: Some participant views related to the student category are as follows:

K2: "One day, autistic student X in my class had a fight with all his classmates and attacked them while I was on internship. I had a hard time restraining him. I learned better how to interact with special needs children afterward."

K1: "...I felt that keeping the students at similar levels, even if their levels are not the same, would be more challenging."

K3: "...I learned to consider the developmental characteristics of children."

K5: "Keeping all students' attention at the same time is challenging. Additionally, the difference in their achievement levels is a negative factor. Some get bored while others can't keep up in the class..."

K4: "Yes, I had difficulty in communicating with foreign students; it was hard to understand the course because they spoke Arabic and didn't understand Turkish."

Under the category of classroom management, the views of pre-service teachers have been analyzed with six codes: effective classroom management, ensuring classroom discipline, communication skills, authority, motivation, and attracting attention. According to the codes created under the classroom management category, it has been identified that the most common problems faced by pre-service teachers during their teaching practicum are effective classroom management and effective communication. K3, expressing the transition from being a student to becoming a teacher, states, *"...if a class can be entrusted to you, I believe you are in the stage of transitioning to teaching,"* emphasizes that effective classroom management skills are a prerequisite for becoming a teacher. Similarly, K7 defines this transition as, "*When we say, 'Now I can be with students all day, be alone with them, manage the classroom, and really teach something, I think we are in a transitional stage,"* highlighting once again that classroom management is a crucial component of the teaching environment and process. K2 articulates challenges in terms of effective classroom management, maintaining classroom discipline, and establishing authority: *"I think I need to learn to be more authoritative. It's nice to spend time with children, to be friends with them. But alongside these, I also need to ensure necessary classroom management. During the internship I had for a semester, I realized that this is the most important aspect I need to improve."* Moreover, a few participants within the study group mentioned the difficulty of keeping students' interest and attention during courses, emphasizing that motivation to *motivate* the desired behavior in students is one of the fundamental objectives of classroom management.

Some of the participants in the study have indicated that they resolved the challenges related to classroom management through the experience gained during their internship and the observations they made. They mentioned that they developed themselves in terms of classroom discipline and management. The prospective teachers who participated in the research expressed difficulties in communicating with students and adjusting social distance within the classroom. They emphasized that communication skills are essential for finding common ground with students, organizing and managing the classroom climate, and that these skills are both necessary and open to improvement. Some participant views related to the classroom management category are as follows:

K3: "I believe I have communication skills with children, but I need to further develop them."

K9: "It is challenging for me when students hug me, and I have to prevent this physical closeness without breaking it."

K9: "I would like to improve my communication skills."

K2: "Communication skills should be imparted to pre-service teachers."

K1: "I think I couldn't adjust the teacher-student relationship and the distance between us. I need to develop in this regard."

K5: "I had problems with classroom management. Keeping all students' attention at the same time is challenging. Additionally, the difference in their achievement levels is a negative factor. Some get bored while others can't keep up in the class..."

Additionally, the difference in their achievement levels is a negative factor. Some get bored while others can't keep up in the class. Some participants acknowledged that their practice teachers serve as successful teacher educators, effective mentors, and professional role models. They expressed a sense of harmony with their practice

teachers. However, there were also participants who raised concerns. They noted that some practice teachers did not implement the knowledge acquired during their teacher education program in the classroom, adhered to traditional teaching methods, and expressed discomfort with the use of contemporary teaching methods by the participants. Some participant views related to the Practice Teacher category are provided below:

K12: "Our practice teacher is successful in the profession, an experienced teacher educator who adds success to every year. We had no problems with them, and we learned a lot from them."

K11: "...they did their best to solve every problem I had; they provided continuous support to us, the intern students, during this process."

K9: "My practice teacher was uncomfortable with my closeness with the students and teaching the course using contemporary teaching methods. She taught the course using traditional methods, and she expressed that my use of methods other than hers caused problems in the way the course was conducted for the students."

Findings Related to the Transition Theme

Findings on the transition theme are presented in Table 2.

Table 2. Findings on the Transition Theme in Shock Expectations of Pre-service Teachers

Theme: Transition				
	Sub-theme (Category)			
	Transition Process		Awareness	
Codes	• *Anxiety* • *Inexperience* • *Administrative support* • *Enhancing Occupational Satisfaction*	• *Building Occupational Confidence* • *Role Confusion* • *Transition from theory to practice* • *Acquisition of self-efficacy* • *Administrative work*	• *Occupational awareness* • *Practice awareness* • *Emotional awareness* • *Occupational respect*	• *Occupational competence* • *Cultural development* • *Responsibility* • *Importance of experience* • *Reality shock*

Within the category of the transition process, nine codes have been identified: anxiety, inexperience, administrative support, enhancing occupational satisfaction, development of occupational confidence, role confusion, transition from theory to practice, acquisition of self-efficacy, and administrative tasks. Pre-service teachers undergoing the transition from student to teacher during the teaching practicum have asserted in their narratives that they have garnered confidence, enhanced self-efficacy, and derived satisfaction from the teaching profession throughout this progression. However, certain participants noted challenges during the transition, attributing difficulties to their lack of experience in transitioning from theory to practice, consequently experiencing anxiety. Furthermore, participant K6 articulated encountering impediments due to a deficiency in administrative knowledge, while participant K11 underscored the support extended by school administration in addressing issues and aiding pre-service teachers engaged in the teaching practicum.

The code *"role confusion,"* delineated under the transition process category, denotes, based on the gathered data, both the struggle of the pre-service teacher to perceive themselves unequivocally as either a student or a teacher and the failure of elementary school students to perceive intern teachers fully as educators. Participant K9 elucidated the experience of role confusion as follows: *"It was a peculiar sentiment, am I assuming the role of a teacher or a student; I did not entirely comprehend. Simultaneously, I posit that I am not a complete teacher owing to my ongoing student status."* Concurrently, participant K10 articulated, *"It's a distinctive emotion, principally you remain a student, yet you also have your own students."* Participants have expressed the role confusion experienced by elementary school students as follows:

K2: "...I encountered difficulties because the children perceived me more like a friend. I faced challenges in establishing authority and occasionally encountered difficulties in getting them to follow my instructions."

K3: "Due to approaching the students very informally, they saw me more as a sister than a teacher."

K7: ". ...they saw me more as a sister than a teacher because I established a very warm relationship with the students."

Within the awareness category, nine codes have been identified: occupational awareness, practical awareness, emotional awareness, occupational respect and competence, responsibility, the importance of experience, cultural development, and reality shock. Some participants have discussed positive professional awareness by addressing the qualities of the teaching profession during the teaching practicum. Others have mentioned facing difficulties in the early stages of the teaching practicum, highlighting that the teaching profession and the classroom environment have different characteristics than expected. This finding can be explained by the concept of reality shock. The misalignment between idealistic thoughts formed during the undergraduate education process and the experienced reality leads to the occurrence of reality shock, and at the same time, the acquired professional training fades away in the face of the reality of the school and the classroom (Veenman, 1984). Pre-service teachers have stated that the teaching practicum has contributed to their socio-cultural development and the development of positive attitudes towards the qualities of the profession. Additionally, they emphasized the importance of practicing and taking responsibility for the classroom to transfer the knowledge acquired during undergraduate education to the real classroom environment and gain experience. Some participant views related to the awareness category are as follows:

K1: "Understanding what our teachers go through. That standing in front of the chalkboard and the situation is not as easy as sitting in our seats. Teaching is more laborious and extensive than learning. Experiencing challenges in individual success as a student, I realized that ensuring the success of many students as a teacher requires more effort, patience, and dedication. When I became a teacher, I understood that the responsibilities are much greater than my expectations. In short, the statement 'If I were a teacher, I would read a teacher' is merely a comment made by the student based on their own experience. Nothing is as it seems."

Findings Related to the Pre-Service Education Theme

Findings related to the pre-service education theme are presented in Table 3.

Table 3. Table 3 presents the findings related to the Pre-Service Education Theme in the Pre-Service Teacher Transition Shock Expectations of Pre-service Teachers

	Theme: Pre-Service Education		
	Sub-theme (Category)		
	Undergraduate Courses	Practice	Academician
Codes	• *Field courses* • *Occupational courses* • *Creating realistic expectations* • *Preventive education*	• *Importance of practicum* • *Duration of the practicum* • *Practicum payment* • *Learning by doing and living* • *School-faculty collaboration* • *Village school experience*	• *Theoretical knowledge transfer* • *Interactive learning* • *Monotonous university education*

Under the category of undergraduate courses, participants' opinions are described with four codes: field courses, professional knowledge courses, creating realistic expectations, and preventive education. Pre-service teachers have expressed that field courses, especially occupational courses, have contributed to their preparation for the profession and have been beneficial for their professional development. Additionally, they have emphasized the importance of planning undergraduate education to create realistic expectations about the teaching profession and the necessity of courses that act as preventive education, minimizing potential issues in the early years of the profession. Some participant views related to undergraduate courses are as follows:

K2: "The courses related to the child's development, both in the field and elective courses, have contributed a lot to me."

K8: "...the most used course is special education and classroom management."

The practice category is focused on courses that involve practical applications within undergraduate education. Particularly evaluated within the context of the teaching practicum course, this category includes codes such as the importance of the practicum, duration of the practicum, practicum payment, learning by doing, school-faculty collaboration, and village school experience. Participants in the study have stated that the teaching practicum course (students taking the teaching practicum course often refer to it intensively as an internship) is crucial for learning by doing, emphasizing the importance of its duration being more than two terms and receiving compensation during the practicum. Moreover, participants have highlighted the benefits of collaboration

between schools affiliated with the Ministry of National Education and education faculties, suggesting that conducting the teaching practicum course (internship) in rural schools would be beneficial for gaining a realistic experience. Some participant views related to the application category are as follows:

K11: "I think the teaching practicum should be a practice that students should do for 4 years as students because it is very productive and very useful in preparing us for the profession. I believe spreading it over 4 years will support students' development in terms of knowledge, accumulation, and experience."

K6: "The weight of the application should exceed 40% of the total course weight. The pre-service teacher should have one foot constantly in the field. And they must definitely earn an intern salary."

K3: "To prevent experiencing this shock, I think the practicum should last for more than a year, and at least for one term, there should be an opportunity to do an internship in a village school."

K7: "I think the most effective way to prevent this problem is to provide the opportunity to do our internship in a village school and the internship period should be 4 terms, not 2."

The category of academicians has been created within the scope of participants' views on academics working in teacher training institutions. The academic category includes codes for theoretical knowledge transfer, interactive learning, and monotonous university education. Among the pre-service teachers participating in the research, there are differing opinions about the academic category. Some participants have expressed that academics are very useful in transferring theoretical knowledge. On the other hand, some participants have addressed the uniformity in the education provided by academics, emphasizing the importance of interactive learning and the necessity of applying the taught methods and techniques themselves. Some participant views related to the academic category are as follows:

K12: "....it is important that our teachers are good instructors and transfer theoretical knowledge to us effectively."

K5: "Theory and practice should go hand in hand. If this is not possible, then instead of classes filled with just slide readings, more interactive classes can be conducted. Otherwise, by reading books instead of slides in daily life, the same level of competence can be achieved. What I mean is if teaching methods and techniques can be discussed, when necessary, the same techniques can be taught more permanently by applying them."

RESULTS AND DISCUSSION

In this research, the views of students studying in the elementary education department and participating in the teaching practicum course were evaluated in the context of reality shock. Data obtained through a semi-structured interview form were used to create three main themes and ten categories related to these themes. Participant opinions were classified under 53 different codes, associated with the theory of reality shock.

In recent years, reality shock, previously explored in various professional fields, has become a subject of study in the teaching profession. The shock is notably evident in the early years of teaching, particularly during the transition from theory to practice in the elementary education branch. Elementary education, particularly in dealing with combined classes (Özdemir, Özdemir, & Gül, 2020), diverges from other branches due to challenges such as transportation, accommodation, nutrition, as well as cultural and physical inadequacies (Karataş & Kınalıoğlu, 2018). Additionally, it distinguishes itself by facing issues like the inadequacy of pre-service theoretical education in the practical application process (Kara & Demir, 2021). As novice elementary school teachers confront these issues specific to their field, the likelihood of experiencing reality shock increases due to the harsher realities of the teaching profession. In the context of this research, this situation is defined as the expectation of reality shock among students currently continuing their undergraduate education and participating in the teaching practicum course. Therefore, the teaching practicum course is considered a significant factor in revealing the expectations related to reality shock and reducing the potential impact of the shock during the early years of the teaching profession.

The research results indicate that pre-service teachers face challenges in selecting and implementing appropriate teaching methods and techniques in the teaching environment, as well as transferring the knowledge acquired during their undergraduate education to the real classroom setting. The effective use of various methods and techniques in the teaching environment (Veenman, 1984), as well as the physical conditions of the school and class size (Dickson et al. 2014; Fantilli, 2009; Gökçe, 2013; Güvendir, 2017; Kozikoğlu & Senemoğlu, 2018; Mudzingwa & Magudu, 2013; Yanık et al. 2016; Yeşilyurt & Semerci, 2012; Yılmaz & Tepebaşı, 2011), are among the challenges emphasized by novice teachers in their profession. In the teaching practicum course, where pre-service teachers mention finding opportunities for application, the use of technology is seen as a skill that

needs to be developed. While skills in using technology can be developed through experiences gained in teaching practicum courses (Nakiboğlu, 2020), according to Eraslan (2009), pre-service teachers who do not have enough opportunities to practice in the schools they are assigned to can develop these skills in subject knowledge courses. Moreover, the use of technology is a necessary competence in the preparation process of the course, including planning and preparing materials. In research, it is expressed that pre-service teachers experience difficulties in course planning (Can & Baştürk, 2018; Gökçe & Demirhan, 2005; Kozikoğlu & Senemoğlu, 2018), material preparation, and the use of technology in the teaching process. However, they gain experience in these areas during the application process (Nakiboğlu, 2020). Newly appointed teachers, on the other hand, are observed to face challenges in obtaining, preparing, and implementing appropriate materials (Braga, 1972; Erdemir, 2007; Gordon & Maxey, 2000; Güvendir, 2017; Korkmaz et al. 2004; Veenman, 1984).

Elementary school students go through developmental stages that progress rapidly and intricately. Developmental characteristics and individual differences are significant factors expressed by pre-service teachers regarding this period. According to Güvendir (2017), students' preparedness, along with individual and developmental differences, complicates the application of theoretical knowledge acquired at the university. Additionally, newly appointed elementary school teachers have reported difficulties in recognizing students with special needs (Başar & Akan, 2022), understanding student problems, formulating appropriate questions (Yıldırım, Kurtdede, & Ergün, 2017), and preparing course plans (Kozikoğlu & Senemoğlu, 2018). In the study by Karataş and Kınalıoğlu (2018), the difference in the mother tongue of students in rural schools has been identified as a student-related issue. Betts (2006) has noted that novice teachers who struggle with addressing students' individual differences, needs, and problems experience a reality shock when entering the profession.

Effective classroom management and communication skills, which create the expectation of reality shock, have been identified by pre-service teachers as concepts requiring improvement and posing challenges. Research indicates that pre-service teachers who take the teaching practicum course experience difficulties in classroom management during the application process (Başal et al., 2017; Bay, Şeker, & Alisinanoğlu, 2020; Busher, Gündüz, Çakmak & Lawson, 2015; Kozikoğlu & Senemoğlu, 2018) and struggle to communicate with students (Tosun, 2019). Being unprepared to deal with such problems within the classroom is a key factor leading to the reality shock experienced by newly appointed teachers (Dicke et al. 2015). Başar and Akan (2022) have also stated that newly appointed teachers experience reality shock most prominently in the area of classroom management.

Practice teachers serve as crucial professional role models within the teaching practicum process. Therefore, it is highly important for pre-service teachers to work in harmony with their practice teachers. Difficulties in communication between practice teachers and pre-service teachers have been observed when harmony is not achieved (Kozikoğlu & Senemoğlu, 2018). The research results indicate that there is a divergence of opinions among pre-service teachers regarding their practice teachers in the teaching practicum course. While most participants express having a good relationship with their practice teachers, some mention encountering issues with them. In Ali, Othman, and Karim's (2014) study, practice teachers were found to guide the teaching process with constructive criticism, assist pre-service teachers in various aspects, and motivate them. In other studies, pre-service teachers have reported difficulties in establishing healthy communication with practice teachers (Ogan et al., 2010; Yakar, Uzun, & Tekerek, 2021; Yeşilyurt & Semerci, 2012), a lack of feedback from practice teachers (Aydın & Akgün, 2014; Eraslan, 2009; Gratch, 1998), and inadequate guidance due to the use of traditional teaching methods by practice teachers (Baştürk, 2009; Can & Baştürk, 2018; Duman, 2013; Eraslan, 2008; Gratch, 1998; Topal & Uzunoğlu, 2020; Yakar et al.2021; Yeşilyurt & Semerci, 2012). It has been revealed that practice teachers fall short in translating various teaching methods and techniques into practice in the teaching practicum course (Gündoğdu et al. 2010), imparting professional knowledge and skills during the adaptation process to the institution and classroom (Baştürk, 2009), and serving as role models for pre-service teachers. In another study, pre-service teachers reported facing negative attitudes from practice teachers, administrators, and students in the practice school (Demir & Çamlı, 2011).

In the research, some pre-service teachers experiencing the transition from being students to becoming teachers during the teaching practicum course were observed to gain self-confidence, develop their self-efficacy, and derive satisfaction from the teaching profession. However, some other pre-service teachers faced challenges in transitioning from theory to practice due to lack of experience, experiencing anxiety and role confusion. Studies have addressed role confusion experienced by pre-service teachers due to being neither fully a teacher nor a student (Kilgore et al. 2003; Alptekin & Vural, 2014), professional role ambiguity (Chunmei & Chuanjun,

2015; Çelik & Saban, 2020; Ekşi, 2006), not being perceived as a teacher by students (Ali et al. 2014; Başal et al., 2017; Topal & Uzunoğlu, 2020; Yeşilyurt & Semerci, 2012), lack of experience (Altıntaş & Görgen, 2014; Chunmei & Chuanjun, 2015; Çuhadar & Yücel, 2010; Hiğde & Aktamış, 2017; Yeşilpınar & Doğanay, 2014), and inadequacy in transitioning from theoretical pre-service training to practice (Yeşilpınar & Doğanay, 2014; Girgin & Şahin, 2019). Some of the participating pre-service teachers mentioned positive awareness towards the teaching profession. In a similar study, a pre-service teacher who experienced the role of a real teacher in a real classroom environment developed a positive attitude towards the teaching practicum course (Can & Baştürk, 2018). Classroom teachers participating in the study by Delican and Sönmez (2020) expressed that, despite feeling inadequate in professional competence and experience in the early years of their profession, the teaching practicum course positively impacted their professional lives. Another result that can be explained by the concept of reality shock is the difficulties faced by pre-service teachers due to the unexpected characteristics of the teaching profession and classroom environment. Similarly, Güvendir's (2017) study found a mismatch between teachers' expectations in pre-service education and their experiences throughout their working lives, indicating that university education did not accurately reflect the real world of the teaching profession.

Pre-service education, including undergraduate courses and teaching practicum, holds significant importance. Training on the most crucial skills to be used in the practice of the teaching profession is provided during this period. According to Ryan (1979), teachers who receive inadequate pre-service education often face difficulties in meeting the requirements of teaching in the early years of their profession. The research has shown that subject knowledge and professional knowledge courses contribute to pre-service teachers during the teaching practicum course. Eraslan (2009) stated that pre-service teachers did not find sufficient opportunities for practice and could not relate their undergraduate courses to the teaching practicum. However, during the practicum, they benefited greatly from professional courses, feeling like the real teacher of the practice class and gaining a closer understanding of the classroom environment. Another result of the research is that, according to pre-service teachers, the allotted program duration for practicum activities is insufficient when considering the objectives of the practicum course. The continuation of the teaching practicum course during the Public Personnel Selection Exam (KPSS) process (Eraslan, 2009; Şimşek, 2013) causes difficulties for pre-service teachers in terms of preparation for the profession. Due to time constraints, pre-service teachers experiencing anxiety may encounter difficulties in fulfilling their roles and responsibilities during the teaching practicum course. It has been observed that pre-service teachers in the first year of their education, who do not have sufficient knowledge about the teaching profession, have higher expectations of reality shock compared to other classes (Demir et al., 2018). To minimize the anticipated shock, pre-service teachers have expressed the need to increase the duration of the teaching practicum course and start it in the first year of undergraduate education (Başal et al., 2017; Doğan, 2005; Gökçe & Demirhan, 2005; Yeşilyurt & Semerci, 2012). In another study, institution personnel working in practice schools have also emphasized the importance of pre-service teachers engaging in longer-term practice in a specific class, reducing the number of pre-service teachers assigned to practice teachers, and increasing collaboration between faculties of education and practice school staff (Şimşek et al. 2013).

Another topic addressed by pre-service teachers to create realistic expectations and minimize the potential impact of reality shock is the inclusion of rural school experience within the scope of teaching practicum. Similarly, pre-service teachers in the study by Gündoğdu et al. (2010) recommended incorporating rural schools into the regional coverage of the teaching practicum course. Pre-service teachers who participated in the teaching practicum course in urban centers during their undergraduate education were reported to be unprepared for the reality of teaching in rural areas and experienced adaptation problems when assigned to village schools (Sidekli et al. 2015). It was also mentioned that they left the profession in their early years (Eret Orhan, 2017).

In this context, for novice teachers to feel competent and successful in the teaching profession, avoid developing negative attitudes towards the profession, and not experience shock due to the inconsistency between what they learned in their undergraduate education and the reality of the teaching environment, undergraduate education should be planned to integrate theory and practice, providing students with pre-professional experiences. Teacher training institutions should incorporate course content that creates realistic expectations from the first year onwards in their education programs. Additionally, more emphasis should be placed on courses related to classroom management and similar topics. School-faculty collaboration should be organized in a coordinated and planned manner, involving pre-service teachers, faculty members, and practice teachers working together. Furthermore, the duration of the teaching practicum course should be extended. This research is limited to students attending the teaching practice course at İnönü University Faculty of Education Classroom Teaching

and the data collected with the measurement tool. The codes, categories, and themes obtained in the research results can be used as variables for quantitative research.

Statements of Publication Ethics

The approval of Fırat University Social Sciences and Humanities Research Ethics Committee was obtained for ethical compliance with the research procedures on the date of 21.03.2023 issued with 15255.

Researchers' Contribution Rate

All authors contributed equally to this work.

Conflict of Interest

This study has no conflict of interest.

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Prediction of Academic Success and Selection of Effective Features with Machine Learning

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Abstract

This study aims to determine whether the success or failure of students after the measurement process can be predicted in terms of some variables, with the help of machine learning algorithms. The research problem statement is "As a result of the evaluation and selection of some variables affecting the student's academic success using machine learning algorithms, are the determined variables more effective than other variables in predicting student success?". The study was conducted with causal-comparative research, one of the quantitative research designs. In this paper, machine learning algorithms have been applied to the dataset that consists of major features to predict students' performances. Thus, the most significant features and the highest-performance machine learning algorithm have also been detected. To this end, univariate, tree-based, and L1-based feature selection methods have been used for the feature selection process. Classification and regression trees, k-nearest neighbors, naive Bayes, random forest, and support vector machines have been employed to build the learning models. In consequence, there exist lots of indicators that impact students' academic successes, the success or failure that emerges after the measurement process can be estimated by regarding these features in advance. Such a task will enable the relationship mechanism between the educational inputs and outputs to be understandable and eliminate shortcomings concerning the education process.

Keywords: Academic performance, academic achievement, artificial intelligence, educational data mining, feature selection

Makine Öğrenmesi ile Akademik Başarının Tahmini ve Etkili Özelliklerin Seçimi

Öz

Bu çalışma öğrencilerin ölçme süreci sonrasında ortaya çıkan başarı ya da başarısızlık durumunun bazı değişkenler açısından önceden tahmin edilip edilemeyeceğinin makine öğrenmesi algoritmaları yardımıyla belirlemeyi amaçlamaktadır. Araştırmanın problem cümlesi: "Öğrencinin akademik başarı sonucuna etki eden bazı değişkenlerin makine öğrenmesi algoritmaları uygulanarak değerlendirilmesi ve seçilmesi sonucunda belirlenen değişkenlerin öğrenci başarısını tahmin etmede diğer değişkenlere göre daha fazla etkili midir?". Çalışma, nicel araştırma desenlerinden nedensel karşılaştırma araştırması ile gerçekleştirilmiştir. Bu çalışmada öğrencilerin performanslarını tahmin etmek amacıyla en temel özelliklerden oluşan bir veri setine makine öğrenmesi algoritmaları uygulanmıştır. Böylece en önemli özellikler ve en yüksek performanslı makine öğrenmesi algoritması da tespit edilmeye çalışılmıştır. Bu amaçla özellik seçim sürecinde tek değişkenli özellik seçimi, ağaç tabanlı özellik seçimi ve L1 tabanlı özellik seçimi yöntemleri kullanılmıştır. Öğrenme modellerini oluşturmak için sınıflandırma ve regresyon ağaçları, k-en yakın komşular, naive Bayes, rastgele orman ve destek vektör makineleri kullanılmıştır. Sonuç olarak öğrencilerin akademik başarılarını etkileyen pek çok gösterge mevcut olup, ölçme süreci sonrasında ortaya çıkan başarı ya da başarısızlık, bu özellikler dikkate alınarak önceden tahmin edilebilmektedir. Böyle bir görev, eğitimsel girdi ve çıktılar arasındaki ilişki mekanizmasının anlaşılmasını sağlayacak ve eğitim sürecine ilişkin eksiklikleri ortadan kaldıracaktır.

Anahtar Sözcükler: Akademik performans, akademik başarı, yapay zekâ, eğitimsel veri madenciliği, özellik seçimi

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INTRODUCTION

The intelligence concept has been defined a lot in literature. The definition by Lenat and Feigenbaum is that "intelligence is the capability to find fast in a search space an acceptable solution that is a priori for observers" (Lenat & Feigenbaum, 1991). Thus, Artificial Intelligence (AI) can be defined as a research area that uses computational models to represent intelligence and instills intelligent behaviors in automata. One of the approaches to AI is the Turing test. With respect to the Turing test approach, learning is regarded as adapting to new circumstances, finding patterns, and deducing from them (Aziz & Memon, 2023; Russell & Norvig, 2010). In this regard, Machine Learning (ML) is a study discipline that aims to reveal patterns in datasets to solve real-world problems and automata acquire abilities regarding learning. Supervised learning is one of the ML sub-research areas frequently exploited in lots of problems. Given a training set, the supervised predictors explore a function that is a member of the hypothesis space.

Applying ML algorithms and data transformation techniques to datasets is known as data mining (DM). In other words, the process of analyzing a large number of data and turning them into knowledge is defined as data mining. Educational data mining (EDM) is used for purposes such as increasing student success by analyzing student data, detecting deficiencies in education and training, and creating effective education and training environments (Özkan, 2015). EDM is a subfield of the DM area. EDM has contributed to theories of learning studied by scholars in educational psychology and the learning sciences (Ryan Shaun Baker & Inventado, 2014). Education is an indispensable factor so as to ensure the development and growth of countries. In this respect, the prediction of students' performance is significant before they take exams or courses. Thus, students' shortcomings and insufficiencies can be corrected. Further, increasing the quality of education is required throughout the current semester so as to enhance students' achievements (Yılmaz & Sekeroglu, 2020). In the education field, data mining and analysis will be used to help individuals discover learning and understand learning behavior, and will also enable a significant level of quality to be achieved in the education system outputs (Özdemir et al., 2018). Furthermore, EDM can be used to design better smart learning technologies for educational goals and to make learners and educators better informed (Ryan S. Baker, 2014).

Since advanced countries establish their governance models on the necessity of change, performance measurement, and efficient use of resources, they should monitor their performance in other countries that aim to keep up with this change and their place in the world with the support of various mechanisms (Acar, 2022). When the 2018 PISA (Programme for International Student Assessment) results and the socio-economic parameters of the countries are investigated, it is seen that the PISA success of countries with a high level of development is the same as their level of development (Yüksel, 2022). Besides, families' thoughts on participation in education vary greatly depending on their total incomes and the amount they spend on activities that will contribute to students' education in out-of-school learning environments (Yıldırım, 2020). Even though teachers who work for schools of different socioeconomic statuses agree on concepts such as academic success, a desire to learn from within the student, and student commitment to the school community, truly, this situation stems from the expectations of the environment or school nowadays (Kazak, 2021). As can be seen from the abovementioned views, there are many parameters that affect students' academic successes, the success or failure that appears at the end of the measurement process can be predicted by considering these parameters previously. This will enable the feedback mechanism between the inputs and outputs of education to be more active and to eliminate deficiencies regarding the education process.

Many works on predicting students' performance have been carried out. However, there are some differences between this study and similar works. These are as follows:

• Other works (Pallathadka et al., 2023; Salah Hashim et al., 2020; Yılmaz & Sekeroglu, 2020) focus on estimating students' final grades. This work concentrates on students' general performance. Hence, the number of categorical values of the outcome has been reduced to two from eight: 'fail' and 'pass'.

• In this work, while the most successful model is a transparent model (e.g., tree-based models), the performance of black box models (e.g., instance-based learning, function learning, Bayesian learning) is higher in the other works (Ismail et al., 2021; Pallathadka et al., 2023; Salah Hashim et al., 2020; Yılmaz & Sekeroglu, 2020). Transparent models can be comprehended by human experts and a new knowledge extraction is possible in such models. However, comprehension of black box models is difficult and can be even impossible for human experts. Meanwhile, Sa et al. have used only tree-based models in their study. However, the performance of these

models is low (Sa et al., 2014). Additionally, Shanmugarajeshwari and Lawrance have used a C5 model in their study (Shanmugarajeshwari & Lawrance, 2016). However, the dataset where they have used is uncomplicated compared to the dataset used in this study.

• The feature selection process is important to boost the performance of ML algorithms. In this respect, powerful feature selection methods based on a filter approach have been used in this work. However, an in-depth feature selection study was not seen in similar studies reviewed in the literature.

METHOD

In this section, the dataset used in this research has been explained, the feature selection method that is employed to select significant features, machine learning algorithms that are required to discover patterns in the dataset, and evaluation criteria to quantify the performance of the models. Finally, the Method section has been finalized by mentioning the experimental procedure. Figure 1 summarizes the overview of the whole learning process.

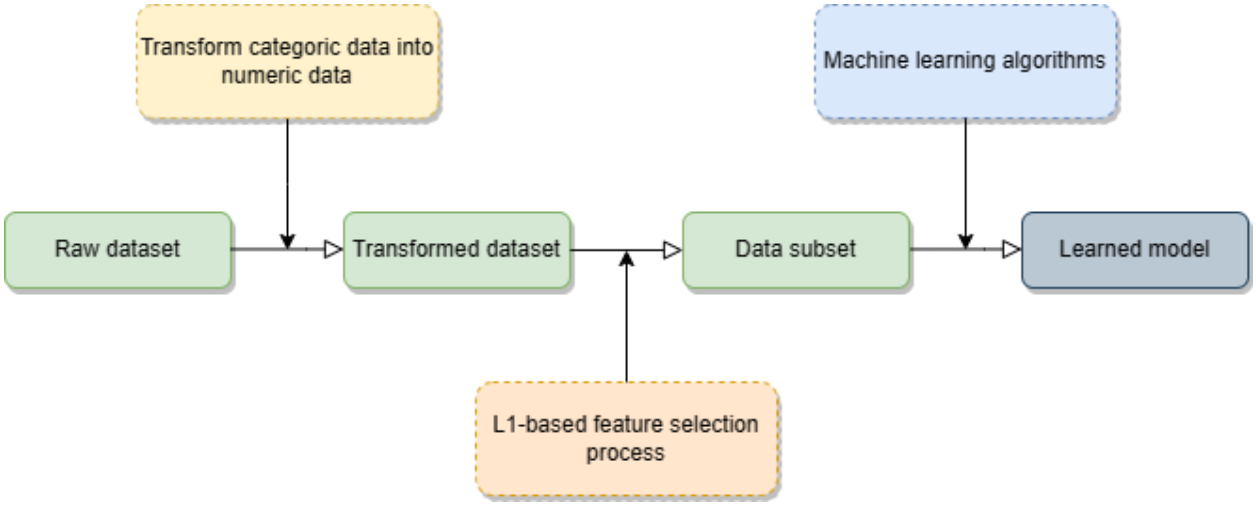

Figure 1. The overview of the learning process

Students Performance Dataset

The Students' Performance dataset (Yılmaz & Sekeroglu, 2020) from the Kaggle[1] has been used in this research. This dataset consists of questions that 145 students are asked. Each column (i.e., features) of the dataset represents those questions. The first 10 features are personal questions. Features 11-16 include questions regarding family. Finally, the rest of the features are on self-education habits. Table 1 shows the detailed information concerning this dataset. In addition, Table 2 presents the descriptive statistics related to the dataset. In this study, each feature takes categorical values. But categorical values have been transformed into numerical values. The reason is that the ML algorithms used can process datasets that consist of numerical data. The outcome class truly consists of 8 categorical values (i.e., AA, BA, BB, CB, CC, DC, DD, FF). The number of these categorical values has been reduced to 2 categorical values: ‘fail’ and ‘pass’ (i.e., FF, DD, and DC are regarded as ‘fail’. The others are counted as ‘pass’). This is because, at many universities in Türkiye, DC, and DD grades are among the conditionally valid letter grades. In other words, if the student's Cumulative Grade Point Average (CGPA) is above 2.00, the student is considered to have passed these courses. However, if the CGPA is below 2.00, these courses can be taken again and the CGPA can be increased. Besides, the aim of this study is to forecast students' general performance rather than students' final grades.

[1] https://www.kaggle.com/datasets/joebeachcapital/students-performance/data

Understanding the nature of the categorical variables allows us to determine appropriate transformation techniques. Categorical variables can be classified into two groups: ordinal and nominal. Nominal variables lack natural order or hierarchy, but ordinal variables do not. Categorical variables particularly present a variety of challenges in the ML area and DM process (Lee & Kim, 2010; Nisbet et al., 2018). These are as follows:

- Most machine learning algorithms take numerical values as input.
- In the case of assigning numbers in ascending order for categorical variables some ML algorithms may misinterpret these values.
- In the case of high cardinality, encoding the performance of a model on a test set can be low in the case of the fact that a categorical variable occurs in a small number in the dataset. Such variables are computationally expensive for the ML algorithms.

In this study, the whole categories within a categorical variable have been first detected. Afterward, each category is assigned an integer value based on the order of appearance in the data if it is nominal, otherwise, the assignment is carried out according to its inherent order or hierarchy. Categorical values in the original dataset are substituted with their corresponding numerical labels later on. Such an encoding process seems more appropriate for ordinal categorical variables since numerical labels accurately reflect the natural order between the categories.

Table 1. The detailed information about the features of the dataset (data counts for each feature are given in parentheses)

#	Features	Categorical values
F1	Student age	18-21 (Count: 65), 22-25 (Count: 70), above 26 (Count: 10)
F2	Gender	Female (Count: 58), male (Count: 87)
F3	Graduated high-school type	Private (Count: 25), state (Count: 103), other (Count:17)
F4	Scholarship type	None (Count: 1), 25% (Count: 3), 50% (Count: 76), 75% (Count: 42), full (Count: 23)
F5	Additional work	Yes (Count: 49), no (Count: 96)
F6	Regular artistic or sports activity	Yes (Count: 58), no (Count: 87)
F7	Do you have a partner?	Yes (Count: 61), no (Count: 84)
F8	Total salary ($)	135-200 (Count: 93), 201-270 (Count: 27), 271-340 (Count: 16), 341-410 (Count: 4), above 410 (Count: 5)
F9	Transportation to the university	Bus (Count: 98), private car/taxi (Count: 25), bicycle (Count: 1), other (Count: 21)
F10	Accommodation type in Cyprus	Rental (Count: 68), dormitory (Count: 49), family (Count: 27), other (Count: 1)
F11	Mother's education	Primary school (Count: 54), secondary school (Count: 27), high school (Count: 39), bachelor (Count: 21), MSc. (Count: 2), Ph.D. (Count: 2)
F12	Father's education	Primary school (Count: 29), secondary school (Count: 36), high school (Count: 46), bachelor (Count: 28), MSc. (Count: 5), Ph.D. (Count: 1)
F13	Number of siblings	1 (Count: 27), 2 (Count: 45), 3 (Count: 26), 4 (Count: 23), 5 or above (Count: 24)
F14	Parents' marital status	Married (Count: 127), divorced (Count: 11), died - one of them or both (Count: 7)
F15	Mother's occupation	Retired (Count: 6), housewife (Count: 103), government officer (Count: 16), private sector employee (Count: 18), self-employment (Count: 2)
F16	Father's occupation	Retired (Count: 36), government officer (Count: 22), private sector employee (Count: 35), self-employment (Count: 38), other (Count: 14)
F17	Weekly study hours	None (Count: 29), <5 hours (Count: 74), 6-10 hours (Count: 30), 11-20 hours (Count: 8), more than 20 hours (Count: 4)

F18	Reading frequency (non-scientific books/journals)	None (Count: 27), sometimes (Count: 99), often (Count: 19)
F19	Reading frequency (scientific books/journals)	None (Count: 20), sometimes (Count: 103), often (Count: 22)
F20	Attendance to the seminars/conferences related to the department	Yes (Count: 114), no (Count: 31)
F21	Impact of your projects/activities on your success	Positive (Count: 128), negative (Count: 4), neutral (Count: 13)
F22	Attendance to classes	Always (Count: 110), sometimes (Count: 35)
F23	Preparation to midterm exams 1	Alone (Count: 107), friends (Count: 27), not applicable (Count: 11)
F24	Preparation to midterm exams 2	Closest date to the exam (Count: 123), regularly during the semester (Count: 20), never (Count: 2)
F25	Taking notes in classes	Never (Count: 5), sometimes (Count: 56), always (Count: 84)
F26	Listening in classes	Never (Count: 29), sometimes (Count: 79), always (Count: 37)
F27	Discussion improves my interest and success in the course	Never (Count: 9), sometimes (Count: 70), always (Count: 66)
F28	Flipped classroom	Not useful (Count: 64), useful (Count: 45), not applicable (Count: 36)
F29	Cumulative grade point average in the last semester (/4.00)	<2.00 (Count: 17), 2.00-2.49 (Count: 38), 2.50-2.99 (Count: 25), 3.00-3.49 (Count: 40), above 3.49 (Count: 25)
F30	Expected cumulative grade point average in the graduation (/4.00)	<2.00 (Count: 16), 2.00-2.49 (Count: 38), 2.50-2.99 (Count: 61), 3.00-3.49 (Count: 30), above 3.49 (Count: 0)
Class	Outcome	fail (Count: 67), pass (Count: 78) 'fail' includes FF, DD, and DC scores 'pass' includes CC, CB, BB, BA, and AA scores Raw class information: FF (Count: 8), DD (Count: 35), DC (Count: 24), CC (Count: 21), CB (Count: 10), BB (Count: 17), BA (Count: 13), AA (Count: 17)

Table 2. The descriptive statistics concerning the transformed dataset

#	Min	Max	Mean	Median	Mode	Variance	Kurtosis	Skewness
F1	1	3	1.62	2	2	0.38	-0.64	0.44
F2	1	2	1.60	2	2	0.24	-1.86	-0.41
F3	1	3	1.94	2	2	0.29	0.50	-0.05
F4	1	5	3.57	3	3	0.65	-0.19	0.37
F5	1	2	1.66	2	2	0.23	-1.54	-0.69
F6	1	2	1.60	2	2	0.24	-1.86	-0.41
F7	1	2	1.58	2	2	0.25	-1.92	-0.32
F8	1	5	1.63	1	1	1.04	2.58	1.76
F9	1	4	1.62	1	1	1.13	0.89	1.55
F10	1	4	1.73	2	1	0.61	-0.84	0.60
F11	1	6	2.28	2	1	1.50	-0.38	0.57
F12	1	6	2.63	3	3	1.32	-0.58	0.20
F13	1	5	2.81	3	2	1.85	-1.14	0.31
F14	1	3	1.17	1	1	0.24	7.34	2.88
F15	1	5	2.36	2	2	0.65	1.29	1.36
F16	1	5	2.81	3	4	1.77	-1.22	-0.03
F17	1	5	2.20	2	2	0.84	1.05	0.90
F18	1	3	1.94	2	2	0.32	0.20	-0.02
F19	1	3	2.01	2	2	0.29	0.51	0.01
F20	1	2	1.21	1	1	0.17	-0.01	1.41
F21	1	3	1.21	1	1	0.35	5.18	2.63
F22	1	2	1.24	1	1	0.18	-0.52	1.22

F23	1	3	1.34	1	1	0.38	1.52	1.64
F24	1	3	1.17	1	1	0.17	5.37	2.42
F25	1	3	2.54	3	3	0.32	-0.43	-0.76
F26	1	3	2.06	2	2	0.46	-0.78	-0.07
F27	1	3	2.39	2	2	0.37	-0.65	-0.44
F28	1	3	1.81	2	1	0.66	-1.38	0.37
F29	1	5	3.12	3	4	1.69	-1.19	-0.08
F30	1	4	2.72	3	3	0.84	-0.69	-0.30
Class	0	1	0.54	1	1	0.25	-2.00	-0.15

Feature Selection

Feature selection is a sub-field of the machine learning study area. Feature selection is the task of choosing a subset of the attributes employed in the model-building process and it is preferred due to three reasons: facilitating the interpretation of models readily (James et al., 2013), decreasing the classifier training time, and preventing overfitting based errors (Bermingham et al., 2015). Feature selection is categorized into four strategies: the filter methods, the wrapper methods, the embedded methods, and the hybrid methods. The filter methods utilize the statistical aspects of the dataset independently of machine learning models (Bolón-Canedo et al., 2013). The wrapper methods search for the most suitable feature subset concerted to a machine learning algorithm by considering the relevance of features to each other (Kohavi & John, 1997). The embedded methods concern the classifiers that conduct good learning about which of the chosen feature subsets. Those methods look like the wrapper method. Whereas in an embedded approach, the learning stage affects the search process. Thereby, this reduces the computational cost, as well. The last approach is a fuse of all the above-mentioned strategies.

In this study, L1-based feature selection has been used, which is a sort of wrapper approach for the feature selection process. L1-based feature selection is a meta-strategy that is used with any classifier that nominates importance to each feature by a specific quantity. The features are supposed trivial if the importance values of the features are underneath a certain threshold value. SVM classifiers (Vapnik & Lerner, 1963) using the linear kernel and L1 norm deliver sparse solutions. Thus, the dimensionality of the data is decreased to choose the non-zero factors. Briefly, a beneficial sparse classifier for this objective is LinearSVC. Finally, the regularization parameter in SVM adjusts the sparsity. The fewer features can be selected with small regularization parameters.

In spite of the popularity of the Lasso as a variable-choosing strategy, the issue of constructing well-founded inferences for a model selected by the Lasso is not greatly resolved. Cai and Yuan have proposed a method called covariance test statistics to test the significance of the predictor variables chosen by Lasso. The researchers argue that the chi-squared test fails when applying to the forward stepwise regression or the Lasso in a vanilla fashion (Lockhart et al., 2014).

Machine Learning Algorithms

Table 3 shows the ML classifiers used in the experiments and some important parameters of them. Accordingly, these algorithms in this sub-section have shortly been mentioned.

Classification and regression trees (CART) are a tree-based machine learning classifier (Breiman et al., 1984). CART builds straightforward but effective models by recursively dividing the data space to extract a hypothesis from the data and commits a greedy technique in which decision trees are created in the form of a top-down recursively to be separated and conducted.

The k-Nearest Neighbors (KNN) classifier is a lazy learning algorithm known to all. The KNN classifiers detect k data points that are nearest to a data point in question in a data space (Beyer et al., 1999). The bias-variance balance of a KNN model can be adjusted by the parameter k (Manning & Raghavan, 2009). Foremost, a distance metric is required to quantify proximity between points in a data space (Han & Kamber, 2006). In this regard, there exist a few conventional distance metrics: Euclidean distance, the City Block distance, etc. In addition to detecting the optimal k value, choosing a fitting distance metric is significant in terms of high classification accuracy (Hechenbichler & Schliep, 2004).

The naive Bayes (NB) is one of the most commonly used classifiers in the ML area. The NB classifier is frequently used in cases where the independent variables are not actually conditionally independent given the dependent variable, as well. NB can perform unexpectedly well, even when the conditional independence assumption is mostly incorrect. In other words, although NB assumes the conditional independence of all input

variables, given a single outcome variable, it turns out to accomplish unusually well in numerous applications (Russell & Norvig, 2010).

The random forest (RF) algorithm is a meta-classifier that fits a series of decision tree algorithms on the division of the dataset and uses averaging to increase classification accuracy and prevent high variance problems (Ghosh & Cabrera, 2022). When the number of sub-samples is not controlled with the corresponding hyperparameter, the entire dataset is employed to form each tree.

Support Vector Machines (SVM) are a number of supervised learning models employed for various ML tasks. SVM can run effectively on high-dimensional datasets. Additionally, it is also partly influential on datasets where the number of features is larger than the number of instances. SVM efficiently uses memory by means of support vectors. For linearly inseparable data points, it allows the use of kernel functions. However, despite these advantages of SVM, it has some crucial disadvantages. In cases where the number of dimensions is much larger than the number of data points, the high variance problem should be paid attention. Lastly, SVM does not directly deliver probabilistic estimations (Baudat & Anouar, 2000; Burges, 1998; Cristianini & Shawe-Taylor, 2000; Lin et al., 2007).

Table 3. The machine learning algorithms that are used in the experiments.

Algorithm	Parameter values
Classification and Regression Trees (CART)	Criterion = “gini”, splitter = “best”
K-Nearest Neighbors (KNN)	N_neighbors = 8, weights = “distance”, metric = “euclidean”
Naïve Bayes (NB)	Force_alpha = True
Random Forest (RF)	Bootstrap = True
Support Vector Machines (SVM)	Kernel = “linear”, C = 1

Evaluation Criteria

The classification accuracy rate in Equation (1) and F1-score in Equation (5) to evaluate the performance of the algorithms have been used. ACC specifies the number of instances classified correctly within all the instances.

$$Accuracy = \frac{1}{m}\sum_{i=1}^{m}\delta(a_i, p_i) \tag{1}$$

$$\delta(x, y) = \begin{cases} 1, & x = y \\ 0, & x \neq y \end{cases} \tag{2}$$

where a denotes the true class labels and p denotes the predictions. In Equation (3), the precision value specifies the rate of positive instances classified correctly within instances predicted as positive. The recall value in Equation (4) specifies the rate of positive instances classified correctly within instances whose actual classes are positive. F1-score is the harmonic mean of precision and recall values as seen in Equation (5). If the F1-score is greater than or equal to 0.5, it can be said the model learns classes well for each of them.

$$Precision = TP/(TP + FP) \tag{3}$$

$$Recall = TP/(TP + FN) \tag{4}$$

$$F1 - score = 2 \times Precision \times Recall/(Precision + Recall) \tag{5}$$

where TP, FP, and FN denote true positive, false positive, and false negative, respectively. TP indicates instances classified correctly as positive. FP is instances classified incorrectly as positive. FN points instances classified incorrectly as negative.

Area Under the Curve (AUC) is a performance criterion for classification problems at a variety of threshold values and it indicates the measurement of separability. AUC describes how much the model is qualified for differentiating between classes. The higher the AUC, the better the model distinguishes classes better.

Experimental Procedure

In this research, Google Colab as a programming and numeric computing platform has been used and all the experiments have been performed under 10-fold cross-validation (CV). Thus, the classifiers have been trained on the same training and test sets each time. Subsequently, the performance of each classifier has been measured. CV provides a method of separating data into almost equal parts so as to estimate a classifier's performance on a test set.

FINDINGS

This section contains the findings that are needed to reinforce the conclusions of this research. Table 4 shows the comparative results of the classifiers in terms of accuracy, F1-score, precision, recall, and AUC before the feature selection process. In terms of classification accuracy, CART, KNN, RF, and SVM correspond to 0.5929, 0.5590, 0.6367, and 0.6076, respectively. Accordingly, the RF classifier delivered the highest average accuracy rate before the feature selection process. The SVM classifier ranks second after RF. In terms of F1-score, CART, KNN, RF, and SVM correspond to 0.6170, 0.5893, 0.5859, and 0.6145, respectively. Accordingly, the CART classifier yielded the highest average F1-score value before the feature selection process. The SVM classifier ranks second after CART. In terms of the weighted average of the accuracy rate and F1-score values, the RF classifier ranks first by 0.6113. Whereas the SVM classifier ranks second by 0.6111. As a result, it can be said that the RF classifier is successful on the original dataset compared to the other classifiers. Additionally, the RF classifier builds transparent models that can be understandable by human experts. In terms of training time, the RF classifier takes 3.6 seconds. But this time can be reduced by adjusting some hyperparameters of the RF classifier. In this case, the performance of the model may fall. However, this dataset does not have a large amount of data. On average, CART, SVM, KNN, and NB take 118, 149, 81, and 94 milliseconds, respectively.

Table 4. The comparison of the classifiers in terms of accuracy, F1-score, precision, recall, and AUC before the feature selection process

Algorithm	Accuracy	Precision	Recall	F1 score	AUC
CART	0.5929	0.6332	0.6143	**0.6170**	0.5929
KNN	0.5590	0.5800	0.6179	0.5893	0.6267
RF	**0.6367**	**0.6819**	**0.7054**	0.5859	**0.6618**
SVM	0.6076	0.6588	0.6161	0.6145	0.6380

Table 5 shows the comparative results of the classifiers in terms of accuracy, F1-score, precision, recall, and AUC after the feature selection process. The features F4, F8, F9, and F29 have been selected by the L1-based feature selection method after the feature selection process. Meanwhile, the feature F29 (i.e., Cumulative grade point average in the last semester) is important to estimate students' general performance, not final grades. Therefore, the fact that this feature was selected during the Feature selection process is also compatible with our intuition. In terms of classification accuracy, CART, KNN, NB, RF, and SVM correspond to 0.7700, 0.7781, 0.7100, 0.7295, and 0.7033, respectively. Accordingly, the KNN classifier delivered the highest average accuracy rate before the feature selection process. The CART classifier ranks second after KNN. In terms of F1-score, CART, KNN, NB, RF, and SVM correspond to 0.7888, 0.7848, 0.7212, 0.7190, and 0.7256, respectively. Accordingly, the CART classifier yielded the highest average F1-score value before the feature selection process. The KNN classifier ranks second after CART. In terms of the weighted average of the accuracy rate and F1-score values, the KNN classifier ranks first by 0.7815. Whereas the CART classifier ranks second by 0.7794. As a result, it can be said that the KNN classifier is successful on the transformed dataset compared to the other classifiers. However, the results of the KNN and CART classifiers are close to each other. Besides, while the CART classifiers generate transparent models, the KNN classifiers build black box models. In other words, the tree-based models are comprehensible to human experts. Therefore, the tree-based model has been preferred in this study.

Table 5. The comparison of the classifiers in terms of accuracy, F1-score, precision, recall, and AUC after the feature selection process

Algorithm	Accuracy	Precision	Recall	F1 score	AUC
CART	0.7700	0.8071	**0.7911**	**0.7888**	0.7260
KNN	**0.7781**	**0.8227**	0.7643	0.7848	0.7533

NB	0.7100	0.7566	0.7161	0.7212	0.7368
RF	0.7295	0.7698	0.7393	0.7190	0.7440
SVM	0.7033	0.7230	0.7554	0.7256	**0.7536**

For a suitable selection of the regularization parameter (i.e., alpha), the Lasso can entirely rescue the exact set of non-zero variables employing only a few observations, providing that typical conditions are encountered. Especially, the number of instances should be adequately big, otherwise, L1 models will randomly run due to reasons such as the number of features, and the amount of noise. There does not exist a widespread rule to choose an appropriate alpha value for the rescue of non-zero coefficients. This selection can be performed by LassoCV or LassoLarsCV. However, this strategy might cause under-penalized models. Unlike those, LassoLarsIC is disposed to determine high values of alpha. Figure 2 explains the changes in the accuracy and F1-score values of the CART classifier according to the regularization parameter during the feature selection process. Accordingly, the highest accuracy and F1-score values have been obtained while the value of the regularization parameter is 0.02. While the value of the regularization parameter increases, the accuracy rate and F1-score values of the CART classifier decrease, as well. On the contrary, the number of features of the model increases. Consequently, the L1-based feature selection method has selected the features F4, F8, F9, and F29 during the feature selection process.

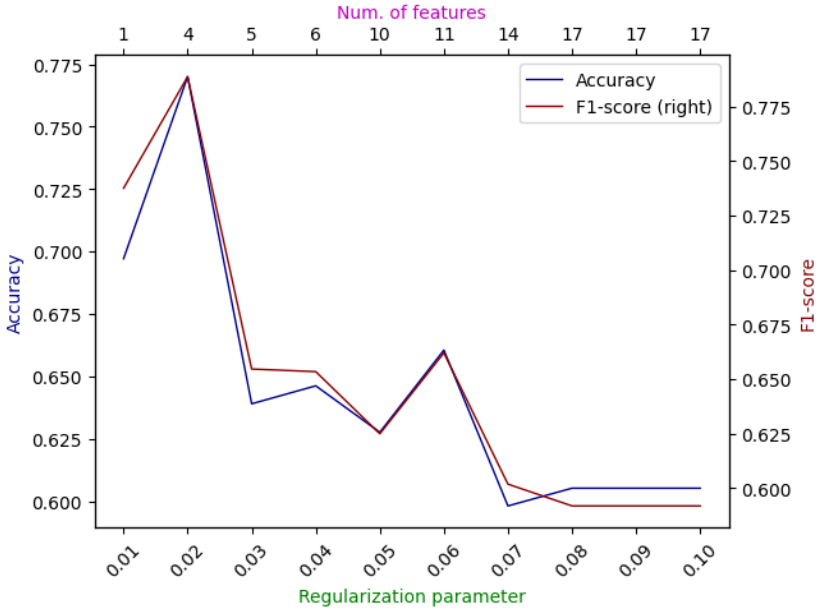

Figure 2. The changes in the accuracy and F1-score values of the CART classifier according to the regularization parameter during the feature selection process.

The CART classifier provides a strategy named cost complexity pruning to prevent a tree from overfitting or from another perspective, to control the size of a tree. This pruning approach is parameterized by alpha. Larger values of alpha increase the number of nodes pruned. Figure 3 shows the change in the accuracy rate of the CART classifier on training and testing sets according to the change in the hyperparameter alpha. Accordingly, the highest alpha value is selected by keeping on high accuracy rate on the test set. Thus, the eleventh model has been selected. The accuracy rate of this model is 0.7919. Namely, the accuracy rate of the model has increased a little. Also, the decision tree model is simplified.

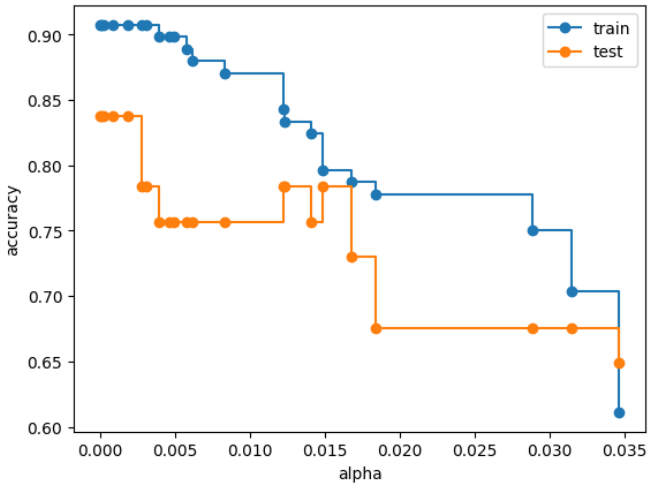

Figure 3. Accuracy vs alpha for training and test sets in terms of the CART model

Figure 4 shows the confusion matrix of the model that is constructed by using the CART classifier. Accordingly, the number of instances that are predicted correctly is 62 for the class 'pass'. For the class 'fail', the number of instances that are predicted correctly is 50. Thus, the number of instances that are predicted correctly is 112 in total. The 33 instances are in total predicted incorrectly. For both 'fail' and 'pass' classes, the number of instances predicted incorrectly is almost the same.

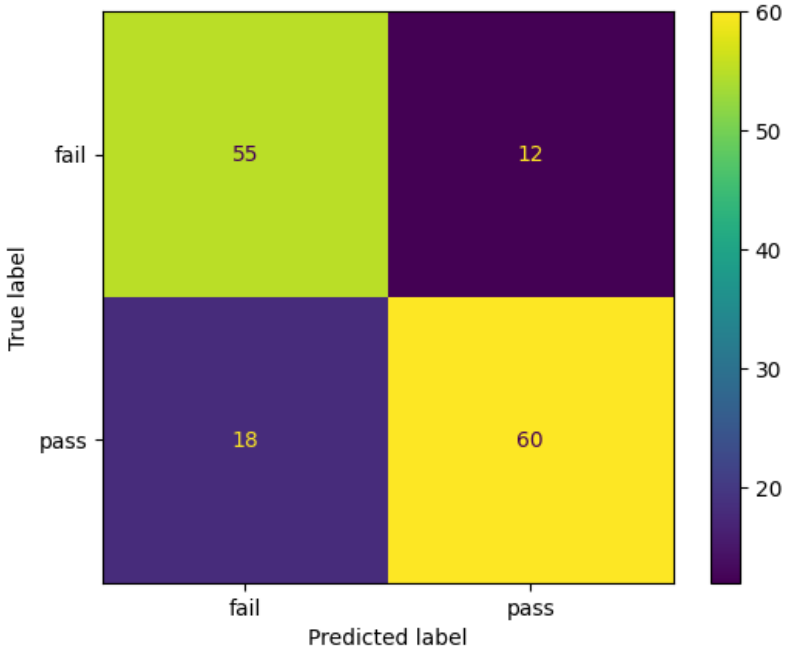

Figure 4. The confusion matrix for the CART classifier after post pruning

Figure 5 shows the decision tree model of the CART classifier. The first row in each node represents the threshold value of the feature of interest (e.g., F29 <= 2.5 for the root). The second row corresponds to Gini index value calculated for situation of interest. Speaking of which, the lower the Gini index, the more homogeneous the node is. The third row denotes the number of instances used in the calculation of the Gini index. As for the fourth row, for instance, the root node has value = [67, 78] which points there are 67 samples of class 'fail' and 78 samples of class 'pass' at the root node. Traversing the tree, the instances are divided, and hereby, the value array reaching each node changes. The last row indicates the majority class after the samples are split.

Figure 5. The decision tree model of the CART classifier after post pruning

Figure 6 shows the decision surfaces of the CART classifier trained on pairs of features. Here, for each pair of features, the decision tree learns decision boundaries that are built combinations of uncomplicated decision rules inferred from the training set. As seen Figure 6, decision tree models yield simple rules, but they are non-linear. In this regard, they are effectively used on non-linear datasets. Furthermore, implementing and deploying decision tree models is easy in terms of programming.

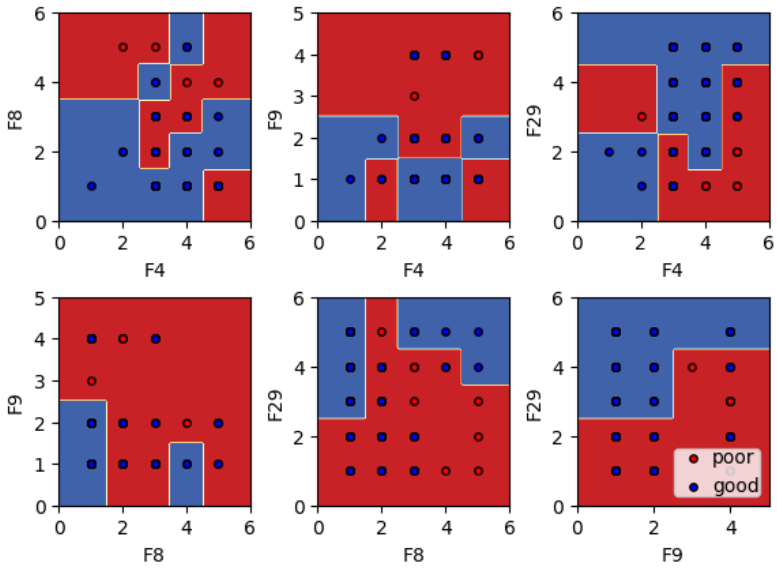

Figure 6. The decision surfaces of the CART classifier trained on pairs of features.

To sum up, throughout the model creation process, it has been observed that the performance of the models built without the feature selection process is low. To this end, the feature selection algorithms (i.e., Univariate feature selection, Tree-based feature selection, and L1-based feature selection) have been applied to the dataset. The performance of Univariate and Tree-based feature selection methods was not as good as the L1-based feature selection method. The L1-based feature selection method delivers good performance because it adopts the wrapper approach. The features that yield the best performance by the L1-based feature selection method have been selected. These features are: F4, F8, F9, and F29. To put it more explicitly, these are scholarship type, total salary, transportation to the university, and cumulative grade point average in the last semester. Subsequently, machine learning algorithms have been applied to the new dataset with 4 features. CART classifier delivered more performance compared to the other algorithms on this new dataset. When the tree-based model has been examined, the feature F29 has been placed at the root node. In other words, the Gini index value calculated for the feature F29 is lower than the other features. The smaller the Gini index the lower the uncertainty because the Gini index value is used to measure the impurity or purity of features. Accordingly, the cumulative grade point average in the last semester is the most important feature to predict the students' performance. After feature F29 at the root node, the purity of feature F4 is higher compared to features F8 and F9 for the left branch of the tree. Subsequent to feature F29 at the root node, the purity of feature F9 is higher compared to features F4 and F8 for the right branch of the tree. Finally, as traversing root to down, note that the purity values of these features will change.

DISCUSSION AND CONCLUSION

When the other works are explored to glimpse the importance of the attributes obtained across the feature selection process, Aslanargun et al. have reached the conclusion that the academic success of children whose families do not have economic troubles is high because they can easily attain adequate opportunity and support and their self-confidence and self-esteem are high (Aslanargun et al., 2016). In this respect, their research supports F4, F8, and F9 are proper to model the students' performance. In addition to Aslanargun's work, Sarıer's study has also shown that one of the variables that positively affect students' mathematics success is socio-economic status in TIMSS applications (Sarıer, 2020). Namely, these two papers overlap with the results obtained in this study. In the study (Şahin & Demirtaş, 2014) conducted on the academic success of foreign students, it was concluded that students who use public transport have difficulty in paying transport fees and also that the academic success of these students is low. As a result, the tie between students' academic performance and the ways they commute to school in their study overlaps with the results of this study. In the study (Akdamar & Kızılkaya, 2022) conducted on university students' academic procrastination tendencies, it was observed that students with low-grade point averages showed academic procrastination tendencies such as not completing homework on time and studying late for exams. This explains why students whose academic grade point average was low in the last semester will be able to have low-grade points in the next semester.

Numerous studies on forecasting students' performance have been realized. However, there exist some distinctions between this study and similar works. For instance, while studies done by Pallathadka, Salah Hashim, and Yılmaz concentrate on predicting students' final grades, this work focuses on students' general performance.

Therefore, the number of categorical values of the class has been reduced from to two: ‘fail’ and ‘pass’. Besides, in this paper, while the highest-performance model is transparent-based (e.g., a CART model), the performance of black box models in the studies done by Ismail, Pallathadka, Salah Hashim, and Yılmaz is higher. Transparent models can be understood by human experts and a new knowledge extraction is achievable in such models. However, understanding black box models (e.g., SVM, NB, Radial-based Neural Networks) is challenging and can even be incomprehensible for human experts. Further, Sa et al. have utilized solely tree-based models in their investigation. However, the performance of these models is rather low. More addition, Shanmugarajeshwari and Lawrance have employed a C5 model in their work. However, the dataset from which they benefit is small in comparison to the dataset employed in this paper. Considering the works that are similar to the outcomes of this study, the features such as scholarship type, total salary, transportation to the university, and cumulative grade point average in the last semester affect students’ performance more in comparison with the other features. Moreover, it is possible to model Students' performance by using only these four features. Besides, it is easy for human experts to comprehend the tree-based model, as well. This leads to obtaining new knowledge. All in all, such models formed by AI systems will hereafter be a pioneer in increasing students' performance.

This study was conducted on a certain data set. Different results can be obtained by applying it to different data sets. Additionally, different results can be obtained by applying different algorithms and methods to data sets. Naturally, the performance of models will be decisive in this situation. In a nutshell, training data, feature selection methods, machine learning classifiers, and data transformation methods all determine the final model. Therefore, many remarkable new investigations on EDM will be able to be carried out in the near future with the development of new approaches and algorithms for AI.

Statements of Publication Ethics

All authors declare that they obey the principles of publication ethics.

Conflict of Interest

This study has no conflict of interest.

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Comparison of Different Bandwidth Determination Methods in Kernel Equating

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Abstract

The study aims to compare the Gaussian Kernel, Logistic Kernel, and Uniform Kernel methods for determining the bandwidth parameter in the Kernel equating on TIMSS data. A bandwidth parameter needs to be determined when Kernel equating is used to equate two test forms. The bandwidth parameters determine the smoothness of the continuous score distributions, so their effect on equating results is critical. Gaussian Kernel, Logistic Kernel, and Uniform Kernel methods were used for bandwidth selection, and the results were compared according to the Percentage Relative Error (PRE), the Standard Error, and the Standard Error of Equating Difference (SEED). The findings of the study show that the three different approaches to minimizing the penalty function have similar results. Although the standard errors of the equated scores obtained with the uniform Kernel method were slightly smaller, the results were almost the same as the other two approaches. When the three equating methods were compared according to the percent relative error, the distribution obtained from Gaussian Kernel equating was more consistent with the population distribution.

Keywords: Kernel equating, bandwidth selection, continuousization

Kernel Eşitlemede Farklı Bant Genişliği Seçimi Yöntemlerinin Karşılaştırılması

Öz

Bu çalışma, Kernel eşitleme yönteminde bant genişliği parametresinin belirlenmesi için sunulan yöntemleri gerçek bir veri seti üzerinde karşılaştırmayı amaçlamaktadır. Kernel eşitlemenin süreklileştirme adımında eşitleme yapabilmek için bir bant genişliği parametresinin belirlenmesi gerekir. Bant genişliği parametresi, sürekli puan dağılımlarının düzgünlüğünü belirler, bu nedenle eşitleme sonuçları üzerindeki etkileri kaçınılmazdır. Bant genişliği seçiminde Gauss Kernel, Lojistik Kernel ve Tek Biçimli Kernel yöntemleri kullanılmıştır ve sonuçlar bağıl hata yüzdesi, standart hata ve eşitleme farkına ait standart hataya göre karşılaştırılmıştır. Çalışmanın bulguları, penalty/ceza fonksiyonunun minimize edilmesine yönelik üç farklı yaklaşımın benzer sonuçlar verdiğini göstermektedir. Tek Biçimli Kernel yöntemiyle elde edilen eşitleme puanlarının standart hataları biraz daha küçük olsa da sonuçlar diğer iki yaklaşımla neredeyse aynıdır. Üç eşitleme yöntemi bağıl hata yüzdelerine göre karşılaştırıldığında ise Gauss Kernel eşitlemesinden elde edilen dağılımın evren dağılımıyla daha tutarlı olduğu görülmektedir.

Anahtar Sözcükler: Kernel eşitleme, bant genişliği parametresi seçimi, süreklileştirme

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INTRODUCTION

In the process of ensuring the fairness of a test administered at different times or different versions of the same standardized test for test takers, test equating studies have emerged. Test equating is a statistical process that involves adjusting test scores to allow different test forms to be used interchangeably. The equating function has five important properties (Dorans & Holland, 2000):

The Same Construct: The tests being equated should measure the same construct,

The Equity: For test takers, it makes no difference whether they take any of the tests to be equated,

The Equal Reliability: Two tests cannot be equated if they measure the same construct but have different reliability,

The Symmetry: The inverse of the equating function equating scores in form X to scores in form Y should equate scores in form Y to scores in form X,

Population invariance: There should be no difference between the selection of sub-populations for X and Y tests, in other words, for the equating function equating X scores to Y scores, the populations of these forms should be invariant.

All these properties are to ensure that the test scores to be equated are used interchangeably. Checking these five properties is important for us to decide whether the equating is appropriate or not. On the other hand, meeting these five properties alone is not sufficient for test equating. This decision also depends on the purpose for which the test will be administered (Kolen & Brennan, 2014). For example, some tests are administered once a year and students are ranked based on the goals of the institution. If the test is administered to identify the highest-performing student, then test equating is not necessary. On the other hand, if several test forms are administered for a common purpose and the differences between the relative item difficulties of these test forms are not intended to affect student assessment, test equating should be used. However, Dorans and Holland (2000) stated that instead of taking these features as a theoretical basis for test equating, we should focus on the question of whether two tests can be equated.

In order to equate test scores, firstly it is necessary to select the appropriate test equating design and test equating method. One of these test equating methods is the Kernel equating described by Holland and Thayer (1989) and later developed by von Davier et al. (2004). Kernel equating differs from other traditional equating methods in that it uses different smoothing approaches to continuousize discrete score distributions.

Kernel equating is a family of equipercentile equating functions and a special case of the linear equating function, so it is a combined test equating approach. This method is so named because of the Kernel function used in nonparametric density estimation (Silverman, 1986; Tapia & Thompson, 1978). Kernel equating involves five steps (von Davier et al., 2004): pre-smoothing, estimation of score probabilities, continuizing the discrete score distributions, equating, and computing the standard error of the equating. In the continuousization step, it is aimed to continuousize the discrete test score distribution. For this, bandwidth parameters need to be chosen. Gaussian Kernel, logistic Kernel or uniform Kernel approaches can be used to continuousize the discrete functions (von Davier et al., 2004).

There are many studies in the literature comparing Kernel equating with other equating methods. In one of these studies, Livingston (1993) compared Kernel equating with other traditional equating methods and found that Kernel equating gives more precise results in terms of standard errors and is more effective than other equating methods with its explicit formula for standard error calculation. In another study comparing Kernel and other observed score equating methods in a real data set, it was found that the difference between Kernel and other traditional equating methods was very small in the equivalent groups design, and in the common-item non-equivalent groups (CINEG) design, Kernel equating gave similar results with equipercentile equating excluding low score ranges (Mao, et al., 2006). In another study conducted with SAT data, Kernel equating results were quite similar to other equating methods (Liu & Low, 2008). However, when the anchor score distributions of the two populations in different forms were similar, it was observed that even the equating methods with different assumptions gave the same or very similar results. In the study examining loglinear presmoothing in terms of equating bias, chained and post-stratification equating methods and Kernel equating were evaluated according to sample sizes, and it was concluded that presmoothing methods with fewer parameters were more biased and

standard error estimation was more precise and accurate in large samples (Moses & Holland, 2007). In the study investigating the effect of atypical extremes on test equating, Kernel estimation yielded more accurate results than traditional equating methods at the ends of the distribution (Cid & von Davier, 2015). There are many studies comparing Kernel equating with other equating methods. In general, Kernel equating has shown similar results with other equating methods. In addition to studies comparing the Kernel equating method with traditional equating methods, there are also studies on the continuization step of Kernel equating.

Liou, et al. (1996) examined the function of simplified formulas to calculate the standard error of the smoothed score distributions that are continuousized using Uniform and Gaussian Kernel functions. The simplified formulas gave good results for equating both observed and smoothed scores. In another study, Lee, and von Davier (2008) examined the impact of different Kernel functions on equating results. Using an equivalent group design, the results show that the characteristics of the tail function of Kernel functions have a large impact on the continuized score distributions. On the other hand, the equated scores obtained using different Kernel functions do not vary much except for the outliers. In another study evaluating the performance of various functions for Kernel density estimation, it was found that uniform Kernel estimation gave poor results compared to other Kernel methods (Soh, et al., 2013). In addition, bandwidth analysis shows that the performance deteriorates as the bandwidth increases.

It has been stated that the choice of the appropriate bandwidth parameter is important in the step of continuousizing the discrete score distribution. The continuousization step, which is considered the most important step of Kernel equating, is very important in terms of ensuring the similarity of the continuized discrete score distribution to the population distribution. Therefore, it is not surprising that studies focused on these issues.

Holland and Thayer (1987) stated that choosing the appropriate bandwidth for the data minimizes the sum of squares of the difference between the continuous distribution and the observed distribution. Moreover, Häggström and Wiberg (2014) emphasized that the choice of band is important because it has a direct impact on the equated scores. It was emphasized that the choice of bandwidth has more influence, especially for extreme scores. Livingston (1993) showed empirically that the bandwidth is not affected by bias in equating for small values. When the sample size is larger than 1000, the standard error formula works quite efficiently. Although the increase in the bandwidth increases the accuracy of the standard error estimation, it is notable that standard error estimations with large bandwidths may be biased in distributions whose score distributions are smoothed using a log-linear model. In another study, a data-adaptive bandwidth tended to be unstable in small samples by minimizing the square of the difference between the observed and continuous distributions (Liou et al., 1996). In this case, an extremely small bandwidth (B = 0.007, and N_X = 100) can be chosen for equating highly scattered distributions.

The bandwidth variable is mathematically complicated as it involves many calculations. In practice, a fixed bandwidth seems to be appropriate for minimizing the square of the differences, but it is clearly still in need of further investigation based on the results of the research. For this purpose, in this study different approaches to selecting the bandwidth parameter used to minimize the penalty function are discussed and presented. In this context, the comparison of three different bandwidth selection approaches (Gaussian, Logistic and Uniform) is considered to be useful in evaluating the accuracy of the continuization step. It is also thought to contribute to the field of "optimal bandwidth selection", which continues to be discussed in the literature. Thus, the research problem is "What is the effect of Uniform, Logistic and Gaussian bandwidth selection approaches on equating results in kernel equating?"

The fact that Kernel equating provides a clear formula for the standard error by using the information in the presmoothing step and allows comparison using the standard error of the difference between the two equating functions gives it an advantage over other equating methods. In this context, the study examined how the equating results of the scores obtained from equivalent test forms according to the Kernel equating method change according to different bandwidths.

METHOD

Equating Design

In the data collection process of the study, a CINEG design was used for test equating. This design is commonly used in exams where only one test form can be administered. For this design, different test forms called old form (Y) and new form (X), with a common set of items (anchor / A) are administered to each of the individuals

of two groups (G_1, G_2) from different populations (P, Q) as shown in Table 1. The common set of items should be as similar as possible to the test forms in terms of both statistical and content characteristics (Kolen & Brennan, 2014).

Table 1. Common-Item Non-Equivalent Groups Design

Population	Sample	**X**	**A**	**Y**
P	G_1	✓	✓	
Q	G_2		✓	✓

Note. P and Q represent different universe, A: anchor items, X : new form, Y : old form

In the study, since the eighth and ninth booklets of the TIMSS 2011 eighth grade mathematics subtest, which had 19 common items, were taken by the whole study group and these common items were included in the scoring together with the other items, a CINEG design with internal common items was used.

Study Group and Data Collection Tools

In the study, the eighth and ninth booklets of the TIMSS 2011 eighth grade mathematics subtest, which have 19 common items, were used. Accordingly, 494 students taking the eighth booklet and 502 students taking the ninth booklet, totally 996 students, constituted the study group. The eighth and ninth booklets of the TIMSS 2011 eighth grade mathematics subtest consisting of 34 multiple-choice questions were used as data collection tools.

Data Analysis

The data were analysed in three stages. In the first stage, moments were obtained by calculating the descriptive statistics of the old form (Y), new form (X) and anchor items (A) used in the study.

Distributions and Moments for the forms of X, Y and A

In this study, Form X scores were equated to Form Y scores. Table 2 shows the descriptive statistics of Forms X and Y, which consist of 19 common items.

Table 2. Descriptive Statistics for Forms X and Y

Form	Mean	S.D.	Skewness	Kurtosis	Min	Max.	N
X	11.051	7.546	0.981	0.008	0	33	494
Y	12.092	8.394	0.843	-0.414	0	34	502

According to the means in the Table 2, it can be said that Form X is more difficult than Form Y. However, according to the skewness and kurtosis values, it was seen that the distributions of the different groups of students who took both forms did not differ much from the normal distribution. When the standard deviation values of the forms X and Y were analysed, it was seen that the variance in Form Y was larger. This table is important in terms of comparing the moments of the score distributions after presmoothing and equating.

In the second stage, Kernel equating was used to obtain equated scores for different bandwidth selection approaches. These bandwidth approaches used in the research were described briefly.

The Gaussian Kernel Method.

This approach requires using a Gaussian Kernel function to continuousize the discrete score distribution in the third step of Kernel equating.

Define $\hat{f}(x_i)$ as a smoothed frequency distribution for the discrete score variable and Φ as the ordinate of a standard normal distribution. The continuous distribution of the random variable x* in the form in R(x_i, x^*) associated with the difference between x_i and x^* is as follows:

$$\hat{f}_{kernel}(x^*) = \frac{1}{constant} \sum_{i=0}^{K} \hat{f}(x_i) \Phi[\, R\,(x_i, x^*)]$$

At each discrete score point, the Kernel equating method uses a normally distributed Kernel to spread the score distribution over the range -∞, +∞. The wider the band parameter, the more intense the distribution at each discrete score point. Although the primary purpose of using a Gaussian Kernel is to make the distribution of scores continuous, it also provides a more uniform distribution of scores. The final distribution of the random variable of x^* is a continuous probability distribution for scores in the range -∞ to +∞. These continuous scores have the same mean and standard deviation as the distribution of discrete smoothed scores. However, scores may differ in kurtosis, skewness, and higher-order moments (Kolen & Brennan, 2014).

The Logistic Kernel Method.

The Logistic Kernel approach uses a logistic function in the third step of Kernel equating, which is the continuization of the discrete score distribution. The following logistic function is used to minimise the penalty function in this step (von Davier, 2010):

$$f_{h_x}^{(1)}(x; r) = \frac{1}{s(a_{xh_x})^2} \sum_i r_i \, k\big(R_{iX}(x)\big)\big[1 - 2K\big(R_{iX}(x)\big)\big].$$

The denser extremes and peaks of the logistic distribution led to larger cumulants than the normal distribution.

Uniform Kernel Method.

The Uniform Kernel approach requires the use of the uniform function in the third step of Kernel equating, which is the continuization of the discrete score distribution. For the optimal bandwidth parameter in the uniform Kernel, the distance between two consecutive possible scores ($2bh_x$) should be close to 1 (von Davier, 2010).

In the last stage of the data analysis, the standard errors of the equated scores were calculated, and the results obtained were compared. Kernel equating has a standard error computation method is provided based on the estimation of standard errors for score probabilities obtained using log-linear models (Anderson et al., 2013). This equation allows to calculate the standard error of the equating for all equating designs: $SEE_Y(x) = \sqrt{VAR(\hat{e}_Y(x))}$.

Another criterion used to compare different equating methods is the Percentage Relative Error (PRE) (von Davier, et al., 2004). PRE is a measure of equating bias. This value, which is obtained by calculating the difference between the moments of the distribution, is an indicator of the distance of the distribution of equated scores from the population distribution (Cid & von Davier, 2015). Before the PRE equation, the moments of Y and $e_Y(X)$ are: $\mu_p(Y) = \sum_k (y_k)^{p} s_k$ and $\mu_p(e_Y(X)) = \sum_j (e_Y(x_j))^{p} r_j$. Accordingly, $PRE_{(p)}$ for the pth moment is calculated as follows: $PRE_{(p)} = 100 \frac{\mu_p(e_Y(X)) - \mu_p(Y)}{\mu_p(Y)}$.

SPSS (version 21) and RStudio Desktop (version 1.4.1106) "*kequate*" package (Andersson et al., 2013) were used to analyze the data.

FINDINGS

In the pre-smoothing step, bivariate observed frequency distributions consisting of test scores and anchor item scores were obtained in accordance with the CINEG design, and both Form X and Form Y raw scores were smoothed according to these frequencies. The distribution of score probabilities was estimated according to the log-linear model. Models were evaluated according to the deviation of goodness-of-fit indices and AIC.

Table 3. Descriptive Statistics and Correlation Values of X, Y and Anchor Tests

	P				Q		
Test Scores	n	Mean	S.D.	Test Scores	n	Mean	S.D.
X	494	11.051	7.546	Y	502	12.092	8.394
A	494	5.988	4.750	A	502	6.436	5.039
Correlation	Form X	Anchor					

Form X	1	0.968
Form Y		0.969

Accordingly, Form X and Form Y showed adequate fit to the observed distribution for the P and Q populations based on the chi-squared values (p>0.05) at the points of $X, X^2, X^3, X^4, A, A^2, A^3, A^4, XA, X^2A^2$ and $Y, Y^2, A^2, A^3, A^4, YA, Y^2A, YA^2$, respectively.

The score probabilities were estimated by setting the weighting coefficients as w = 0.5. For the estimated distributions, bandwidths were determined according to Gaussian, Uniform and Logistic Kernel methods in the continuization step. The values that minimize the penalty function for the bandwidths were calculated. The values of h_x = 0,538, h_y= 0,557 for Gaussian; h_x = 1,0, h_y = 1,0 for uniform; and h_x = 0,395, h_y= 0,418 for logistic Kernel approach.

In the next step, the findings regarding the equated scores according to Gaussian, Uniform and Logistic Kernel equating methods were presented respectively. Figure 1 shows the relationship between the scores equated with the Gaussian Kernel equating method and the raw scores, as well as the difference in the standard error of equating in the CINEG design.

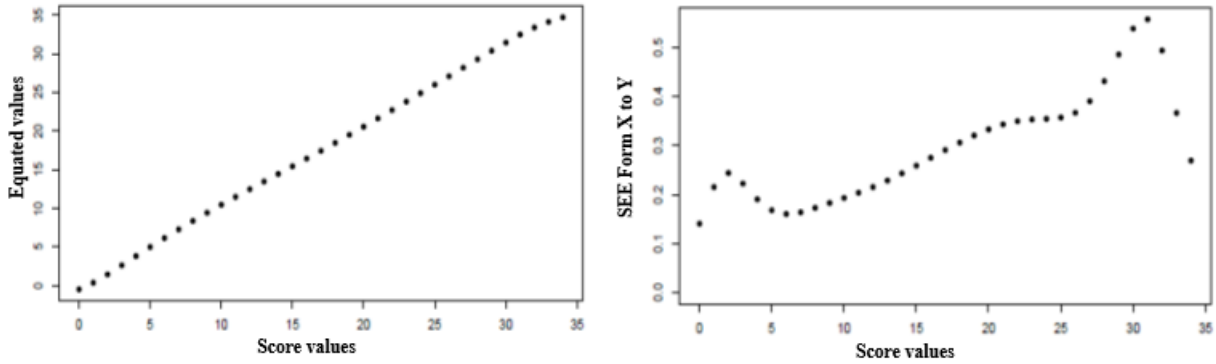

Figure 1. *Raw scores and equated scores according to Gaussian Kernel equating method.*

According to Figure 1, it can be said that the equated scores with Gaussian Kernel equating method are quite similar to the raw scores based on the linear relationship between them. When the standard error values in the next figure are examined, it is seen that the standard error is large at the lower values of the scale; however, it reaches maximum at the upper end. This indicates that the number of students who had very high scores on the test and those who had low scores may be small.

In the next step, the results were obtained according to the Uniform Kernel equating method. Figure 4 shows the relationship between the scores equated using the Uniform Kernel equating method and the raw scores and the difference in the standard error of the equating in the common-item non-equivalent groups design.

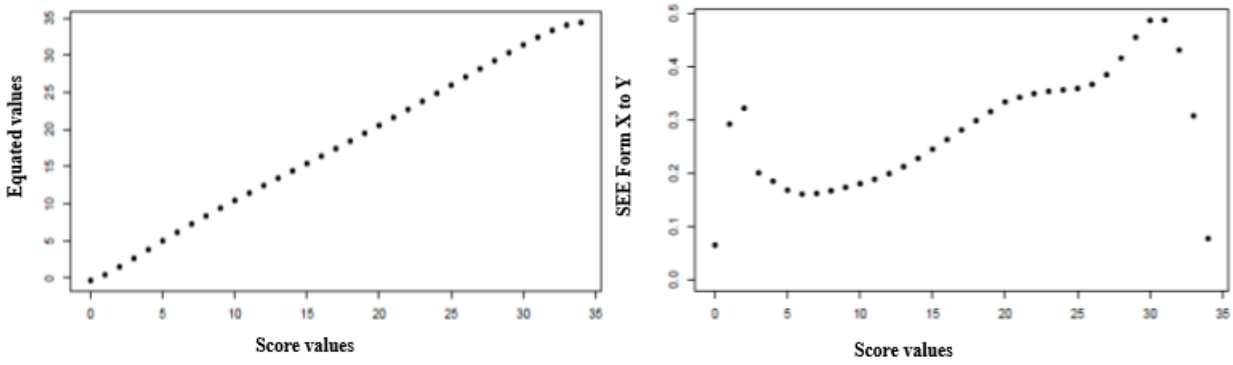

Figure 2. *Raw scores and equated scores according to Uniform Kernel equating method.*

The relationship in Figure 2 showed that the scores equated using the uniform Kernel equating method and the raw scores were quite similar. In addition, when the standard errors of the equated scores were examined based

on their distribution, it is seen that the standard errors were large in the range of 0-5 and 30-34 scores. In the range of 5-30, the standard error tends to increase.

Finally, equating results were obtained according to the Logistic Kernel equating method. Figure 5 shows the relationship between the scores equated using the Logistic Kernel equating method and the raw scores and the difference in the standard error of the equating in the CINEG design.

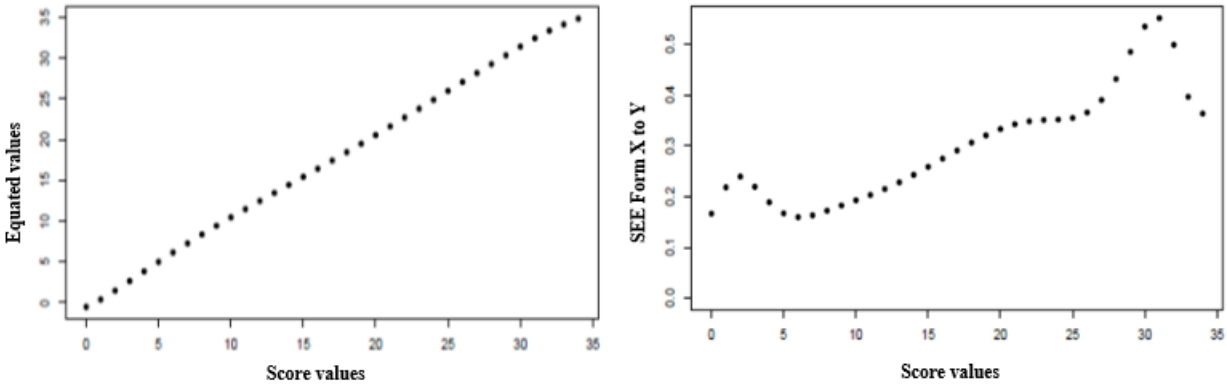

Figure 3. *Raw scores and equated scores according to Logistic Kernel equating method.*

The relationship between the scores obtained by logistic Kernel equating and the raw scores was linear, as shown in Figure 3, and thus the scores were quite similar. When the standard error of the logistic Kernel equating was examined, it was seen that the standard error is large at the lower and especially at the upper endpoints.

In the last step of Kernel equating, the standard error of the equating function can be estimated, as well as the standard error of the equating difference (SEED), which allows the comparison of different equating results. SEED values, which allow pairwise comparison of equating results, were compared in the following order: Logistic-Gaussian, Uniform-Gaussian, Uniform-Logistic.

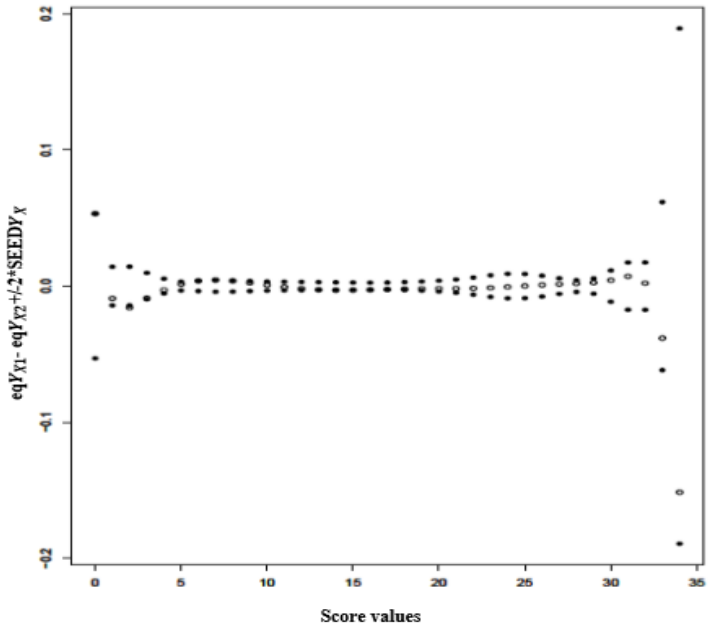

Figure 4. The difference between Gaussian Kernel and Logistic Kernel in relation to SEED for each score range.

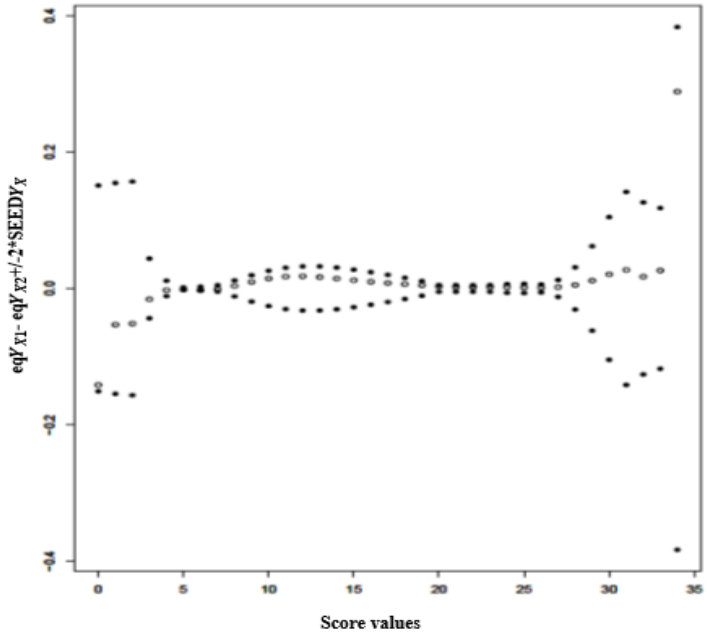

Figure 5. The difference between Gaussian Kernel and Uniform Kernel in relation to SEED for each score range.

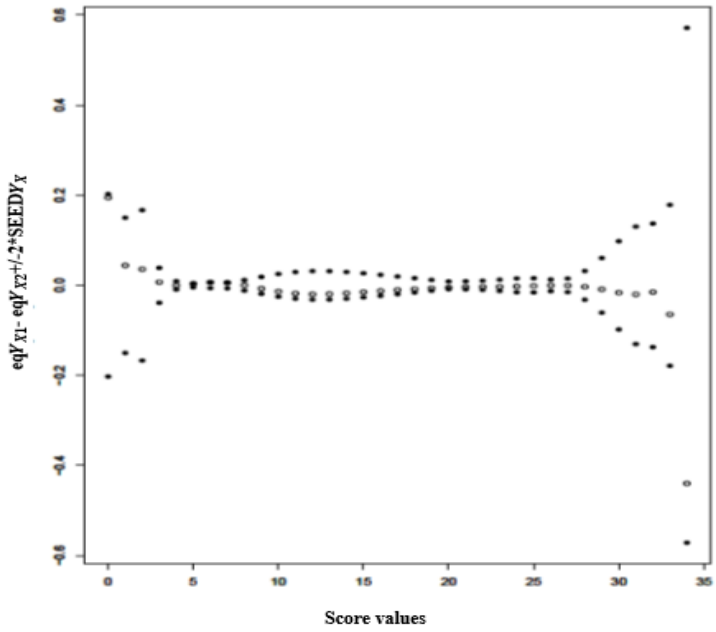

Figure 6. The difference between Logistic Kernel and Uniform Kernel in relation to SEED for each score range.

Figure 4, Figure 6 and Figure 6 showed that for each pairwise comparison, most of the difference between the equated values did not exceed the intervals of +2 and -2 standard error band. In this case, it was seen that there is a high level of consistency between the scores equated according to all three Kernel equating approaches. This is also clearly observed in Figure 7. Additionally, the equated scores obtained according to all three methods and standard errors of equated scores can be examined in Appendix 1 and Appendix 2.

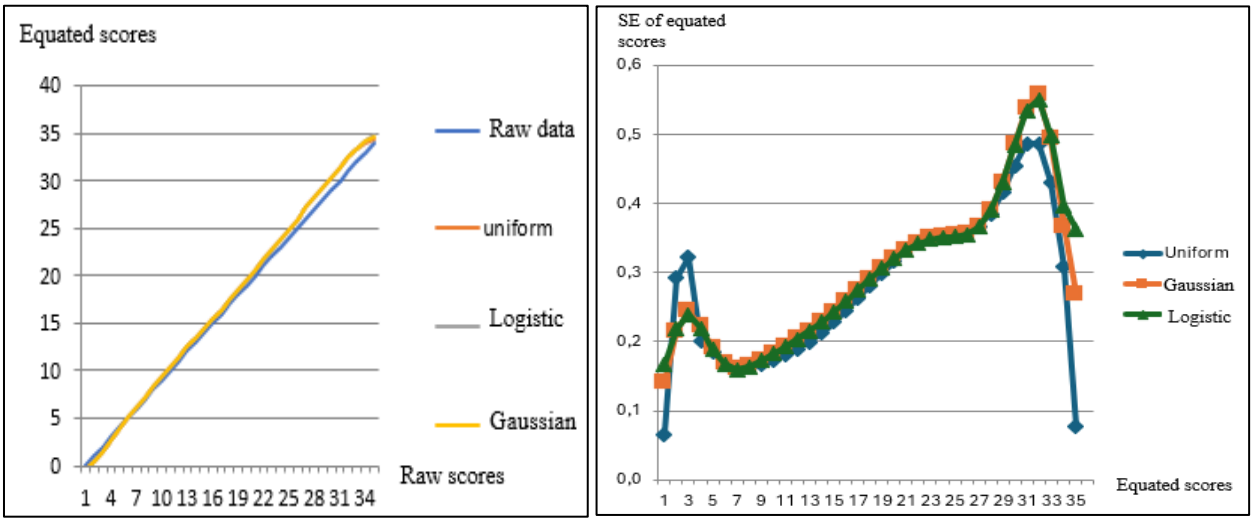

Figure 7. *Equated scores and standard errors for the three Kernel approaches*

The first graph in Figure 7 showed that the three different Kernel approaches in this study give almost the same result. However, according to the second graph, the standard errors differ for low and high values. While the Logistic and Gaussian Kernel approaches were more in line with each other in terms of standard error values, the standard error of the Uniform Kernel approach tended to be higher at low scores and lower than the other approaches at high scores.

Between the score range of 5 and 30, the standard errors of the equated scores according to all three approaches are almost the same. For extreme values, peaks were observed in the standard error values. In this case, it can be said that the number of individuals scoring in this range is low.

In the study, percentage relative error (PRE) was also calculated to compare the moments of distribution of the scores equated according to different Kernel approaches with the moments of distribution of the Y-form scores in the target population.

Table 4. Percentage Relative Error (PRE) of the Equated Score Distribution

	Equating Methods		
	Gaussian PRE ($\boldsymbol{Y_x}$)	Logistic PRE ($\boldsymbol{Y_x}$)	Uniform PRE ($\boldsymbol{Y_x}$)
1	0.003	0.006	-0.010
2	0.002	0.005	-0.077
3	0.016	0.023	-0.099
4	0.030	0.042	-0.120
5	0.044	0.061	-0.152
6	0.060	0.084	-0.194
7	0.079	0.115	-0.244
8	0.106	0.157	-0.300
9	0.140	0.212	-0.359
10	0.183	0.283	-0.420

The PRE values in Table 4 are close to each other for all three Kernel equating approaches. This supports the graphs in Figure 9. The deviation percentages of the first 10 moments from the target population vary between

0.002-0.183 for Gaussian Kernel equating, 0.005-0.283 for Logistic Kernel equating and 0.009-0.420 for Uniform Kernel equating. Considering the PRE values, it can be concluded that the equating results obtained from the bandwidth selected according to the Gaussian Kernel approach show a better fit to the distribution in the population.

DISCUSSION AND CONCLUSION

In this study, using a real data set, the equated scores according to different bandwidth selection strategies in the continuization step of Kernel equating are comparatively examined. Gaussian, Logistic and Uniform Kernel bandwidth selection approaches were used. PRE, Standard Error and SEED were used as criteria for comparing the equated results.

It was observed that the scores obtained with three different Kernel equating under the CINEG design with common items were quite similar to the raw score distribution in all three methods. When all three equating approaches were compared according to standard errors, it was observed that the error distributions were quite similar to each other, but the Logistic and Gaussian Kernel approaches gave closer results. However, as in Lee and von Davier (2008), these methods differed only at the endpoints. Häggström and Wiberg's study (2014) also emphasized that the choice of bandwidth has more impact, especially for endpoints. When the three equating approaches are compared according to the percentage relative error, it is seen that although the PRE values are close to each other, the Gaussian Kernel equating has a relatively lower PRE value.

The results of the study show that Gaussian Kernel equating has a lower percentage relative error, but in terms of standard errors, the standard error distributions obtained using Gaussian Kernel and Logistic Kernel equating are quite similar. This finding is also supported by von Davier (2011) who compared the results of Gaussian, Logistic and Uniform Kernel equating. In addition, another study by Liu et al. (1996) found no difference between Uniform and Gaussian Kernel methods, while Soh et al. (2013) found that Uniform Kernel estimation gives poor results compared to other Kernel methods.

According to the results of the study, it can be said that the effect of different bandwidths selected according to Gaussian Kernel, Logistic Kernel and Uniform Kernel approaches on the equating results is almost similar. As mentioned in many studies (Andersson, 2014; Liang & von Davier, 2014; Wang, 2008) where bandwidth selection approaches are developed, the choice of this parameter aims to minimize the penalty function in the continuization step and keep the fit distribution quite close to the distribution in the target population. In this respect, the choice of the bandwidth parameter is important for the continuization step of Kernel equating. In this context, in line with the findings of this study, researchers may be advised to use Gaussian Kernel or Logistic Kernel approach, which are less affected by the score distribution, in selecting the bandwidth parameter. However, bandwidth selection can also be determined based on cross validation techniques. In studies comparing Gaussian, Logistic and Uniform Kernel approaches based on minimizing the penalty function with techniques based on cross-validation, the results are similar with minor differences (Andersson & von Davier, 2014; Häggström & Wiberg, 2014; Wallin et al., 2021).

One of the limitations of this study is the use of PRE, Standard Error, and SEED as criteria for comparing bandwidth selection methods. It has been stated that PRE does not provide much information about bandwidth selection (Häggström & Wiberg, 2014). The criteria should be enhanced with mean squared error and other bias indicators so that the basis for selecting the appropriate bandwidth becomes stronger.

The bandwidth selection approaches in this study are based mainly on minimizing the penalty function. Due to the complexity of minimizing the penalty function, researchers have proposed simplified methods derived from the modified standard errors of equating (Andersson & von Davier, 2014) and cross-validation techniques (Liang & von Davier, 2014). These different approaches can be compared with approaches based on minimizing the penalty function.

In this study, the effects of three different approaches were examined under a CINEG design; studies comparing these methods under different designs can be conducted. In addition, different bandwidth selection methods can be compared with simulation data to examine the effect of sample size and score distributions in Kernel equating. Furthermore, how bandwidth selection methods perform at different test lengths could be examined.

Statements of Publication Ethics

The data of this study were taken from the TIMSS and PIRLS official web page, which is open to everyone. Therefore, it does not require ethics committee permission. During the research, the process was carried out by paying attention to the rules of research ethics.

Conflict of Interest

The corresponding author states that there is no conflict of interest.

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APPENDIX

Appendix 1. Results of Kernel Equating According to Different Bandwidth Selection Approaches

Raw Scores	Uniform	Logistic	Gaussian
0	-0.332	-0.527	-0.474
1	0.431	0.386	0.377
2	1.504	1.468	1.453
3	2.648	2.641	2.633
4	3.829	3.829	3.826
5	5.005	5.002	5.003
6	6.156	6.150	6.154
7	7.275	7.270	7.274
8	8.361	8.361	8.365
9	9.416	9.424	9.426
10	10.447	10.461	10.462
11	11.458	11.476	11.476
12	12.455	12.475	12.473
13	13.443	13.463	13.460
14	14.429	14.446	14.443
15	15.417	15.432	15.429
16	16.413	16.426	16.423
17	17.422	17.433	17.430
18	18.447	18.456	18.454
19	19.489	19.496	19.494
20	20.547	20.552	20.550
21	21.618	21.622	21.620
22	22.699	22.702	22.701
23	23.787	23.790	23.789
24	24.880	24.882	24.882

25	25.976	25.977	25.978
26	27.074	27.074	27.075
27	28.169	28.170	28.171
28	29.260	29.263	29.265
29	30.341	30.350	30.352
30	31.403	31.419	31.423
31	32.424	32.444	32.451
32	33.350	33.365	33.368
33	34.068	34.132	34.094
34	34.402	34.842	34.691

Appendix 2. Standard Errors of Equated Scores According to Different Bandwidth Selection Approaches

Raw Scores	**Uniform**	**Gaussian**	**Logistic**
0	0.066	0.141	0.167
1	0.292	0.216	0.218
2	0.322	0.244	0.239
3	0.201	0.223	0.220
4	0.185	0.191	0.189
5	0.169	0.168	0.167
6	0.161	0.161	0.160
7	0.162	0.164	0.163
8	0.167	0.173	0.172
9	0.174	0.183	0.183
10	0.181	0.194	0.193
11	0.189	0.204	0.203
12	0.200	0.216	0.215
13	0.213	0.229	0.228
14	0.228	0.243	0.243
15	0.245	0.259	0.259
16	0.263	0.275	0.275
17	0.281	0.291	0.291

18	0.299	0.306	0.306
19	0.316	0.321	0.321
20	0.334	0.333	0.333
21	0.343	0.343	0.343
22	0.349	0.350	0.348
23	0.354	0.353	0.351
24	0.356	0.355	0.352
25	0.359	0.357	0.355
26	0.367	0.367	0.366
27	0.385	0.391	0.390
28	0.416	0.431	0.431
29	0.455	0.486	0.485
30	0.487	0.539	0.535
31	0.487	0.557	0.551
32	0.431	0.494	0.499
33	0.308	0.367	0.396
34	0.078	0.270	0.364

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Examining the Relation Among Internet Addiction, Cyberbullying, and Cyber Victimization in Adolescents: A Systematic Review

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Abstract

Internet addiction, cyberbullying, and cyber victimization are serious public health issues that are highly prevalent among adolescents. Research addressing the aforementioned concepts has significantly increased in the recent years. Using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines, this paper presents the first systematic review of studies examining the relation among internet addiction, cyberbullying, and cyber victimization. A literature review was conducted through Web of Science, PubMed, ScienceDirect, Google Scholar, and Yöktez. A search of five electronic databases indicated 2648 studies published between 2010 and 2024. The following inclusion criteria were considered for articles: (i) they made an objective assessment of cyberbullying and/or cyberbullying victimization and internet addiction, (ii) they were conducted on adolescents, (iii) they were articles and theses published between 2010 and 2024, (iv) they were written in Turkish or English, (v) they were published theses or articles published in an academic refereed journal, and (vi) they were empirical studies with primary data. Accordingly, 32 empirical studies were included in the current review, involving 55.923 participants. The results revealed that internet addiction was positively associated with cyberbullying and cyber victimization, despite many methodological limitations. In this context, taking the relevant variables together in the research, education and intervention programs to be conducted on these variables will allow more accurate and effective results to be obtained.

Keywords: Adolescents, cyberbullying, cyber victimization, internet addiction, systematic review

Ergenlerde İnternet Bağımlılığı, Siber Zorbalık ve Siber Mağduriyet İlişkisinin İncelenmesi: Sistematik Derleme

Öz

İnternet bağımlılığı, siber zorbalık ve siber mağduriyet ergenler arasında oldukça yaygın olan ciddi halk sağlığı sorunlarıdır. Bu kavramları ele alan araştırmalar son yıllarda önemli ölçüde artmıştır. Bu çalışma, Sistematik İncelemeler ve Meta-Analiz için Tercih Edilen Raporlama Öğelerini (PRISMA) kullanan internet bağımlılığı, siber zorbalık ve siber mağduriyet arasındaki ilişkileri inceleyen çalışmaların ilk sistematik incelemesini içermektedir. Web of Science, PubMed, ScienceDirect, Google Scholar ve Yöktez aracılığıyla bir literatür taraması yapılmıştır. Beş elektronik veri tabanında yapılan arama sonucunda 2010 ile 2024 yılları arasında yayınlanmış 2648 çalışma tespit edilmiştir. Dahil edilme kriterleri (i) siber zorbalık ve/veya siber mağduriyet ile internet bağımlılığı üzerinde nesnel bir değerlendirme yapması, (ii) ergenler üzerinde yürütülmüş olması, (iii) 2010-2024 tarihleri arasında yayınlanmış makale veya tezler olması, (iv) İngilizce veya Türkçe dillerinde yazılmış olması, (v) yayınlanmış bir tez veya bilimsel hakemli bir dergide yayınlanmış makale olması ve (vi) birincil verileri toplayan ampirik bir çalışma olması şeklindedir. Sonuç olarak toplam 55.923 katılımcıyı içeren mevcut derlemede 32 ampirik çalışma ele alınmıştır. Sonuçlar, pek çok metodolojik sınırlılığa rağmen, internet bağımlılığının, siber zorbalık ve siber mağduriyet ile pozitif yönde ilişkili olduğunu göstermektedir. İnternet bağımlılığı, siber zorbalık ve siber mağduriyetle ilgili yapılması planlanan araştırma ve müdahale programların bu değişkenlerin birlikteliğini ele alacak biçimde planlanması önerilmektedir.

Anahtar Sözcükler: Ergenler, internet bağımlılığı, siber mağduriyet, siber zorbalık, sistematik derleme

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INTRODUCTION

Undoubtedly, the internet, one of the most important tools of our age, facilitates access to information. There are countless conveniences that the internet has brought to our lives in almost all areas of life, such as communication, education, socialization, shopping, entertainment, and so on. All these conveniences have made the use of the internet more widespread day by day. However, in addition to all the conveniences, there are many negative aspects that may arise from the misuse of the internet. The most important of these negative aspects are internet addiction, cyberbullying, and cyber victimization variables, which have been the subject of many studies.

Internet addiction is a problem characterized by spending time on the internet intensively, not being able to prevent the desire to use it, experiencing negative emotions when the internet is inaccessible; and experiencing problems in work, family, and social life (Young, 2004). Young (1998) created an 8-item diagnostic form for internet addiction by modeling the criteria for gambling addiction defined in DSM IV for the first time. Having five of the criteria written below is considered sufficient for the diagnosis of internet addiction:

1.Feeling preoccupied with online activities (previous or next online activities).

2.Using the internet in increasing amounts to achieve satisfaction.

3.Repeated unsuccessful efforts to control, reduce, or stop internet use.

4.Feeling moody, restless, irritable, or depressed when internet use is reduced or tried to be stopped.

5.Staying online longer than intended.

6.Jeopardize or risk losing an important relationship, educational, job or career opportunity due to the internet use.

7.Lying to others in an attempt to hide the extent of your internet involvement.

8.Using the internet to avoid problems or relieve dysphoric mood.

Examining the literature indicates that internet addiction is named in different ways such as problematic internet use, pathological internet use, obsessive internet use and excessive Internet use. However, the terms internet addiction and problematic internet use are more commonly used (Doğan, 2013). Although there is no disorder called “Internet addiction” in DSM 5, a disorder called “Internet gaming disorder” is defined in the third section, which includes disorders requiring advanced research (American Psychiatric Association [APA], 2013). It has been stated that internet addiction is associated with online gambling and online pornography viewing (Siomos et al., 2012), social anxiety (Torrente et al., 2014; Weinstein et al., 2015; Zorbaz and Dost, 2014), cyberbullying, cyber victimization (Nurtan et al., 2022; Şimşek et al., 2019), depression (Chang et al., 2015; Jung et al., 2014), and loneliness (Yao and Zhong., 2014). When considered in this context, internet addiction is an important variable in terms of adolescents’ mental health.

Another risk factor related to internet use is cyberbullying. Cyberbullying is defined as the use of information and communication technologies by a person or group to harm others (Belsey, 2006). Cyberbullying can take many forms, including sending harassing or threatening messages, sharing inappropriate photos, and making negative comments on social media accounts (Hinduja and Patchin, 2014). In addition, it poses a serious risk due to its prevalence, especially among young people, in the recent period. The results of a study conducted by UNICEF in 2019 with more than 170.000 participants aged between 12 and 24 years from 30 countries indicated that one in three young people are exposed to cyberbullying and one in five children are unable to attend school from time to time due to bullying (UNICEF, 2019). Cyberbullying has a different impact compared to traditional bullying because people's identities are hidden, cannot be controlled, the victims are not visible, and the potential effects cannot be easily predicted (Slonje and Smith, 2008). Van Geel et al. (2014) observed that cyberbullying was associated with higher levels of suicidal thoughts in children and adolescents compared to traditional bullying. The literature indicates that cyberbullying is associated with smoking and alcohol use (Chang et al., 2015), irregular and aggressive behaviors (Jung et al., 2014), and negative emotional symptoms. Individuals exposed to cyberbullying exhibit more depressive symptoms and psychoactive substance use (Zsila et al., 2018), have low self-esteem (Wachs et al., 2020), exhibit psychological and physiological symptoms (Lin et al., 2020), and have low well-being (Eroğlu et al., 2022). In addition, they experience many emotional, social, and behavioral problems such as decreased interest in classes, failure in their course grades, absenteeism, and bringing of weapons to school (Gürhan, 2017).

As observed, internet addiction, cyberbullying, and cyber victimization can negatively affect individuals. internet-addicted individuals spend a large part of their time in online environments. This situation increases the possibility of individuals being exposed to cyberbullying. Furthermore, people who spend excessive time on the internet are prevented from acquiring appropriate social skills and learning social norms due to their withdrawal from social environments (Chou et al., 2016; Naeim et al., 2020; Torrente et al., 2014). This situation increases the likelihood of individuals engaging in bulling behaviors in online environments. Problem behavior theory suggests that involvement in any problem behavior increases the possibility of involvement in other problem behaviors because of their connection in the social opportunities to learn and to practice them together. According to this theory, an adolescent who engages in one problem behavior is more likely to engage in another risky behavior (Jessor, 1987, 1991). In this context, it can be said that internet addiction, cyberbullying, and cyber victimization are interrelated concepts. The literature indicates that numerous research articles have addressed these variables. These studies have identified the relationships between internet addiction, cyberbullying, and cyber victimization, as well as risk factors for these variables and factors associated with healthy internet use. Many studies found positive and significant relationships among internet addiction, cyberbullying, and cyber victimization (Altundağ, 2016; Chang et al., 2015; Efe et al., 2021; Jung et al., 2014; Şimşek et al., 2019). A study conducted in Turkey found that the inability to socialize, negative affect, and social attitude are risk factors for cyberbullying and cyber victimization. Additionally, parental lack of control over a child's internet use is identified as a risk factor for cyberbullying (Peker, 2015). In a study conducted in Hungary, it was determined that cyber victims had significantly higher levels of problematic internet use, depressive symptoms, and psychoactive substance use. Perceived social support has been found to be an important protective factor against traditional bullying and cyberbullying (Zsila et al., 2018). In a study conducted on Spanish adolescents, cyber victimization has been found to predict depressive symptoms and problematic internet use longitudinally (Gámez-Guadix et al., 2013). In another study, problematic internet use predicted an increase in cyberbullying at the longitudinal level (Gámez-Guadix et al., 2016). In this context, it can be said that internet addiction, cyberbullying, and cyber victimization have serious negative effects on adolescents' mental health. Studies addressing the relevant variables are needed to detect these problems at an early stage and to develop the necessary education, intervention, and prevention programs. Literature indicates that many research articles have addressed these variables. However, no study has examined and summarized the research conducted in the context of cyberbullying, cyber victimization and internet addiction in adolescents. In conclusion, this study synthesizes the existing literature using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA).

METHOD

Eligibility Criteria

In this review, researches conducted between 2010-2024 on cyber bullying, cyber victimization, and internet addiction in adolescents are included. The following inclusion and exclusion criteria were considered for the articles and theses included in the scope of the research: (i) they made an objective assessment of cyberbullying and/or cyberbullying victimization and internet addiction, (ii) they were conducted on adolescents, (iii) they were articles and theses published between 2010 and 2024, (iv) they were written in Turkish or English, (v) they were published theses or articles published in an academic refereed journal, and (vi) they were empirical studies with primary data. Studies that did not address internet addiction and cyberbullying and/or cyber victimization variables were not included.

Information Sources and Search

In the literature review, the studies in Web of Science, PubMed, Science Direct, Google Scholar, and Yöktez databases between 2010 and 2024 were examined. Searches were conducted using various variants of the following keywords: Adolescent AND cyberbullying OR bulling OR cyber victimization OR cyber victim AND internet addiction OR (pathological OR excessive OR problematic OR obsessive) internet use. The first search was conducted between October 2022 and November 2022, and a second search was conducted between January 2024 and February 2024.

Data Collection

The titles and abstracts of the studies were assessed in term of inclusion criteria after the literature review. The information about the evaluation process is presented in the Figure 1. The included studies were evaluated in terms of sampling bias and measurement bias to assess the risk of bias.

Study Quality Assessment

A modified version of Newcastle-Ottowa Scale (Wells et al., 2012) was used to evaluate quality of selected studies (See Appendix 1). The following criteria were used for the quality assessment of the studies: representativeness of sample (0-2 stars), sample size (0-1 star), measurement of internet addiction (0-2 stars), measurement of cyberbullying/cyber victimization (0-2 stars), comparability (0-1 star), outcome (0-2 stars), and statistical analyzes (0-1 star). The scale score range was from 0 to 10 points. The classification of the studies is as follows: unsatisfactory studies (0-4), satisfactory studies (5-6), good studies (7-8), and very good studies (9-10).

RESULTS

Selection of Studies

A total of 2648 studies were identified in the initial search process (Web of Science = 364, PubMed = 251, ScienceDirect = 526, Yöktez = 128, Google Scholar = 1379). After reviewing the titles and abstracts of the studies, 27 studies were excluded as they did not meet the inclusion criteria. In addition, 9 more studies were excluded based on text content and as a result 32 studies were included.

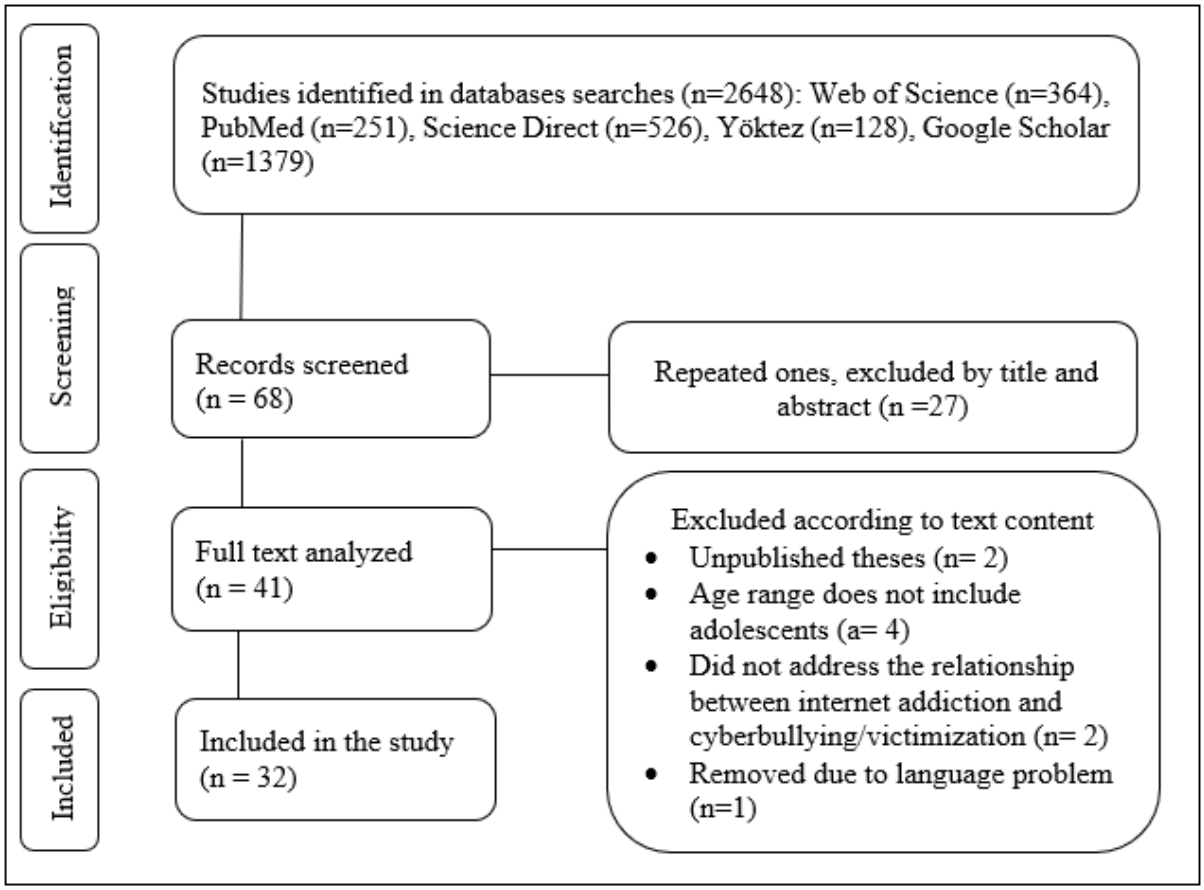

Figure 1. PRISMA flowchart

Study Quality Evaluation

The quality classification of studies used for this review was as follows: 13 good studies, (Blinka et al., 2023; Cebollero-Salinas et al., 2022; Cicioğlu, 2014; Efe et al., 2021; Ergüder, 2019; He et al., 2023; Liu et al., 2020; Nurtan et al., 2022; Şimşek et al., 2019; Tsimtsiou et al., 2018; Türkoğlu, 2013; Xin et al., 2021; Zsila et al., 2018) and 19 satisfactory studies (Altundağ, 2016; Arpacı et al., 2020; Aytaç et al., 2022; Boniel-Nissim and Sasson, 2018; Brighi et al., 2019; Chang et al., 2015; Cinar et al., 2017; Çiçek, 2019; Erdoğan, 2023; Gámez-Guadix et al., 2013; Gámez-Guadix et al., 2016; Gencer, 2017; Jung et al., 2014; Lin et al., 2020; Machimbarrena et al., 2018; Ünver and Koç, 2017; Wachs et al., 2020; Yudes-Gómez et al., 2018; Yudes et al., 2021). Results from quality assessment are presented in Table 1.

Features of the Studies

The findings regarding the general characteristics and methodological features of the 32 studies presented in Table 1 and Table 2.

Table 1. *Main features of the studies (N=32)*

Study	Sample Size	Gender (%)	Age range and mean range (SD)	Sample features	Operationalization of Internet Addiction	Operationalization of Cyberbullying/ Cyber Victimization	Quality Assessment
Şimşek et al. (2019)	2.422	48.50% male	Range = 14-21 M_{age} = 16.23 ± 1.11	High school students (adolescents)	Internet Addiction Scale	Cyber Victim and Bullying Scale	1 = *, 2 = *, 3 = **, 4 =**, 5 = -, 6 = *, 7 = *, TS = 8.
Arpacı et al. (2020)	665	30.5% male	Range = 17-19 M_{age} = 17.94 ± 1.12	University student (adolescents)	Internet Addiction Scale	The Cyberbullying Scale	1 = -, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 6.
Chang et al. (2015)	1917	45.9% male	Range = N/R M_{age}= N/R	High school students (adolescents)	Chen Internet Addiction Scale	An eight-item self-report questionnaire	1 = -, 2 = *, 3 = **, 4 = *, 5 = *, 6 = *, 7 = *, TS = 6.
Lin et al. (2020)	1854	49.3% male	Range = N/R M_{age} = 15 ± 1.6	Middle and high school students (adolescents)	Young Internet Addiction Test	An item was used.	1 = *, 2 = -, 3 = **, 4 = -, 5 = *, 6 = *, 7 = *, TS = 6.
Xin et al. (2020)	1006	48.2% male	Range = 12-15 M_{age} = 13.16 ± .67	Middle school students (adolescents)	Internet Gaming Disorder Questionnaire	Cyber Bullying Inventory	1 = -, 2 = -, 3 = **, 4 = **, 5 = *, 6 = *, 7 = *, TS = 7.
Jung et al. (2014)	4531	51.1% male	Range = 11-14 M_{age} = N/R	Elementary and middle school students (adolescents)	Internet Addiction Proneness Scale for Youth Short From	A nine-item self-report questionnaire	1 = -, 2 = -, 3 = **, 4 = *, 5 = -, 6 = *, 7 = *, TS = 5.
Liu et al. (2020)	661	61.4% male	Range = N/R M_{age} = 14.02 ± 1.50	Middle school students (adolescents)	Adolescents Problematic Internet Use Scale	Chinese version of Revised Cyberbullying Subscale	1 = *, 2 = -, 3 = **, 4 = **, 5 = *, 6 = *, 7 = *, TS = 7.
Zsila et al. (2018)	6237	51.13% male	Range = 15-22 M_{age} = 16.62 ± .95	High school students (adolescents)	Problematic Internet Use Questionnaire	Two items were used.	1 = *, 2 = -, 3 = **, 4 = *, 5 = *, 6 = *, 7 = *, TS = 7.
Brighi et al. (2019)	3602	56% male	Range = 11-20 M_{age} = 14.64 ± 1.70	Middle and high school students (adolescents)	Five items were used.	European Cyberbullying Intervention Project Questionnaire Lodz Electronic Aggression Prevalence Questionnaire	1 = -, 2 = -, 3 = *, 4 = **, 5 = *, 6 = *, 7 = *, TS = 6.
Yudes et al. (2021)	2039	46% male	Range = 12-18 M_{age} = 14.57 ± 1.58)	Middle and high school students (adolescents)	Internet Addiction Test	European Cyberbullying Intervention Project Questionnaire	1 = -, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 6.
Gámez-Guadix et al. (2016)	888	40% male	Range = 13-18 M_{age} = 15.42 ± 1.01	Middle school students (adolescents)	Generalized and Problematic Internet Use Scale 2	Cyberbullying Questionnaire	1 = -, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 6.
Gámez-Guadix et al. (2013)	845	39% male	Range = 13-17 M_{age} = 15.2 ± 1.2	Middle school students (adolescents)	Generalized Problematic Internet Use Scale 2	Cyberbullying Questionnaire	1 = *, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 6.

Table 2. *(Continued)*

Study	Sample Size	Gender (%)	Age range and mean range (SD)	Sample features	Operationalization of Internet Addiction	Operationalization of Cyberbullying/ Cvber Victimization	Quality Assessment
Boniel-Nissim and Sasson (2018)	1000	47% male	Range = 12-17 M_{age} = 14.19 ± 1.34	Middle and high school students (adolescents)	The Short Problematic Internet Use Test	Five-item self-report questionnaire	1 = -, 2 = -, 3 = **, 4 = *, 5 = -, 6 = *, 7 = *, TS = 5.
Wachs et al. (2020)	1.442	51.5% male	Range = 12-17 M_{age} = 14.17 ± 1.38	Students (adolescents)	The Internet-Related Experiences Questionnaire	Four-item self-report questionnaire	1 = -, 2 = -, 3 = **, 4 = 1, 5 = *, 6 = *, 7 = *, TS = 6.
Cinar et al. (2017)	239	N/R	Range = 14-19 M_{age} =N/R	High school students (adolescents)	Internet Addiction Scale	Cyber Bullying Scale	1 = -, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 6.
Machimbarrena et al. (2018)	3212	46.6% male	Range = 11-21 M_{age} = 13.92 ± 1.44	Middle and high school students (adolescents)	Generalized and Problematic Internet Use Scale	Victimization Subscale of the Cyberbullying Questionnaire, Victimization Scale, Questionnaire for Online Sexual Solicitation and Interaction of Minors with Adults	1 = -, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 6.
Altundağ (2016)	310	48.1% male	Range =N/R M_{age} =N/R	High school students (adolescents)	Internet Addiction Scale	Cyber Bullying/Victim Questionnaire	1 = -, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 6.
Efe et al. (2021)	546	41% male	Range = 12-19 M_{age} = 15.26 ± 1.19	High school students (adolescents)	Internet Addiction Scale	Cyber Bullying and Aggressiveness on the Internet Scanning Scale	1 = *, 2 = *, 3 = **, 4 = **, 5 = 0, 6 = *, 7 = *, TS = 8.
Nurtan et al. (2022)	550	40.9% male	Range = 13-17 M_{age} =N/R	High school students (adolescents)	Young Internet Addiction Test Short Form	Cyberbullying Scale, Cyber Victimization Scale	1 = *, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 7.
Ergüder (2019)	513	32.7% male	Range =N/R M_{age} =N/R	High school students (adolescents)	Internet Addiction Scale	Revised version of Cyber Bullying İnventory-II	1 = *, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 7.
Çiçek (2019)	2060	46.6% male	Range =N/R M_{age} =N/R	High school students (adolescents)	Problematic Internet Use Scale-Adolescent	Cyber Victims and Bullying Scale	1 = -, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 6.
Cicioğlu (2014)	563	55.8% male	Range =N/R M_{age} =N/R	High school students (adolescents)	Problematic Internet Use Scale	Cyber Bullying Scale	1 = -, 2 = *, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 7.
Tsimtsiou et al. (2018)	8053	46.7% male	Range = 12-18 M_{age} = 14.37 ± 1.94	Middle and high school students (adolescents)	Internet Addiction Test	Questions adapted from the 2013 National Youth Risk Behavior Survey were used	1 = *, 2 = *, 3 = **, 4 = *, 5 = *, 6 = *, 7 = *, TS = 8.

Table 3. *(Continued)*

Study	Sample Size	Gender (%)	Age range and mean range (SD)	Sample features	Operationalization of Internet Addiction	Operationalization of Cyberbullying/ Cvber Victimization	Quality Assessment
Gencer (2017)	779	47.4% male	Range = 12-15 M_{age} = 13.14 ± .83	Middle school students (adolescents)	Internet Addiction Scale	Cyber Bullying Scale	1 = -, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 6.
Türkoğlu (2013)	540	56.9% male	Range = 14-18 M_{age} = N/R	High school students (adolescents)	Problematic Internet Use Scale	Cyber Bullying Attitude Scale	1 = *, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 7.
Cebollero-Salinas et al. (2022)	1013	43.6% male	Range = 12-18 M_{age} =14.0 ± 1.42	Elementary and middle school students (adolescents)	The Internet-Related Experiences Questionnaire	Cyberbullying Scale	1 = *, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 7.
Aytaç et al. (2022)	320	49.9% male	Range = 14-19 M_{age} = 16.25 ± 1.13	High school students (adolescents)	Young Internet Addiction Scale	Revised Cyberbullying Inventory	1 = -, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 6.
He et al. (2023)	831	50.8% male	Range = 13-15 M_{age} =14 ± .55	High school students (adolescents)	Adolescent Pathological Internet Use Scale	Cyber Bullying Inventory	1 = *, 2 = -, 3 = **, 4 = **, 5 = *, 6 = *, 7 = *, TS = 8.
Yudes-Gómez et al. (2018)	2.653	50.8% male	Range = 10–18 $M_{age.}$ = 14.48	High school students (adolescents)	Revised Generalized and Problematic Internet Use Scale	Cyberbullying aggression Scale, Cyberbullying/ victim scale	1 = -, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 6.
Blinka et al. (2023)	3939	49.4% male	Range= 13-15 M_{age} =13.90	Elementary students (adolescents)	Excessive Internet Use Scale	Four items were used.	1 = *, 2 =* -, 3 = **, 4 = *, 5 = -, 6 = *, 7 = *, TS = 7.
Erdoğan (2023)	150	47.3% male	Range = 11-13 M_{age} = 11.92	Elementary students (adolescents)	Young Internet Addiction Test Short Form	Cyber Bullying Scale, Cyber Victimization Scale	1 = -, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 6.
Ünver and Koç (2017)	523	41.1% male	Range = 14-20 M_{age} = 16.43	Middle school students (adolescents)	Cognitive Position on Internet Scale	Cyberbullying Scale	1 = -, 2 = -, 3 = **, 4 = **, 5 = -, 6 = *, 7 = *, TS = 6.

Countries Where Research is Conducted

An analysis of the studies that 14 studies were conducted in Turkey (Altundağ, 2016; Arpacı et al., 2020; Aytaç et al., 2022; Cicioğlu, 2014; Cinar et al., 2017; Çiçek, 2019; Efe et al., 2021; Ergüder, 2019; Gencer, 2017; Nurtan et al., 2022; Şimşek et al., 2019; Türkoğlu, 2013; Ünver and Koç, 2017), five studies in Spain (Cebollero-Salinas et al., 2022; Gámez-Guadix et al., 2013; Gámez-Guadix et al., 2016; Machimbarrena et al., 2018; Yudes et al., 2021), four studies in China (He et al., 2023; Lin et al 2020; Liu et al., 2020; Xin et al., 2021), one study in Taiwan (Chang et al., 2015), one study in Hungary (Zsila et al., 2018), one study in the Republic of Korea (Jung et al., 2014), one study in Israel (Boniel-Nissim and Sasson, 2018), one study in Italy (Brighi et al., 2019), one study in Slovakia (Blinka et al., 2023), and one study in Greece (Tsimtsiou et al., 2018). In addition, two studies were conducted cross-culturally. One of these studies was conducted in Germany, the Netherlands, and the United States (Wachs et al., 2020), and the other in Spain, Uruguay, and Colombia (Yudes-Gómez et al., 2018).

Participants

In the studies included in the systematic review, 55.923 participants were included. As observed, 45.9% of the participants were males (n = 25.664) and 49.1% were females (n = 27.455). All participants were adolescent students. The age range of the participants was determined as 10–22. In these studies, the minimum sample size was 150 (Erdoğan, 2023) and the maximum sample size was 8053 (Tsimtsiou et al., 2018). Examination of the sample groups indicated that the studies were mostly carried out on middle school and high school students. Six of the studies were conducted in middle schools (Gámez-Guadix et al., 2013; Gámez-Guadix et al., 2016; Gencer, 2017; Liu et al., 2020; Ünver and Koç, 2017; Xin et al., 2021), 13 in high schools (Altundağ, 2016; Aytaç et al., 2022; Chang et al., 2015; Cicioğlu, 2014; Cinar et al., 2017; Çiçek, 2019; Efe et al., 2021; Ergüder, 2019; He et al., 2023; Nurtan et al., 2022; Şimşek et al., 2019; Türkoğlu, 2013; Zsila et al., 2018), two in elementary schools (Blinka et al., 2023; Erdoğan, 2023), one in university (Arpacı et al., 2020), two in primary and middle schools (Cebollero-Salinas et al., 2022; Jung et al., 2014), and six in middle and high schools (Boniel-Nissim and Sasson, 2018; Brighi et al., 2019; Lin et al., 2020; Machimbarrena et al., 2018; Tsimtsiou et al., 2018; Yudes et al., 2021). In two studies, the educational levels of the participants were not specified (Wachs et al., 2020; Yudes-Gómez et al., 2018).

Operationalization of Internet Addiction

Operationalization refers to the objective measurement of a variable (Dantzker and Hunter 2011). Although the scales previously used in the literature were largely used to measure the relevant variables, it is observed that self-reporting questionnaire forms created by researchers were used in some studies. Measurement tools used to measure internet addiction are as follows: Internet Addiction Scale (Altundağ, 2016; Arpacı et al., 2020; Cinar et al., 2017; Efe et al., 2021; Ergüder, 2019; Gencer, 2017; Şimşek et al., 2019), Chen Internet Addiction Scale (Chang et al., 2015), Young Internet Addiction Test (Lin et al., 2020), Internet Gaming Disorder Questionnaire (Xin et al., 2021), Internet Addiction Proneness Scale for Youth-Short Form (Jung et al., 2014), Adolescents Problematic Internet Use Scale (Çiçek, 2019; Liu et al., 2020), Problematic Internet Use Questionnaire (Cicioğlu, 2014; Zsila et al., 2018), Internet Addiction Test (Tsimtsiou et al., 2018; Yudes et al. 2021), Generalized and Problematic Internet Use Scale 2 (Gámez-Guadix et al., 2013; Gámez-Guadix et al., 2016; Yudes-Gómez et al., 2018), The Short Problematic Internet Use Test (Boniel-Nissim and Sasson 2018), Internet-Related Experiences Questionnaire (Cebollero-Salinas et al., 2022; Wachs et al., 2020), Generalized and Problematic Internet Use Scale (Machimbarrena et al., 2018), Adolescent Pathological Internet Use Scale (He et al., 2023), Young Internet Addiction Test- Short Form (Erdoğan, 2023; Nurtan et al., 2022). Young's Internet Addiction Scale (Aytaç et al., 2022), Problematic Internet Use Scale (Türkoğlu, 2013), Excessive Internet Use Scale (Blinka et al., 2023), and Cognitive Position on Internet Scale (Ünver and Koç, 2017).

Operationalization Cyberbullying and Cyber Victimization

The following measurement tools were used to measure cyber bullying and cyber victimization in the studies included in the review: Cyber Victim and Bullying Scale (Çiçek, 2019; Şimşek et al., 2019), Cyberbullying Scale (Arpacı et al., 2020; Cebollero-Salinas et al., 2022; Cicioğlu, 2014; Cinar et al., 2017; Erdoğan, 2023; Gencer,2017; Nurtan et al., 2022; Ünver and Koç, 2017), Cyber Bullying Inventory (He et al., 2023; Xin, 2021), Revised Cyber Bullying Inventory-Cyberbullying Subscale (Liu et al., 2020), European Cyberbullying Intervention Project Questionnaire (Brighi et al., 2019; Yudes et al., 2021), Lodz Electronic Aggression Prevalence Questionnaire (Brighi et al., 2019), Cyberbullying Questionnaire (Gámez-Guadix et al., 2013; Gámez-Guadix et al., 2016), Victimization Scale of the Cyberbullying Questionnaire (Machimbarrena et al., 2018), Cyber Bullying/Victim Questionnaire (Altundağ, 2016), Cyber Bullying and Aggressiveness on the Internet Scanning Scale (Efe, 2021), Cyber Bullying Attitude Scale (Türkoğlu, 2013), Revised Cyberbullying Inventory (Aytaç et al., 2022; Ergüder, 2019), Cyberbullying Aggression Scale (Yudes-Gómez et al., 2018), Cyberbullying Victim Scale (Yudes-Gómez et al., 2018), and Cyber Victimization Scale (Nurtan et al. 2022).

The Relationships Between Internet Addiction, Cyberbullying and Cyber Victimization

All of the studies included in the systematic review examined the relationship between internet addiction, cyber bullying and cyber victimization. An analysis of these studies indicated that 24 studies addressed the relation between cyberbullying and internet addiction. In 20 studies, internet addiction positively correlated with cyberbullying (Altundağ, 2016; Arpacı et al., 2020; Blinka et al., 2023; Brighi et al., 2019; Cebollero-Salinas et al., 2022; Cicioğlu, 2014; Cinar et al., 2017; Çiçek, 2019; Efe et al., 2021; Erdoğan, 2023; Ergüder, 2019; Gencer, 2017; He et al., 2023; Nurtan et al., 2022; Şimşek et al., 2019; Tsimtsiou et al., 2018; Türkoğlu, 2013; Ünver and Koç, 2017; Yudes et al., 2021; Yudes-Gómez et al., 2018). In a study, internet addiction levels of adolescents in the cyberbullying group were significantly higher than the levels of those not in that group (Jung et al., 2014). In another study, adolescents with internet addiction were more likely to engage in cyberbullying (Chang et al., 2015). Gámez-Guadix et al. (2016) determined that internet addiction predicted the increase in cyberbullying at the longitudinal level. In another study, internet addiction and daily internet usage of more than 5 hours significantly predicted cyberbullying (Aytaç et al., 2022).

In this review, 22 studies addressed the relation between internet addiction and cyber victimization. Furthermore, in 16 studies, internet addiction positively correlated with cyberbullying (Altundağ, 2016; Arpacı et al., 2020; Blinka et al., 2023; Brighi et al., 2019; Cebollero-Salinas et al., 2022; Cicioğlu, 2014; Cinar et al., 2017; Çiçek, 2019; Efe et al., 2021; Erdoğan, 2023; Ergüder, 2019; Nurtan et al., 2022; Şimşek et al., 2019; Tsimtsiou et al., 2018; Yudes et al., 2021; Yudes-Gómez et al., 2018). In one study, a negative relation was observed between internet addiction and cyberbullying (Nurtan et al., 2022). In a study, internet addiction levels of adolescents in the cyber victimization group were significantly higher than non-victimized adolescents (Jung et al., 2014; Lin et al., 2020; Zsila et al., 2018). In another study, internet-addicted adolescents experienced more cyber victimization (Chang et al., 2015). In a study, cyber victimization predicted the increase in internet addiction at the longitudinal level (Gámez-Guadix et al., 2013). In another study, internet addiction significantly predicted cyber victimization (Aytaç et al., 2022). Finally, in a study conducted on participants from three different countries, cyber victimization and internet addiction were directly related and indirectly related through alexithymia in all three country samples (Wachs et al., 2020).

Table 4. *Main findings, limitations, recommendations and risks of bias (N=32)*

Study	Key Findings	Limitations	Recommendations	Risks of Bias
Simsek et al. (2019)	Cyberbullying and cyber victimization were associated with internet addiction and internet usage characteristics. A positive relationship was found between cyber victimization and cyberbullying. Internet addiction does not differ according to gender. Males had significantly higher levels of cyberbullying and cyber victimization than females.	The study covers only one province in the Black Sea Region. A single question was asked about the participants' internet usage purposes and time intervals. The participants were asked about the purposes of using the internet and the time they spend in the internet in the form of "most," and a single answer was requested.	Conducting research on cyber victimization and factors that may be related to cyberbullying; conducting studies to raise awareness of family and school health professionals about inappropriate use of the internet	Exclusion of clinical samples.
Arpaci et al. (2020)	A significant positive correlation was observed between cyberbullying and internet addiction. Individuals with horizontal individualism were found to be more vulnerable to internet addiction. Females were found to have significantly lower levels of internet addiction than males. Cyberbullying does not differ according to gender.	The fact that the study consists of a limited age group and a monocultural sample; the fact that the study was conducted with a single external factor and mediator variable	Conducting studies involving different age groups and cultures; examining different factors and mediators that may be related	Use of non-probability sampling methods (convenience sampling) and the exclusion of clinical samples.
Chang et al. (2015)	The internet-addicted group had higher levels of cyberbullying, cyber victimization, online sexual harassment victimization, smoking and alcohol use, depression, and low self-esteem. It was determined that cyberbullying and cyber victimization were associated with male gender, lower internet literacy, parental attachment, parental restrictive mediation, and internet addiction. In addition, cyberbullying was associated with smoking and alcohol consumption, while cyber victimization was associated with depression. The proportion of females in the internet addicted group was significantly lower than in the non-addicted group.	Cross-sectional research design; the likelihood that participants tended to give socially acceptable responses; the fact that one fifth of the participants refused to respond may have caused a possible bias.	Conducting longitudinal studies to examine the long-term effects of study variables	Use of an excessively abbreviated measurement tool in the measurement of cyberbullying and victimization (only 4 items); sampling bias due to the exclusion of clinical samples.

Table 5. *(continued)*

Study	Key Findings	Limitations	Recommendations	Risks of Bias
Lin et al. (2020)	It was determined that internet addiction, psychological and physiological symptoms were significantly higher in the cyber victimization group. Internet addiction has a mediating effect on the relationship between cyber victimization and psychological and physical symptoms.	Cross-sectional design; assessment of cyber victimization with a single item; recall bias caused by the fact that all the scales were filled in by the participants; participants were asked to rate cyber victimization for the last year, psychological and physical symptoms for the last month, and internet addiction in general, so it is not known which variable emerged earlier.	Conducting studies on the regulatory effect of physical exercise; using more detailed questionnaires or scales.	Use of an excessively shortened measurement tool in the measurement of cyber victimization (only 1 item); exclusion of clinical samples.
Xin et al. (2021)	It has been found that cyber victimization, internet addiction, impulsivity, and rejection sensitivity were positively related.	Cross-sectional design; self-reported assessments; data collected from individuals living in a specific region.	Collecting data from different sources of information such as parents, peers, teachers; addressing different variables that may have a mediating effect (teacher-student relationships, etc.); conducting longitudinal or experimental studies; conducting research on individuals from different cultures, developmental stages, and regions.	Use of non-probability sampling methods and the exclusion of clinical samples.
Jung et al. (2014)	It has been determined that students who were victims and/or perpetrators of cyberbullying had significantly higher internet addiction scores than other students. Cyberbullying was associated with irregular and aggressive behavior. Cyber victimization was associated with depressive symptoms. It was determined that the number of boys who were perpetrators/victims of cyberbullying was significantly higher than that of girls.	Cross-sectional design; self-reported assessments; data collected from individuals living in a specific region.	Conducting studies to raise the awareness of parents, educators, and public health officials.	Use of non-probability sampling methods and the exclusion of clinical samples.

Table 6. *(continued)*

Study	Key Findings	Limitations	Recommendations	Risks of Bias
Liu et al. (2020)	Problematic internet use, cyber victimization, and depression were found to be positively related. Mindfulness was negatively associated with problematic internet use, cyber victimization, and depression. Mindfulness and depression had a mediating effect on the relationship between cyber victimization and problematic internet use.	The use of scales based on self-reporting; the study findings do not reveal causal inferences	Data collection by more than one method.	Exclusion of clinical samples.
Zsila et al. (2018)	It has been determined that students who were victims of cyberbullying had significantly higher problematic internet use, depressive symptoms, and psychoactive substance use. It has been found that perceived social support was an important protective factor against traditional bullying and cyberbullying. It was determined that cyber victimization did not differ according to gender.	Cross-sectional design; findings obtained through regression analysis; limited measurement of cyber victimization (only two items); low explanatory power of the tested research model.	Using alternative research models; using more comprehensive measurement tools; addressing different concepts that may be related to cyber victimization.	Use of an excessively shortened measurement tool in the measurement of cyber victimization (only 2 items); exclusion of clinical samples.
Brighi et al. (2019)	Problematic internet use and cyberbullying were found to be positively related. Negative emotional symptoms and low levels of parental monitoring were risk factors for problematic internet use and cyberbullying, and this effect was mediated by time spent online.	The use of scales based on self-report; the probability that participants tend to give socially acceptable answers; cross-sectional design	Conducting longitudinal studies; developing intervention programs that address relevant variables.	Use of an excessively shortened measurement tool in measuring problematic internet use (only 5 items); Sampling bias due to the use of non-probability-based sampling methods and the exclusion of clinical samples.
Yudes et al. (2021)	Cyberbullying was positively associated to problematic internet use and negatively associated to emotional intelligence. Emotional intelligence had a moderating effect on the relationship between problematic internet use and cyberbullying in males. Problematic internet use and cyberbullying did not differ according to gender.	Cross-sectional design; use of self-report scales.	Conducting longitudinal studies on relevant variables; using alternative assessment criteria (e.g., peer review); planning activities to obtain qualitative information.	Use of non-probability-based sampling methods and the exclusion of clinical samples.

Table 7. *(continued)*

Study	Key Findings	Limitations	Recommendations	Risks of Bias
Gámez-Guadix et al. (2016)	Problematic internet use predicted an increase in cyberbullying and online dating with strangers at the longitudinal level.	The use of scales based on self-report: short-term longitudinal study; evaluation of meeting strangers online, assessed in a short time frame (daily) with a single item.	Use different data sources (teachers, parents, peers, etc.); conduct longer-term longitudinal studies; include younger participants; address different online behaviors (e.g., cyber victimization)	Use of non-probability-based sampling methods and the exclusion of clinical samples.
Gámez-Guadix et al (2013)	Cyber victimization predicted depressive symptoms and problematic internet use at the longitudinal level. High depressive symptoms and substance use predicted cyber victimization.	Measuring cyber victimization with a broad frequency criterion (only once or twice)	Addition of strategies aimed at preventing cyberbullying to interventions aimed at behavioral problems in adolescence; providing counseling services for problematic internet addiction; mental health professionals taking into account depressive symptoms and problematic internet use in the treatment of cyberbullying.	Exclusion of clinical samples.
Boniel-Nissim and Sasson (2018)	It has been determined that poor parent-child communication and cyber victimization were related to problematic internet use. Bullying and/or cyberbullying victimization mediated the relationship between poor parent-child communication and problematic internet use. Positive mother-child and father-child communication had an indirect negative impact on problematic internet use through bullying and/or cyberbullying victimization.	Cross-sectional design; assessment of parental communication with only three variables; limited collection of information about participants' internet usage characteristics; failure to control random effects caused by data clustering.	Conducting longitudinal studies; evaluating parent-child communication more comprehensively; conducting studies that take into account the internet use characteristics of adolescents.	Use of an excessively shortened measurement tool in the measurement of cyber victimization (only 5 items); Use of non-probability-based sampling methods and exclusion of clinical samples.

Table 8. *(continued)*

Study	Key Findings	Limitations	Recommendations	Risks of Bias
Wachs et al. (2020)	In the Dutch sample, there was a direct relation between cyber victimization and self-esteem and an indirect relation mediated by alexithymia. In the German and US samples, an indirect relation was found only through alexithymia, but no direct effect of cyber victimization on self-esteem was found. In the three country samples, cyber victimization and internet addiction were found to be directly related and indirectly related through alexithymia.	Cross-sectional design; self-reported data collection; relatively small number of schools included in the study despite the large sample size.	Conducting longitudinal studies with at least three measurements; collecting data from different information sources.	Use of an excessively abbreviated measurement tool in the measurement of cyber victimization (only 4 items); use of non-probability-based sampling methods and the exclusion of clinical samples.
Cinar et al. (2017)	Cyberbullying was significantly associated with internet addiction.	The majority of the sample consists of female participants; the participants were students living in a certain region and in a certain age range; the data were collected through quantitative data collection method	Creating a balanced sample in terms of gender variables; conducting studies on students of different ages, cultures, regions, and levels; conducting qualitative studies; providing trainings to students to raise awareness about the relevant variables	Use of non-probability-based sampling methods and the exclusion of clinical samples.
Machimbarrena et al. (2018)	It has been determined that problematic internet use, cyber victimization, online sexual abuse, cyber flirting victimization, and sexually explicit messaging were positively related It was determined that cyber victimization, online sexual abuse, and problematic internet usage of girls were significantly higher than that of boys.	Cross-sectional design; collection of data based on self-reporting; sampling procedure is not based on probability; the sample does not statistically represent the entire population of Spain; the study is limited to some important internet risks	Conducting longitudinal studies; collecting data from additional sources of information such as sociograms and parents/peers/teachers; conducting studies on other important internet risks such as nomophobia, online gaming disorder, fear of missing updates, etc.	Use of non-probability-based sampling methods and the exclusion of clinical samples.

Table 9. *(continued)*

Study	Key Findings	Limitations	Recommendations	Risks of Bias
Altundağ (2016)	Problematic internet use, cyberbullying, and cyber victimization were found to be significantly related. It has been determined that adolescents who had a social media tool without the knowledge of their parents were more at risk in terms of problematic internet use, cyberbullying, and victimization. Males had higher levels of cyberbullying and victimization than females. Problematic internet use did not differ according to gender.	Cross-sectional design; small sample size.	Conducting longitudinal studies; including more participants; considering the association of relevant variables in prevention and intervention studies.	Use of non-probability-based sampling methods (convenience sampling) and the exclusion of clinical samples.
Efe et al. (2021)	Cyberbullying, cyber victimization, and internet addiction were found to be positively correlated.	The fact that the study was conducted on high school students living in a specific region; collection of data online	Conducting studies on individuals from different regions; conducting awareness-raising intervention studies that address the relevant variables; organizing informative seminars for students and families in cooperation with school management/staff, health professionals and school guidance services	Exclusion of clinical samples.
Nurtan et al. (2022)	Internet addiction and cyberbullying were positively related. A significant negative relation was found between internet addiction and cyber victimization. A significant negative relation was found between cyberbullying and cyberbullying victimization. It was determined that the cyberbullying levels of boys were higher than those of girls. On the other hand, it was determined that girls had higher levels of cyber victimization.	The fact that the obtained data are limited to the measurement tools used and the sample size.	Development of training and intervention programs for families, students and teachers;	Exclusion of clinical samples.

Table 10. *(continued)*

Study	Key Findings	Limitations	Recommendations	Risks of Bias
Ergüder (2019)	There were significant positive relationships between internet addiction, cyberbullying and cyber victimization. It was determined that boys performed more cyberbullying behaviors than girls. It was determined that cyber victimization and internet addiction did not differ according to gender.	Collecting data from individuals from a specific region, level, and age range; limiting the data obtained to the measurement tools used.	Conducting studies on students of different ages, regions, and levels; working with samples of cyberbullies or victims; developing intervention programs for students.	Exclusion of clinical samples.
Cicek (2019)	Problematic internet use, cyberbullying, and cyber victimization were found to be positively related. Girls had lower levels of problematic internet use, cyberbullying, and cyber victimization than boys.	Data were obtained from individuals living in a specific region.	Addressing different variables that may be related to similar concepts; conducting studies on individuals from different regions; organizing seminars to inform students and raise their awareness.	Use of non-probability-based sampling methods (convenience sampling) and the exclusion of clinical samples.
Cicioğlu (2014)	Problematic internet use and cyberbullying were positively correlated. As the time spent on the internet increased, cyberbullying attitudes increased significantly. Girls had lower levels of cyberbullying and problematic internet use than boys.	Obtaining data from individuals of a certain age group living in a certain region; the data obtained being limited to the measurement tools used.	Organizing group guidance, individual interviews or seminars for students; conducting studies on individuals from different ages, levels, and regions	Use of non-probability-based sampling methods and the exclusion of clinical samples.
Tsimtsiou et al. (2018)	Internet addiction was positively associated with cyberbullying and cyber victimization. While the cyberbullying levels of males were higher compared to those of females, the cyber victimization levels of females were higher compared to those of males. It was determined that internet addiction did not differ according to gender.	Obtaining data based on self-reporting.	Providing trainings to families and adolescents on safe internet use; developing mass communication campaigns for individuals	Exclusion of clinical samples
Gencer (2017)	Internet addiction and cyberbullying were positively correlated. Male students had higher cyberbullying and internet addiction scores than female students.	Obtaining data from individuals of a certain age group living in a certain region; the data obtained being limited to the measurement tools used.	Organizing informative trainings for schools and school staff; conducting research on individuals of different ages, regions, and levels.	Use of non-probability-based sampling methods and the exclusion of clinical samples.

Table 11. *(continued)*

Study	Key Findings	Limitations	Recommendations	Risks of Bias
Türkoglu (2013)	Internet addiction was positively and significantly associated with cyberbullying. The cyberbullying and internet addiction levels of males were higher than females	Selecting the sample with appropriate sampling method; obtaining the data from individuals from a certain age group living in a certain region; limiting the data to the measurement tools used	Conducting studies on individuals of different ages, regions, and levels; addressing different variables that may be similar to the related variables; organizing trainings for students, teachers, and families on cyberbullying and internet addiction.	Exclusion of clinical samples.
Cebollero-Salinas et al. (2022)	For all age and gender groups, cyberbullying, cyber victimization, cybergossip, and problematic internet use were found to have a significant positive relation. Girls had lower levels of cyberbullying cyber victimization than boys.	Cross-sectional design; relatively low reliability index of the internet-Related Experiences Questionnaire and Cyberbullying Scale; inclusion of participants from only one region although the sample was large; obtaining data based on self-reporting.	Training children and young people on the use of communication tools and prevention of problematic internet use; planning studies with individuals from different regions, conducting longitudinal studies.	Exclusion of clinical samples.
Aytaç et al. (2022)	It has been determined that internet addiction, lack of parental supervision, and daily internet use for more than 5 hours significantly predicted cyberbullying and victimization. It was found that cyberbullying and cyber victimization were significantly related to the type of family that free their child and act protectively toward their child. It was found that male students showed more cyberbullying. On the other hand, it was determined that cyber victimization did not differ according to gender.	The fact that the study was conducted on individuals living in a specific region; the data were limited to the measurement tools used.	Assigning personnel such as social workers who can conduct intervention programs for relevant variables in schools.	Use of non-probability-based sampling methods and the exclusion of clinical samples.

Table 12. *(continued)*

Study	Key Findings	Limitations	Recommendations	Risks of Bias
He et al. (2023)	There were significant positive relationships between problematic internet use, negative emotions, and cyberbullying. Negative emotions had a partial mediating and moderating effect on the relationship between problematic internet use and cyberbullying. Females had lower levels of problematic internet use and cyberbullying than males.	Cross-sectional design; general measurement of participants' emotions under the title of "negative emotions"; collection of data through self-report questionnaires.	Conducting experimental or longitudinal studies; addressing different variables; addressing specific emotions, collecting data from different information sources (teachers, students, parents, etc.); conducting prevention programs for online risks; organizing trainings emotion regulation skills in schools.	Exclusion of clinical samples.
Yudes-Gómez et al. (2018)	Problematic internet use was positively associated with cyberbullying and cyber victimization for all samples. There was no significant difference between all samples in terms of problematic internet use.	Obtaining data based on self-reporting; use of convenience sampling; small sample size in Uruguay compared with those of the other two countries; sample consists of only students with low/middle socioeconomic status.	Collecting data from sources such as families, teachers, parents, etc.; conducting longitudinal studies, conducting studies with different countries and cultures.	Use of non-probability-based sampling methods and the exclusion of clinical samples.
Blinka et al. (2023)	There were significant positive relationships between problematic internet use, cyberbullying and cyber victimization.	Cross-sectional design; obtaining data based on self-reporting.	Conducting longitudinal studies; Conducting prevention and intervention studies for adolescents	Use of an excessively abbreviated measurement tool in the measurement of cyber victimization (only 4 items) and exclusion of clinical samples.
Erdoğan (2023)	There were significant positive relationships between problematic internet use, cyberbullying and cyber victimization. Females had lower levels of cyberbullying than males. Parental adjustment was negatively associated to cyberbullying.	Cross-sectional design; small sample size; sampling procedure is not based on probability.	Conducting longitudinal studies; including more participants; conducting studies (seminars, short films, educational books, etc.) to raise the awareness of students and parents.	Use of non-probability-based sampling methods and the exclusion of clinical samples.
Ünver and Koç (2017)	There were significant positive relationships between problematic internet use, cyberbullying and risky internet behaviors. Adolescents who shared internet activities with their parents had lower levels of problematic internet use, cyberbullying and risky internet behaviors.	Obtaining data based on self-reporting; data collected from individuals living in a specific region.	Conducting prevention and intervention studies on safe internet and technology use for adolescents	Use of non-probability-based sampling methods and the exclusion of clinical samples.

Methodological Characteristics of the Studies

All studies included in the systematic review were quantitative studies. Quantitative cross-sectional design was used in 30 studies (Altundağ, 2016; Arpacı et al., 2020; Aytaç et al., 2022; Boniel-Nissim and Sasson, 2018; Blinka et al., 2023; Brighi et al., 2019; Cebollero-Salinas et al., 2022; Chang et al., 2015; Cicioğlu, 2014; Cinar et al., 2017; Çiçek, 2019; Efe et al., 2021; Erdoğan, 2023; Ergüder, 2019; Gencer, 2017; He et al., 2023; Jung et al., 2014; Lin et al., 2020; Liu et al., 2020; Machimbarrena et al., 2018; Nurtan et al., 2022; Şimşek et al., 2019; Tsimtsiou et al. 2018; Türkoğlu, 2013; Ünver and Koç, 2017; Wachs et al., 2020; Xin et al., 2021; Yudes et al., 2021; Yudes-Gómez et al., 2018; Zsila et al., 2018). Two studies used longitudinal design (Gámez-Guadix et al., 2016; Gámez-Guadix et al., 2016).

Self-report scales were used in all studies to measure internet addiction. Self-report questionnaires created by researchers were used in 8 studies to measure cyberbullying and victimization (Blinka et al., 2023; Boniel-Nissim and Sasson, 2018; Chang et al., 2015; Jung et al., 2014; Lin et al., 2020; Tsimtsiou et al., 2018; Wachs et al., 2020; Zsila et al., 2018). However, 24 studies used self-report scales previously used in the literature (Altundağ, 2016; Arpacı et al., 2020; Aytaç et al., 2022; Brighi et al., 2019; Cebollero-Salinas et al., 2022; Cicioğlu, 2014; Cinar et al., 2017; Çiçek, 2019; Efe et al., 2021; Erdoğan, 2023; Ergüder, 2019; Gencer, 2017; Gámez-Guadix et al., 2013; Gámez-Guadix et al., 2016; He et al., 2023; Liu et al., 2020; Machimbarrena et al., 2018; Nurtan et al., 2022; Şimşek et al., 2019; Türkoğlu, 2013; Ünver and Koç, 2017; Xin et al., 2021; Yudes et al., 2021; Yudes-Gómez et al., 2018).

Table 2 indicates that different explanations have been made in terms of limitations. These limitations can be categorized into 3 groups in general: limitations related to the sample, limitations related to measurement tools, and the preponderance of cross-sectional studies (Longitudinal design was used in only 2 studies). With regard to limitations related to sampling, studies were conducted on adolescents from a certain region, age range, or grade level; non-probability-based sampling methods were used; and sample sizes were small. Limitations related to measurement included the self-reported nature of the measurements in all studies and the use of previously unvalidated measurements in some studies.

As observed in Table 2, many suggestions have been made in the studies included in the systematic review study. These can be summarized as recommendations for researchers and practitioners. Suggestions for researchers include conducting experimental and longitudinal studies, (Altundağ, 2016; Blinka et al., 2023; Boniel-Nissim and Sasson, 2018; Brighi et al., 2019; Cebollero-Salinas et al., 2022; Chang et al., 2015; Erdoğan, 2023; Gámez-Guadix et al., 2016; He et al., 2023; Machimbarrena et al., 2018; Yudes et al., 2021;Yudes-Gómez et al., 2018; Wachs et al., 2020; Xin et al., 2021), including more participants (Altundağ, 2016; Erdoğan, 2023), collecting data from different information sources (teachers, peers, parents, etc.) (Gámez-Guadix et al., 2016; He et al., 2023; Machimbarrena et al., 2018; Wachs et al., 2020; Xin et al., 2021; Yudes-Gómez et al., 2018), conducting studies with different sample groups (age, region, level, etc.) (Arpaci et al., 2020; Cebollero-Salinas et al., 2022; Cicek, 2019; Cicioğlu, 2014; Cinar et al., 2017; Efe et al., 2021; Ergüder, 2019; Gámez-Guadix et al., 2016; Gencer, 2017; He et al., 2023; Türkoglu, 2013; Yudes-Gómez et al., 2018), and addressing different variables that may be related to internet addiction and cyberbullying (Arpaci et al., 2020; Cicek, 2019; Gámez-Guadix et al., 2016; Machimbarrena et al., 2018; Türkoglu, 2013; Zsila et al., 2018). Recommendations for practitioners include strategies that can be used to prevent or reduce internet addiction, cyber bullying, and cyber victimization. The recommendations for practitioners are as follows: (i) conducting educational and preventive studies (individual interviews, seminars, group guidance, etc.) for students and families on safe internet use and online risks (Blinka et al., 2023; Cebollero-Salinas et al., 2022; Cicioğlu, 2014; Cinar et al., 2017; Çiçek, 2019; Efe et al., 2021; Erdoğan, 2023; Ergüder, 2019; He et al., 2023; Jung et al., 2014; Şimşek et al., 2019; Tsimtsiou et al., 2018; Türkoğlu, 2013), (ii) conducting informative and awareness-raising activities for school personnel (teachers, school administrators, guidance services, etc.)(Jung et al., 2014; Gencer, 2017; Nurtan et al., 2022; Şimşek et al., 2019; Türkoğlu, 2013), (iii) conducting awareness-raising intervention studies that address the relevant variables, (iv) organizing awareness-raising activities such as mass communication campaigns (Tsimtsiou et al., 2018), seminars, educational books, short films, etc. for the public (Ünver and Koç, 2017), (v) assigning personnel such as social workers who can conduct intervention programs for relevant variables in schools (Aytaç et al., 2022), (vi) organizing trainings on regulation skills in schools (He et al. (2023), and (vii) mental health professionals

taking into account depressive symptoms and problematic internet use in the treatment of cyberbullying (He et al., 2023).

Risks of Bias

Sampling bias and measurement bias were examined to assess the risk of bias in the studies included in the systematic review. Regarding these biases, not including clinical samples in all studies and using non-probability-based sampling techniques in 18 studies posed a risk in terms of sampling bias (Altundağ, 2016; Arpacı et al., 2020; Aytaç et al., 2022; Boniel-Nissim and Sasson, 2018; Brighi et al., 2019; Cicioğlu, 2014; Cinar et al., 2017; Çiçek, 2019; Erdoğan, 2023; Gencer, 2017; Gámez-Guadix et al., 2016; Jung et al., 2014; Machimbarrena et al., 2018; Wachs et al., 2020; Ünver and Koç, 2017; Xin et al., 2021; Yudes et al., 2021; Yudes-Gómez et al., 2018). In addition, the use of internet gaming disorder scales to assess internet addiction in one study (Xin et al., 2021) and the use of excessively abbreviated instruments to assess variables in seven studies were considered high risk for measurement bias (Blinka et al., 2023; Boniel-Nissim and Sasson, 2018; Brighi et al., 2019; Chang et al., 2015; Lin et al., 2020; Wachs et al., 2020; Zsila et al., 2018).

DISCUSSION AND CONCLUSION

In the current systematic review study, published articles and theses addressing the relation between internet addiction, cyberbullying, and cyber victimization were examined. The included studies were reviewed for the following criteria: Countries where the studies were conducted, participants, operationalization of internet addiction, operationalization of cyberbullying and victimization, relation among internet addiction, cyberbullying and victimization, methodological features of the studies, and risks of bias.

Within the scope of the research, 32 studies addressing the relation between cyberbullying and/or cyberbullying victimization and internet addiction in adolescents were included. Of these, two were longitudinal studies (Gámez-Guadix et al., 2013; Gámez-Guadix et al., 2016) and 30 were cross-sectional studies. The scarcity of longitudinal studies leads to the fact that the effect of relevant variables on adolescents is not fully understood, and it can be said that there is a need to increase longitudinal research on this topic. The studies were conducted on adolescent students from many different countries. The studies included in the review were mostly carried out on middle and high school students. This situation limits our knowledge about how the relevant variables may affect individuals, especially in early and late adolescence. Accordingly, it can be said that the studies to be conducted with primary school and university students may contribute to the literature.

Regarding the operationalization of internet addiction, cyberbullying, and victimization, it is observed that all the studies reviewed were quantitative, and data were collected on the basis of the self-reporting of individuals. The fact that all of the studies were quantitative causes the findings to be limited to the measurement tools used. In addition, the collection of data based on self-reporting may have caused a tendency for individuals to give socially acceptable responses. In this context, using qualitative research methods in future studies and collecting data from alternative information sources (family, teacher, peer, etc.) will contribute to the literature.

This study aimed at examining the studies evaluating the relation among internet addiction, cyberbullying, and cyber victimization. When the findings of the studies examining the relation between internet addiction and cyberbullying are reviewed, all studies report a positive relation between internet addiction and cyberbullying. In one study, it was determined that internet-addicted adolescents engaged in cyberbullying more than non-addicted adolescents (Chang et al., 2015). In addition, it was determined that adolescents who were cyberbullies had higher internet addiction scores than non-cyberbullies (Jung et al., 2014), and internet addiction predicted the increase in cyberbullying at the longitudinal level (Gámez-Guadix et al., 2016). In this context, it is seen that internet addiction and cyberbullying are clearly related concepts. Internet-addicted individuals spend most of their time on online activities. Since individuals carry out their socialization processes only in online environments, they are able to learn behavioral patterns that are valid only in online environments. As a result, they have difficulty forming a social identity and have difficulty adapting to the norms of society (Ögel, 2012). This situation promotes the development of individuals' social skills (Chou et al. 2016; Torrente et al., 2014) and adaptation to social norms and rules (Naeim et al. 2020), causing an inhibiting effect on their learning to express their feelings and thoughts correctly. In addition, internet addiction is associated with many concepts like social anxiety (Torrente et al., 2014; Weinstein et al. 2015), depression (Chang et al., 2015; Jung et al., 2014), low self-esteem (Chang et al., 2015), and loneliness (Yao and Zhong, 2014). This situation leads to individuals becoming more introverted, which causes

their social skills to be more negatively affected. When evaluated in this context, it can be said that internet addiction is an important factor in adolescents' cyberbullying.

When the studies on the relation between cyber victimization and internet addiction were examined, significant positive relations were found in almost all studies. Only one study found a negative relation (Nurtan et al., 2022). In one study, it was determined that internet-addicted adolescents were exposed to cyberbullying more than non-addicted adolescents (Chang et al., 2015). In another study, it was determined that adolescents who were victims of cyberbullying had higher internet addiction scores than non-victims (Jung et al., 2014). In addition, it has been found that cyber victimization at the longitudinal level predicted an increase in internet addiction (Gámez-Guadix et al., 2013). Internet-addicted individuals spend most of their time on online environment and activities. This increases the likelihood of being exposed to cyberbullying. Furthermore, because they do not have sufficient social skills (Chou et al. 2016; Torrente et al., 2014), it can be said that they have difficulty in taking measures and fighting against cyberbullying. For this reason, it is expected that internet-addicted individuals are exposed to cyberbullying more than non-addicted individuals. However, in a study, it was determined that there is a negative relationship between internet addiction and cyber victimization (Nurtan et al., 2022). It is thought that this may be due to the sample group in which the relevant research was conducted as well as that internet-addicted individuals may have had a protective effect on their exposure to cyberbullying, albeit rarely, due to their mastery of online activities over time.

When analyzing the included studies, it is observed that gender differences are addressed in many of them. It has been determined that in the vast majority of studies where cyberbullying is considered in the context of gender, boys engage in cyberbullying more frequently than girls (Altundağ, 2016; Aytaç et al., 2022; Cebollero-Salinas et al., 2022; Chang et al., 2015; Cicioğlu, 2014; Çiçek, 2019; Erdoğan, 2023; Ergüder, 2019; Gencer, 2017; He et al., 2023; Jung et al., 2014; Nurtan et al., 2022; Şimşek et al., 2019; Tsimtsiou et al., 2018). Furthermore, cyberbullying did not differ according to gender in two studies (Arpacı et al., 2020; Yudes et al., 2021). When examining studies that considered cyber victimization in the context of gender, it was found that boys experienced cyber victimization more than girls in six studies (Altundağ, 2016; Cebollero-Salinas et al., 2022; Chang et al., 2015; Çiçek, 2019; Jung et al., 2014; Şimşek et al., 2019), and girls experienced cyber victimization more than boys in three studies (Machimbarrena et al., 2018; Nurtan et al., 2022; Tsimtsiou et al., 2018). Additionally, cyber victimization did not differ according to gender in three studies (Aytaç et al., 2022; Ergüder, 2019; Zsila et al., 2018). When the studies examining internet addiction in the context of gender were analyzed, it was determined that in seven studies (Arpacı et al., 2020; Chang et al., 2015; Cicioğlu, 2014; Çiçek, 2019; Gencer, 2017; He et al., 2023; Türkoğlu, 2013), boys had a higher level of internet addiction than girls, while in only one study (Machimbarrena et al., 2018), girls had a higher level of internet addiction than boys. In five studies, it was found that internet addiction did not differ according to gender (Altundağ, 2016; Ergüder, 2019; Şimşek et al., 2019; Tsimtsiou et al. 2018; Yudes et al., 2021). When the existing findings are examined, it is seen that in most of the studies, male adolescents engage in cyberbullying more frequently than girls. However, in the studies that deal with internet addiction and cyber victimization, it is concluded that there are different research findings related to gender. Thus, no consensus has been reached in the literature. In this context, it can be said that there is no consensus in the literature about the effect of gender on cyber victimization and internet addiction.

Many personal and interpersonal variables have been addressed in the studies examined within the scope of the systematic review. When these studies were examined, internet addiction was found to be positively associated with smoking, alcohol use (Chang et al., 2015), depression (Chang et al., 2015; Liu et al., 2020), low self-esteem (Chang et al., 2015; Wachs et al., 2020), psychological and physical symptoms (Lin et al, 2020), negative emotional symptoms (Brighi et al., 2019; He et al., 2023), alexithymia (Wachs et al., 2020), risky internet behaviors (Ünver and Koç, 2017), impulsivity, and rejection sensitivity (Xin et al., 2021). Additionally, factors related to parent-adolescent interaction, such as a low level of parental monitoring (Brighi et al., 2019), poor parent-child communication (Boniel-Nissim and Sasson, 2018), not sharing internet activities with their parents (Ünver and Koç, 2017), and having a social media tool without parental knowledge (Altundağ, 2016), were reported to be important risk factors in the development of internet addiction. Furthermore, positive mother-child and father-child communication (Boniel-Nissim and Sasson, 2018), high levels of awareness (Liu et al., 2020), and emotional intelligence (Yudes et al., 2021) were negatively associated with internet addiction.

When the studies on cyberbullying were examined, it was found that cyberbullying was positively associated with negative emotional symptoms (Brighi et al., 2019; He et al., 2023), low internet literacy, smoking, alcohol use (Chang et al., 2015), risky internet behaviors (Ünver and Koç, 2017), illegal and aggressive behaviors

(Jung et al., 2014). Additionally, variables related to parent-adolescent communication, such as low parental attachment, parental restrictive mediation (Chang et al., 2015), a low level of parental supervision (Aytaç et al., 2022; Brighi et al., 2019), having a social media tool without parental knowledge (Altundağ, 2016), not sharing internet activities with their parents (Ünver and Koç, 2017), and permissive and protective family type (Aytaç et al., 2022), were reported to be positively related to cyberbullying. By contrast, higher emotional intelligence (Yudes et al., 2021), positive mother-child, and father-child communication were reported to be negatively associated with cyberbullying. Finally, when the studies on cyber victimization were examined, it was found that cyber victimization was positively associated with depression (Chang et al., 2015; Gámez-Guadix et al., 2013; Jung et al., 2014; Liu et al., 2020; Zsila et al., 2018), psychological and physical symptoms (Lin et al, 2020), psychoactive substance use (Zsila et al., 2018), alexithymia and low self-esteem (Wachs et al., 2020), low internet literacy (Chang et al., 2015), and impulsivity and rejection sensitivity (Xin et al., 2021). In addition, variables related to parent-adolescent communication, such as low parental commitment, parental restrictive mediation (Chang et al., 2015), having a social media tool without parental knowledge (Altundağ, 2016), and protective family type (Aytaç et al., 2022), were reported to be risk factors associated with cyber victimization. By contrast, higher levels of awareness (Liu et al., 2020), perceived social support (Zsila et al., 2018), and positive mother-child and father-child communication (Boniel-Nissim and Sasson, 2018) were reported as negatively associated with cyber victimization. In light of the current findings, it can be said that internet addiction, cyberbullying, and cyber victimization are serious risk factors that impact adolescents' health and psychological well-being. Furthermore, it is observed that negative parent-adolescent interaction is an important risk factor in terms of related variables.

When the included studies were examined, it is seen that there are many methodological strengths and weaknesses. The methodological strengths of the included studies are as follows: the use of validated measurement tools, adequate sample size, and application of appropriate statistical analysis. However, all studies were considered at high risk for sampling bias, and seven studies (Boniel-Nissim and Sasson, 2018; Brighi et al., 2019; Chang et al., 2015; Lin et al., 2020; Wachs et al., 2020; Xin et al., 2021; Zsila et al., 2018) were considered high risk for measurement bias. Self-report questionnaires were used in all studies to measure variables. Additionally, due to the limited number of longitudinal and experimental studies, causality cannot be established in almost all studies. These findings restrict the generalizability of the results of the studies included in the review. The use of longitudinal or experimental designs, clinical sample groups, clinical interviews, and probability-based sampling methods in future studies can aid in generalizing study findings.

Many suggestions have been made in the studies included. These can be summarized as recommendations for researchers and practitioners. Suggestions for researchers include conducting longitudinal studies, collecting data from different information sources, conducting studies with different sample groups (age, region, level, etc.), and addressing different variables that may be related to internet addiction and cyberbullying. In addition, the recommendations for practitioners are as follows: organizing seminars and trainings aimed at increasing the level of awareness and knowledge of students, families, and teachers, as well as organizing prevention programs for online risks.

LIMITATIONS, RECOMMENDATIONS, AND CONCLUSIONS

Research findings clearly reveal the relation among cyberbullying, cyber victimization, and internet addiction. The internet is a tool with many functions such as access to information, education, socialization, shopping, etc., which facilitates many of our daily tasks. This important tool, like many other tools in our age, has positive and useful functions as well as some negative effects due to improper use. Internet addiction, cyberbullying, and cyber victimization are some of the negative consequences of improper internet use, especially among adolescents. Based on the relevant study findings, it is seen that internet addiction, cyberbullying, and cyberbullying victimization are interrelated concepts. From this point of view, taking the relevant variables together in the research, education and intervention programs to be conducted on these variables will allow more accurate and effective results to be obtained.

The current study has some limitations. Firstly, only studies published in Turkish and English between 2010 and 2024 were included. In addition, within the scope of the study, only studies conducted on adolescents were addressed. This situation limits the generalizability of the present findings. In future studies, it would be beneficial to include individuals from different age groups to obtain more comprehensive findings. The studies covered in the research were identified by analyzing five different databases. Additionally, the majority the included studies

were cross-sectional. However, survey method was used in all discussed studies. In future studies, examining different databases and addressing studies conducted using different research methods may contribute to the literature.

Ethical Approval

Not applicable

Competing interests

The authors declare no conflicts of interest

Authors' contributions

The authors contributed equally to this study.

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Availability of data and materials

Data supporting the findings of this review are openly available within the studies included in this review’s analysis.

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APPENDIX

Appendix 1: Newcastle-Ottawa Scale (Adapted Version for the Purposes of the Review)

Selection: (Maximum 6 stars)

1) Representativeness of the sample:
   a) Truly representative of the average in the target population. * (all subjects or random sampling)
   b) Somewhat representative of the average in the target population. * (nonrandom sampling)
   c) Selected group of users/convenience sample.
   d) No description of the sampling strategy.
2) Sample size:
   a) Justified and satisfactory. * b) Not justified. c) No information provided.
3) Measurement of internet addiction
   a) Using a validated measurement tool. ** b) non-validated measurement tool, but well described in methods section * c) No description or insufficient description in methods section.
4) Measurement of cyberbullying/cyber victimization:
   a) Validated measurement tool. ** b) non-validated measurement tool, but the tool is available or described. *
   c) No description of the measurement tool.

Comparability: (Maximum 1 star)

5) Confounding factors controlled.
   a) Data/ results adjusted for relevant predictors/risk factors/confounders e.g. age, sex, time, etc. *
   b) Data/results not adjusted for all relevant confounders/risk factors/information not provided.

Outcome: (Maximum 3 stars)

6) Assessment of the outcome:
   a) Independent or blind assessment. ** b) Record linkage. ** c) Self report or no blind assessment. *
   d) No description.
7) Statistical test:
   a) The statistical test used to analyze the data is clearly described and appropriate, and the measurement of the association (including confidence intervals and/or the probability level) are presented. *
   b) The statistical test is not appropriate, not described or incomplete.

Scoring legend:

Very Good Studies: 9-10 stars, Good Studies: 7-8 stars, Satisfactory Studies: 5-6 stars, Unsatisfactory Studies: 0 to 4 stars

This scale has been adapted from the Newcastle-Ottawa Quality Assessment Scale for cohort studies to provide quality assessment of cross-sectional studies.

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Intolerance of Uncertainty and Psychological Flexibility Predict Worry in Young Adults

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Abstract

This research purposed to examine the relationship between worry, intolerance of uncertainty, and psychological flexibility in young adults with a university degree, as well as to explore the influence of their demographic characteristics in relation to these variables. Additionally, the study used hierarchical regression analysis to predict participants' level of worry based on these factors. The sample of this correlational research consisted of 425 young adults (339F, 86M). The data of the study were obtained using the Demographic Information Form, the Penn State Worry Questionnaire, the Intolerance of Uncertainty Scale, and the Acceptance and Action Questionnaire-II during the COVID-19 pandemic period. The results of the study revealed that there were significant high-level relationships among the research variables. While participants' worry levels showed significant differences based on gender and monthly family income, their levels of worry did not show significant differences based on age and current employment status. The hierarchical regression analysis conducted using a three-step model revealed that participants' worry levels were predicted gender, intolerance of uncertainty, and psychological flexibility. Intolerance of uncertainty was found to be the most significant predictor of worry accounting for 39.5% of the total variance in worry. Lastly, the findings of the study were discussed and interpreted, and recommendations were provided for following studies.

Keywords: COVID-19, intolerance of uncertainty, psychological flexibility, worry, young adult

Genç Yetişkinlerde Belirsizliğe Tahammülsüzlük ve Psikolojik Esnekliğin Endişeyi Yordaması

Öz

Bu araştırma üniversite mezunu genç yetişkin bireylerin endişe, belirsizliğe tahammülsüzlük ve psikolojik esneklik düzeylerinin demografik değişkenlerle olan ilişkisini incelemeyi ve katılımcıların endişe düzeylerinin değişkenler açısından yordanmasını hiyerarşik regresyon analiziyle test etmeyi amaçlamıştır. İlişkisel araştırma yöntemiyle gerçekleştirilen bu araştırmanın örneklemi toplam 425 genç yetişkin bireyden (339K, 86E) oluşmaktadır. Araştırmanın verileri COVID-19 pandemisi döneminde Demografik Bilgi Formu, Penn Eyalet Endişe Ölçeği, Belirsizliğe Tahammülsüzlük Ölçeği ve Kabul ve Eylem Formu-II kullanılarak elde edilmiştir. Araştırmanın sonucunda, araştırma değişkenlerinin arasındaki ikili ilişkiler incelendiğinde üç değişkenin de birbiriyle yüksek düzeyde anlamlı ilişkisinin olduğu; katılımcıların endişe düzeylerinin, cinsiyete ve aile aylık gelir düzeyine göre anlamlı farklılık gösterirken yaşa ve aktif çalışma durumuna göre anlamlı bir farklılık göstermediği; üç aşamalı modelle yapılan hiyerarşik regresyon analizi sonucunda ise katılımcıların endişe düzeylerini cinsiyet, belirsizliğe tahammülsüzlük ve psikolojik esneklik değişkenlerinin birlikte yordadığı ve bu değişkenlerden endişeyi en iyi açıklayan değişkenin toplam varyansa sağladığı %39,5'lik katkıyla belirsizliğe tahammülsüzlük olduğu sonuçlarına ulaşılmıştır. Son olarak araştırmadan elde edilen bulgular tartışılıp yorumlanarak sonraki çalışmalar için öneriler sunulmuştur.

Anahtar Sözcükler: COVID-19, belirsizliğe tahammülsüzlük, psikolojik esneklik, endişe, genç yetişkin

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INTRODUCTION

Individuals go through several stages during their lifetimes, including childhood, adolescence, young adulthood, adulthood, and late adulthood. Each stage has certain developmental tasks that individuals need to accomplish. Havighurst (1972) stated that if individuals fail to overcome these developmental tasks, they will be unhappy in their following life stages and may even be excluded by society. Young adulthood represents the transition from adolescence to adulthood, making it a significant milestone in a person's life (Gönül, 2008; Tanner, 2006). Arnett pointed out that during this period, individuals neither fully eliminate of their dependency from childhood nor fully embrace the responsibilities required by adulthood (Arnett, 2000; Hochberg & Konner, 2020). The common developmental tasks of young adulthood can be categorized into five groups: completing education, gaining independence, getting married, becoming a parent, and obtaining full-time employment (Shanahan et al., 2002). However, nowadays, these milestones are often delayed for young adults, and alongside this, subjective interpretations of adulthood are becoming increasingly significant (Wright & Von Stumm, 2024). In addition to this, the transition to adulthood begins later for individuals today compared to the past, partly due to the extended duration of time spent in education (Atak et al., 2016).

The main developmental task for individuals in young adulthood is typically entering the workforce and securing employment (Eryılmaz & Mutlu, 2017). However, unemployment has become an increasingly significant problem both in Türkiye and worldwide. The group most affected by this problem is undoubtedly young people (Bedel, 2014). According to the Turkish Statistical Institute (TÜİK, 2024), the youth unemployment rate among the 15-24 age group in June 2024 was 14.8% for males and 23.2% for females, making a total of 17.6% in the overall youth population. In relation to the youth unemployment problem, each year, over 2.5 million students in Türkiye take university entrance exams, aiming to pursue higher education for specialized qualifications and to enhance their competitiveness in the job market (Kıçır, 2017; ÖSYM, 2024). According to current data, a total of 208 universities are conducting educational activities in Türkiye (Higher Education Information Management System [YBYS], 2024). A total of 961,194 students graduated from undergraduate and associate degree programs in the 2022-2023 academic year (YBYS, 2024). However, statistical data shows that unemployment rates among young adult individuals with higher education degrees are notably high (Surat & Ceran, 2020).

People facing various challenges often need to understand their circumstances, explore potential actions they can take, and consider the possible outcomes of their choices (Karataş & Uzun, 2018). Uncertainty, can be defined as the inability to predict the outcomes of an event, situation, or behavior, which can be especially challenging for individuals who have difficulty tolerating ambiguity (Sarı, 2007). Intolerance of uncertainty has been specified as a predisposition to perceive uncertain situations, information, or events negatively, without taking into account possibilities and outcomes (Ladouceur et al., 1998; Ladouceur et al., 2000). Individuals who have high intolerance of uncertainty are more vulnerable to a range of psychological disorders such as depression, anxiety, stress, and worry (Andrews et al., 2023; Grupe & Nitschke, 2013; Lin et al., 2024; Mantzios et al., 2014), and high levels of worry are particularly closely related to this condition (Adamis et al., 2024; Koerner & Dugas, 2006). Individuals who cannot tolerate the uncertainty, perceive uncertainty as stressful, distressing, and worry-provoking, and they have a strong belief that uncertainty is an unfavorable thing and should absolutely be avoided (Buhr & Dugas, 2006). Individuals with such negative thoughts and intolerance of uncertainty tend to avoid situations that may create uncertainty and motivate themselves by avoiding such situations (Bavolar et al., 2021; Mantzios et al., 2014; Newman & Llera, 2011). When faced with situations involving uncertainty, these individuals tend to respond with negative emotional, cognitive, and behavioral reactions and exhibit experiential avoidance (Newman & Llera, 2011; Roemer et al., 2005; Sahib, 2023).

Experiential avoidance can be specified as an individual's effort to avoid or distance themselves from internal experiences such as emotions, thoughts, memories, and images (Hayes et al., 2012). Given that experiential avoidance is a key aspect of psychological flexibility, central to Acceptance and Commitment Therapy (ACT) (Harris, 2019; Hayes et al., 2012), it can be inferred that avoidance behaviors are associated with low psychological flexibility. There are also studies indicating that experiential avoidance increases the severity of worry and transforms worry from a pervasive cognitive activity into a pathological experience (Roemer et al., 2005). The fundamental aim of ACT is to help individuals accept their internal experiences and personal values without disconnecting from the present moment and to act in accordance with what is important to them (Harris, 2019). In light of this information, individuals with high psychological flexibility are able to tolerate uncertainty, and they are more resilient against psychological disorders such as high levels of worry, anxiety and depression. In this regard, particularly for young adult individuals who have completed their university education, fulfilling

developmental tasks such as completing their education, getting married, becoming parents, and having a full-time job (Atak et al., 2016) will make their lives more meaningful and valuable.

Studies considering the relationship between worry, intolerance of uncertainty, and psychological flexibility in young adults have mostly emerged during the COVID-19 pandemic. This can be attributed to the uncertainty experienced by most individuals during the pandemic (Adamis et al., 2024; Smith et al., 2020). Demographic factors, including age, gender, socioeconomic status, and education level have been examined in relation to their responses to the pandemic (Bayhan & Bozkurt, 2021). The uncertainties arising from the pandemic have led to increased levels of worry among individuals. Research indicates that young adults are more negatively affected by the pandemic compared to other age groups (Acar, 2020; Bayhan & Bozkurt, 2021; Tarhan, 2020). Furthermore, individuals with lower income and education levels, often categorized as disadvantaged groups, along with women, are considered to be at higher risk during this period. (Bozkurt, 2020). Moreover, the mandatory restrictions implemented during the pandemic have slowed down countries' economic growth, resulting in increased unemployment rates and consequently exacerbating youth unemployment. This, in turn, has led to increased levels of depression and worry among young adult individuals regarding their future (Bayhan & Bozkurt, 2021). Psychological flexibility is positively associated with individuals' well-being, and research on psychological flexibility during the COVID-19 pandemic demonstrates that individuals' psychological flexibility skills play a critical role in coping with depression, worry, and other challenges brought by the pandemic (Dawson & Golijani-Moghaddam, 2020; Prudenzi et al., 2022; Tolan & Uğur, 2021). A review of the relevant literature reveals that while young adults' demographic characteristics, worry, intolerance of uncertainty, and psychological flexibility levels have been investigated individually or in pairs, no study has been identified that examines these factors collectively. In this respect, examining the relationship between demographic variables, worry, intolerance of uncertainty, and psychological flexibility in university-educated young adults is important, particularly given that they are in a significant stage in their lives. In this regard, this study focuses on data obtained from university graduate young adults during the COVID-19 pandemic, providing valuable insights into these relationships under unique and stressful conditions. The findings of this study will contribute to research as well as mental health services for young adults both from developmental and preventive perspectives. The research questions in this study, which examine the relationships among intolerance of uncertainty, psychological flexibility, and worry in university-educated young adults, are as follows:

1. Is there a significant relationship among worry, intolerance of uncertainty, and psychological flexibility levels in university-educated young adults?
2. Do the worry levels of university-educated young adults show significant differences based on demographic variables?
3. Does the combination of demographic variables, intolerance of uncertainty levels, and psychological flexibility levels significantly predict the university-educated young adults' worry levels?

METHOD

Research Design and Sample

This correlational study, designed to investigate the relationships among intolerance of uncertainty, psychological flexibility, and worry, employed convenience sampling method. Convenience sampling involves starting the sample selection with the most accessible participants until the desired sample size is reached (Cohen et al., 2007). The sample of this study consists of young adult individuals who graduated from a state university in 2019 and 2020 (N=411). Out of the participants, 328 (80%) are female, and 83 (20%) are male. The ages of the participants range from 20 to 50 (M=24.12, SD=3.09). Among the participants, 90 (21.9%) hold an associate degree, and 321 (78.1%) hold a bachelor's degree, representing 15 different faculties and 8 different vocational schools of the respective university. Of the participants, 123 (29.9%) graduated in 2019, 288 (70.1%) in 2020, with 389 (94.6%) identifying as single and 22 (5.4%) as married.

Data Collection Process and Data Collection Tools

The data gathered during the COVID-19 pandemic, a period when individuals experienced intense feelings of uncertainty and worry that deeply affected the world. Prior to commencing the data collection, ethical approval was obtained from the Ethics Committee for Human Research in Social Sciences of related university, then an online data collection package, including a demographic information form and scale items, was created. The package was disseminated to individuals who graduated in 2019-2020 through the university's distance education center and information technology center via email and messages, and data were collected from voluntary

participants in the first and second weeks of April 2021. It took approximately 10 minutes for each participant to respond to the questions in the data package. Four different tools for data collection were used in this research.

Demographic Information Form. It is a form that includes information such as age, gender, marital status, faculty, department, graduation year, income level, and information related to work life. This form has been created by the researchers.

Penn State Worry Questionnaire (PSWQ). This questionnaire was developed by Meyer et al. (1990), reevaluated by Molina and Borkovec (1994), and translated and adapted into Turkish by Yılmaz et al. (2008). Permission was obtained from the researchers to use the scale. The scale is a 5-point Likert-type scale (1=never true for me and 5=always true for me), consisting of 16 items. Eleven items (2, 4, 5, 6, 7, 9, 12, 13, 14, 15, and 16) are positively scored, while five items (1, 3, 8, 10, and 11) are negatively scored, representing higher levels of pathological worry (Boysan et al., 2008). The minimum score that can be gathered from this scale is 16, while the maximum score is 80. The translation and adaptation of the scale into Turkish were tested with a non-clinical sample of 561 participants. During the process of adapting the scale into Turkish, the researchers found a two-factor structure. The first factor (excessive worry) consists of the positively scored 11 items, while the second factor (absence of worry) consists of the reverse-coded five items. The Cronbach's alpha coefficient for the entire Turkish version of the scale was found to be .91, while it was .92 for the excessive worry subscale and .68 for the absence of worry subscale. In the analysis conducted using the data obtained from the research sample, the Cronbach's alpha coefficient for the entire scale was found to be .94.

Intolerance of Uncertainty Scale Short Form (IUS-12). The original form of the scale, consisting of 27 items, was developed by Freeston et al. (1994). However, a short form consisting of 12 items (IUS-12) was later developed by Carleton et al. (2007) and the short form of this scale adapted into Turkish by Sarıçam et al. (2014). Permission was obtained from the researchers for the use of the scale. The scale comprises 12 items and 2 subscales (Prospective Anxiety and Inhibitory Anxiety) and is a 5-point Likert-type scale (1=Not suitable for me at all, 5=Completely suitable for me). There are no reverse-coded items in the scale. The Cronbach's alpha coefficient for internal consistency was found to be .88 for the entire scale, .84 for the Prospective Anxiety subscale, and .77 for the Inhibitory Anxiety subscale. The test-retest correlation coefficient was .74. A low score on the scale indicates low intolerance of uncertainty, while a high score points out high intolerance of uncertainty (Sarıçam et al., 2014). In the analysis conducted based on the data obtained from the research sample, the Cronbach's alpha coefficient for the entire form was found to be .91

Acceptance Action Questionnaire-II (AAQ-II). This questionnaire developed by Bond et al. (2011) and adapted into Turkish by Yavuz et al. (2016), was used. Permission was obtained from the researchers for the use of the scale. The scale consists of 7 items and a single dimension and is a 7-point Likert-type scale (1: Never true, 7: Always true). The scale measures individuals' level of psychological flexibility, and a high score indicates high psychological inflexibility, while a low score points out high psychological flexibility. The internal consistency coefficient of the scale was .84, and the test-retest reliability coefficient was .85 (Yavuz et al., 2016). In the analysis conducted based on the data obtained from the research sample, the Cronbach's alpha coefficient for the entire form was found to be .90.

Data Analysis

After the application of the scales, the data sets were analyzed using the IBM SPSS 26.00 software package. Prior to data analysis, data entries were checked, reverse items in the scales were identified and recoded, missing data and outliers in the obtained data sets were examined, and the normality of the data distribution was tested. Based on the assumption tests conducted, no missing data were found, allowing the analysis to proceed with the available data. Subsequently, outlier analysis was conducted, and outliers were identified in items 1 and 2 of IUS-12 and items 9 and 10 of PSWQ. As a result, 14 participants (218, 241, 289, 294, 372, 374, 376, 381, 395, 406, 410, 418, 419, 422) with outlier values were excluded from the sample among 425 participants (N=411). After removing the outliers, the skewness and kurtosis values were examined in the normality analysis. The values were found to be within the appropriate reference ranges, indicating that the data exhibited a normal distribution and met the assumption of normality. Therefore, the decision was made to use parametric tests.

In the study, descriptive statistical tables were used. Descriptive statistics were conducted for the dependent variable of worry and its relationship with demographic variables, using independent samples t-test and one-way analysis of variance (ANOVA), and the obtained values were interpreted. The relationships among the variables of the study were examined using Pearson correlation analysis. To investigate the predictive effect of demographic variables and independent variables on the dependent variable, a hierarchical regression analysis was

conducted, which allows for a multidimensional examination of the relationship between variables based on the theoretical framework (Büyüköztürk, 2020; Tabachnick & Fidell, 2019). Prior to the hierarchical regression analysis, the suitability of the data set for analysis was evaluated. According to Tabachnick and Fidell (2019), the assumptions required for hierarchical regression analysis are the same as other forms of regression analysis. After testing the necessary assumptions and confirming that the data set is suitable for hierarchical regression analysis, the analysis was conducted. During the hierarchical regression analysis, conducted in three models, demographic variables and independent variables were included in the analysis in a theoretically appropriate order. In the first model, demographic variables, which are the fundamental variables predicting worry, were included in the model. In the second model, uncertainty intolerance variable, which was predicted to have a high contribution to the explained variance since it is closely related to worry, was included while keeping the demographic variables constant. In the final model, the first two groups of variables were held constant, and the psychological flexibility variable, which was hypothesized to be less related to worry than uncertainty intolerance, was added to the model to complete the hierarchical regression analysis.

FINDINGS

Findings Regarding Descriptive Statistics and Correlations of Variables

The relationship between scores obtained by young adult individuals with university education in PSWQ, IUS-12, and AAQ-II was tested using the Pearson Correlation Analysis method. Independent samples t-test analysis was aimed to explore whether there is a significant difference in the worry levels of university graduate young adult individuals between male and female individuals, among individuals in the age ranges of 20-23 and 23+ (since the average age of graduation from university in our country is generally 23, the age groups were grouped as 20-23 and 23+ based on the data gathered from the demographic information form), and between actively employed and unemployed individuals (although the data gathered from the demographic information form was categorized into three categories as “Yes/Full-time” (N=88), “Yes/Part-time” (N=25), and “No” (N=298) for the ANOVA analysis, the first two groups were combined due to insufficient sample size in the first two groups for ANOVA analysis, resulting in two groups as “Yes (Employed)” and the last group remained the same as “No (Unemployed)”).

The findings related to the Pearson Correlation analysis and analysis of the t-test for independent samples are presented in Table 1, indicating whether there is a significant difference in the worry levels of university-educated young adults according to monthly income level of their families. The findings of the ANOVA (One-way) test analysis are showed in Table 2.

Table 1. Descriptive Statistics and Correlations of Variables

Variable		N	$\bar{X}$	S	sd	t	p	1	2	3
1.PSWQ								1	.647**	.632**
2.IUS-12								.647**	1	.519**
3.AAQ-II								.632**	.519**	1
Gender	Female	328	52.17	13.98						
	Male	83	46.34	14.62	409	3.270	.001**			
Age	20-23	187	51.36	14.63						
	23+	224	50.69	14.03	409	.487	.633			
Working Status	Yes	113	3.07	.90						
	No	298	3.22	.88	409	-1.52	.128			
Family Monthly Income	0-1 (MMW)	92	52.54	13.08						
	1-2(MMW)	204	51.43	14.14	409					
	2-3(MMW)	74	51.12	15.04						
	4+ (MMW)	36	44.36	15.32						

**p<0.01, MMW: Minimum monthly wage

When Table 1 is examined, there are significant positive relationships at a high level between all three variables. Also, there is a significant difference in the levels of worry of young adult individuals with university education is observed based on gender, t (409) = 3.270, p <.05. The worry levels of young adult women with university education (M = 52.17) are higher than the worry levels of young adult men with university education (M = 46.34). Furthermore, when Table 1 is examined, it is noticed that there is no significant difference in the worry levels of young adult individuals with university education based on age, t (409) = .487, p> .05, and employment status, t (409) =-1.52, p > .05.

Table 2. ANOVA and Gabriel Test Results of PSWQ Scores by Individual's Family Income Level

Source of Variance	Sum of Squares	Degree of Freedom (dF)	Mean of Squares	F	p	Gabriel Test
Between the Groups	1844.016	3	614.672	3.053	.028*	.017 (1-4) .018 (2-4)
within the Groups	81949.984	407	201.351			
Total	83794.000	410				

*p<.05

When Tables 1 and 2 are examined, a significant difference is observed in the worry levels of university-educated young adult individuals based on their families' income levels (F (3,407) = 3.053, p < .05). To determine the source of this difference between groups, the Gabriel Test was conducted. The results showed that individuals from the lowest family income (0-1) have higher levels of worry (M = 52.54) compared to individuals from the highest family income (4+) (M = 44.36). Similarly, individuals from lower income family (1-2) also have higher levels of worry (M= 51.42) compared to individuals from the highest family income (4+) (M = 44.36).

Findings on Whether the Demographic Characteristics, Intolerance of Uncertainty, and Psychological Flexibility Significantly Predict the Worry Levels of Young Adults

Hierarchical regression analysis was conducted to examine the multidimensional relationship between the variables that predict the worry levels of young adult individuals who have graduated from university, based on a theoretical framework. The findings of the hierarchical regression analysis, which were conducted in three stages, are presented in Table 3.

Table 3. Hierarchical Regression Analysis Results Regarding the Prediction of University Graduate Young Adult Individuals' Worry Levels

Variables	B	β	t	p	F	p	R^2	Adjusted R^2
Model 1					3.59	.004*	.042	.030
Constant	60.09		10.87	.000**				
Gender	-5.26	-.148	-2.99	.003*				
Marital Status	-2.17	-.034	-.669	.504				
Age	.263	.009	.185	.854				
Family Monthly Income	-1.42	-.086	-1.64	.100				
Active Working	.864	.050	.959	.338				
Model 2					52.30	.000**	.437	.429
Constant	22.25		4.63	.000**				
Gender	-3.89	-.109	-2.88	.004*				
Marital Status	-1.95	-.031	-.783	.434				
Age	.048	.002	.044	.965				
Family Monthly Income	-.317	-.019	-.475	.635				

Active Working	.708	.041	1.02	.307				
IUS-12	.868	.634	16.84	.000**				
Model 3					70.55	.000**	.551	.543
Constant	16.77		3.87	.000**				
Gender	-3.22	-.091	-2.66	.008*				
Marital Status	-1.74	-.027	-.780	.436				
Age	.537	.019	.549	.583				
Family Monthly Income	.177	.011	.296	.768				
Active Working	.755	.044	1.22	.223				
IUS-12	.592	.433	11.05	.000**				
AAQ-II	.561	.397	10.08	.000**				

* p<01 **p<.001

When Table 3 is examined, it can be seen that the F and p values of Model 1 are statistically significant (F (5,410) = 3.55; p < .01). In explaining the worry levels of young adult individuals with a university degree, it was concluded that only gender (β = -.148; p < .01) had a significant contribution among demographic variables, explaining 3% of the total variance (R^2 = .030). Model 2, created by adding the intolerance of uncertainty variable to Model 1, is statistically significant (F (6,410) = 52.30; p < .001). When the variables in Model 1 are controlled, it can be observed that the intolerance of uncertainty variable added to Model 2 contributes to 39.5% of the previously explained variance in individuals' worry levels, thus increasing the total explained variance to 43% (R^2 = .429). When the variables in Model 2 are examined, it can be seen that the intolerance of uncertainty variable added in the 2nd Model has a significant predictive effect on worry (β = .634; p < .001), and the gender variable continues to have a significant predictive effect in Model 2 (β = -.109; p < .01). Model 3, created by adding the psychological flexibility/rigidity variable to Model 2, is statistically significant (F (7,410) = 70.55; p < .001). When the effects of demographic variables and the intolerance of uncertainty variable on worry in Model 2 are controlled, it can be observed that the psychological flexibility/rigidity variable added to Model 3 contributes 7.2% to the total variance of worry, increasing the explained total variance to 54% (R^2 = .543). When the variables in Model 3 are examined, it can be seen that the gender (β = -.091; p < .01) and intolerance of uncertainty (β = .433; p < .001) variables continue to have a significant predictive effect in Model 3. In Analysis 3, it is observed that the psychological flexibility/rigidity variable added to the analysis also has a significant predictive effect on worry (β = .397; p < .001). When the three models are examined together, a positive and significant relationship is found between individuals' worry levels, their intolerance of uncertainty, and their level of psychological flexibility/rigidity. Among the variables, intolerance of uncertainty makes the best contribution to explaining worry, accounting for 39.5% of the total variance.

DISCUSSION

This study aimed to explore the relationship among worry, intolerance of uncertainty, and psychological flexibility levels of university-educated young adult individuals with demographic variables, and to test the prediction of participants' worry levels in terms of these variables through hierarchical regression analysis. The results of the study show that worry, intolerance of uncertainty, and psychological flexibility levels of young adults significantly predict each other and demonstrate the presence of strong relationships among these variables. According to the analyses, there is a high level of positive and significant relationship between intolerance of uncertainty levels and worry levels of university graduate young adults, and intolerance of uncertainty is found to be a significant predictor of individuals' worry levels. In other words, participants with high intolerance of uncertainty also have high levels of worry. Similarly, there is a high level of positive and significant relationship between intolerance of uncertainty levels and psychological inflexibility levels of participants, and psychological flexibility is found to be a significant predictor of individuals' worry levels. In other words, university graduate young adult individuals with high intolerance of uncertainty have high levels of psychological inflexibility and low levels of psychological flexibility. Lastly, there is a high level of positive and significant relationship between

psychological inflexibility levels and worry levels of participants, and psychological flexibility is found to be a significant predictor of individuals' worry levels. In other words, university graduate young adult individuals with high psychological inflexibility also have high levels of worry. Finally, the outcomes of the current study are consistent with the findings in the literature.

In addition, when examining the relationship between worry levels and demographic characteristics of university-educated young adult individuals, research results show that there is a significant difference in worry levels between male and female individuals among university graduates. The study found that worry levels were higher in women who were compared to men. These findings are largely consistent with the information presented in the literature. For example, a study examining the worry levels of young adult individuals in terms of various variables stated that women experience more worry than men (Hunt et al., 2003). Similar results can be observed in other studies that examine worry in individuals in terms of various variables and gender (Gonçalves & Byrne, 2013; Gould & Edelstein, 2010; Lindesay et al., 2006; Schoeps et al., 2022), which are like the findings of the current study. Furthermore, another study indicated that young adult women experience more worry than men, and even more than older adult women (Gould & Edelstein, 2010).

The results of this study demonstrate that worry levels of university-educated young adult individuals do not significantly differ according to age. The reason for this may be due to the relatively narrow sample of the current study, consisting of individuals whose ages are relatively close to each other, contrary to the findings of most similar studies in the literature that focus on this relationship. As with the age variable, it has been found that the worry levels of young adult individuals with a university degree do not significantly differ based on their active employment status. Considering that the research data were collected during the COVID-19 pandemic, this result becomes even more interesting. This is because the mandatory restrictions applied during the COVID-19 pandemic have led to a contraction in the labor market, an increase in unemployment rates, and consequently an increase in youth unemployment. This situation has resulted in an increase in depression and worry levels related to the future for young adult individuals (Bayhan & Bozkurt, 2021; Prime et al., 2020). Another reason for the lack of significant differentiation in worry levels of participants' employment status may be the composition of the research sample. The sample consists of young adults who have graduated from university and have been unemployed for a relatively short period. Additionally, although there are studies in the literature that indicate individuals experience worry and uncertainty because of the unemployment during the COVID-19 pandemic (Bayhan & Bozkurt, 2021; Godinic et al., 2020), it should be kept in mind that individuals experienced more worry and uncertainty regarding health issues during this process (Puci et al., 2020). Lastly, regarding demographic variables, it is observed that the worry levels of the participants significantly differ based on the monthly income level of their families. Numerous studies in the literature that support the notion that individuals with lower income are more anxious compared to those with higher income (Bracke et al., 2013; Drentea, 2000; Patler & Laster Pirtle, 2018; Wolbers, 2003), which is also in accordance with the findings of this study.

The study found that worry levels among young adults with university education were significantly influenced by demographic factors, intolerance of uncertainty, and psychological flexibility. The hierarchical regression analysis revealed that among the demographic variables including gender, age, family income status, and current employment, only gender had a significant contribution (3%) in explaining the worry levels of young adult individuals with university education. There was a significant positive relationship among individuals' worry levels and their intolerance of uncertainty as well as their levels of psychological flexibility/rigidity. Intolerance of uncertainty was found to be the most significant predictor (39.5%) contributing to the explained total variance and worry levels. The findings of the conducted hierarchical regression analysis largely align with the literature and expected results. Also, it was unexpected that the participants' worry levels did not significantly differ based on their current employment status, as stated in both the t- test results and the hierarchical regression analysis, even when considering other demographic variables.

In conclusion, it was observed that the three variables included in this study (worry, intolerance of uncertainty, and psychological flexibility/rigidity) have a high significant relationship with each other. While participants' worry levels showed significant differences based on gender and monthly family income level, they did not show significant differences based on age and current employment status. Participants' worry levels were collectively predicted by gender, intolerance of uncertainty, and psychological flexibility variables, with intolerance of uncertainty being the best predictor among these variables.

This study should not be considered without its limitations and some recommendations. The limitations of the study include the limited age variations due to the sample consisting of 411 young adults who graduated from a state university only in the years of 2019-2020. Therefore, the results cannot be generalized to all young

adult university graduates. Additionally, the study was based on a correlational design using only the variables included in the research, and the data were collected during the COVID-19 period. Considering these limitations, it should be noted that more generalizable results can be obtained in future studies. Furthermore, a quantitative method was employed in the current research, which examined the relationship among demographic variables, worry, intolerance of uncertainty, and psychological flexibility. In this context, qualitative research could be focused to examine the emotions, thoughts, and experiences of university graduate young adults in detail during the data collection process. Alternatively, experimental studies could be conducted with a sample group characterized by high levels of worry and intolerance of uncertainty, in which a psycho-educational program aimed at enhancing psychological flexibility skills is implemented and its effectiveness is tested. Finally, based on the results of this study, professionals working with young adults can conduct studies, particularly targeting the reduction of worry levels in women. Specifically, psycho-educational programs based on Cognitive-Behavioral Therapy (CBT) and Acceptance and Commitment Therapy (ACT) that focus on coping strategies, which have been proven effective in previous research, can be developed and implemented. Mental health professionals can utilize CBT-based intervention approaches that have been proven effective in this field to increase individuals' tolerance of uncertainty and reduce worry levels, both during and after the COVID-19 pandemic or in the event of any future global outbreak.

Last but not the least in a broader context, institutions should aim to develop individuals with clear values, greater psychological flexibility, higher tolerance for uncertainty, and effective coping skills for worry as they graduate from the university and enter the workforce. To achieve this, systematic preventive and empowering activities can be implemented throughout the entire education life, starting from the preschool. These educational activities should continue during primary, secondary and higher education systems with the support of school counselors and counseling centers at universities.

Researchers' Contribution Rate

Authors	Literature review	Method	Data Collection	Data Analysis	Results	Conclusion
Author 1's name	☒	☒	☒	☒	☒	☒
Author 2's name	☐	☒	☒	☐	☒	☒

Statements of Publication Ethics

Ethical Committee Approval Letter was given by Bolu Abant Izzet Baysal University Ethics Committee On Human Research in Social Sciences issued with 2020/320 on the date of 24.12.2020.

Conflict of Interest

The authors have no conflicts of interest to disclose.

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The Investigation of the Effect of Science Education Program-Dramatic Activities (Sep-Da) on the Science Process Skills of 60–72-Month-Old Children

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Abstract

This study was conducted in a quasi-experimental design to examine the effect of science education given to 60-72-month-old children through dramatic activities on their science process skills. The study group consisted of two groups of 60-72-month-old children attending kindergartens and having similar social, cultural and economic characteristics. Pre-test, post-test and retention test scores were calculated using the Scientific Process Skills Test developed to evaluate children's scientific process skills. SEP-DA (Science Education Program-Dramatic Activities), which was planned for 7 weeks and 14 activities, was used for the experimental application. In the education program, science process skills were presented to children with drama techniques. At the end of the experimental process, the difference between the science process skills scores of the children in the experimental and control groups was found to be significant. The science education program given through dramatic activities had a strong effect on the science process skills of the children in the experimental group. The retention test also revealed that this effect was long lasting.

Keywords: creativity, drama, science process skills, science education.

Dramatik Etkinlikler Aracılığı ile Verilen Fen Eğitiminin (Sep-Da) 60-72 Ay Çocuklarının Bilimsel Süreç Becerilerine Etkisinin İncelenmesi

Öz

Bu araştırma, 60-72 aylık çocuklara dramatik etkinlikler yoluyla verilen fen eğitiminin bilimsel süreç becerilerine etkisini incelemek amacıyla yarı deneysel desende gerçekleştirilmiştir. Çalışma grubu, anaokullarına devam eden ve benzer sosyal, kültürel ve ekonomik özelliklere sahip 60-72 aylık iki grup çocuktan oluşmaktadır. Çocukların bilimsel süreç becerilerini değerlendirmek amacıyla geliştirilen Bilimsel Süreç Becerileri Testi kullanılarak ön test, son test ve kalıcılık testi puanları hesaplanmıştır. Deneysel uygulama için 7 hafta ve 14 etkinlik olarak planlanan SEP-DA (Fen Eğitim Programı-Dramatik Etkinlikler) kullanılmıştır. Eğitim programında bilimsel süreç becerileri çocuklara drama teknikleri ile sunulmuştur. Deneysel süreç sonunda deney ve kontrol grubundaki çocukların bilimsel süreç becerileri puanları arasındaki fark anlamlı bulunmuştur. Dramatik etkinlikler aracılığı ile verilen fen eğitim programı deney grubundaki çocukların bilimsel süreç becerileri üzerinde güçlü bir etkiye sahiptir. Kalıcılık testi de bu etkinin uzun süreli olduğunu ortaya koymuştur.

Anahtar kelimeler: yaratıcılık, drama, bilimsel süreç becerileri, fen eğitimi.

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INTRODUCTION

The preschool period, during which most of the child's development is completed at an important level, constitutes the foundation of life (Özkan, 2015). The knowledge, skills and experiences acquired during this period support children's emotional, mental, physical, linguistic and social development and enable them to prepare for life in the best way (Kale, 2019). Therefore, the education provided in the preschool period has permanent effects on children (Özbey and Alisinanoğlu, 2010). Children are individuals who can be original, express their feelings, have critical approach and a wide imagination (Bulut Üner, 2018). Therefore, by providing an educational environment in which they can use their five sense organs and be active, children should be given the opportunity to gain experience through practice (Güngör Seyhan, 2015). Science activities that support children's cognitive skills and allow them to observe, investigate and question can provide these opportunities (Aktaş Arnas, 2002). In the preschool period, children build the bridge between human, science and technology, through science (Özpir and Mantaş, 2018). Through science, they begin to consciously observe, examine, investigate and question their environment and make predictions and inferences (Karakuş, 2021). As children are curious, they use scientific skills almost every day by observing stones, animals, grass, trees, in short, everything living or inanimate on the earth and in the sky, while questioning the colors of the sea and blood, the reasons for the movement of clouds, which objects sink in water and which objects float, how ants walk or stand on the ground (Aktaş Arnas, 2002; MEB, 2013; Nuhoğlu, Ceylan, 2012; Özoğlu, 2020).

Science education in the preschool period provides children with information about science and nature, as well as scientific process skills such as learning about the environment, making assumptions, making inferences, and rational thinking (Kunt, 2016). Children comprehend sciences better by using their scientific process skills (Mutlu, 2012). Science education also enables children to use scientific process skills effectively and make observations and discoveries (Trundle and Sackes, 2015). Scientific process skills refer to all the skills used in determining a problem, making different assumptions in the face of the problem, obtaining information about it and reaching the result in line with the information obtained, following an observation and recognition of the environment (Yılmaz, 2017). On the other hand, scientific process skills are examined in two groups as basic process skills and integrated skills (Ayvacı and Yurt, 2016). While observation, comparison, classification, measurement, prediction, scientific communication and inference are sub-dimensions of basic process skills; determining and controlling the variables, forming and testing the hypotheses, planning and conducting the experiments, and interpreting data are among the sub-dimensions of integrated process skills (Bingöl and Ünal, 2019). Previous research idicate that, the integrated process skills follow the basic process skills, therefore, the basic process skills need to be acquired first (Kefi, 2018). The basic process skills are acquired during the preschool period, in direct proportion to the science education (Büyüktaşkapu, 2010; Öztürk, 2016). Acquiring these skills at an early age not only supports the child's sense of curiosity but also supports critical thinking and problem-solving skills. The acquisition of science concepts at this age also enables them to produce innovative solutions to complex problems at a later age (Lutfiani et al., 2021).

While science education in preschool period supports the development of scientific process skills, providing these trainings with interaction-based methods such as drama and play also affects the child's positive attitude (Sriwarthini et al., 2023).As a matter of fact, plants, animals, our body, our health, nutrients, liquids, landforms, natural phenomena, rocks, soil, seasons, simple gravity, matter, space, sound, light, motion-force-energy, temperature-heat, floating-sinking, discoveries, inanimate objects are examples of subjects of science in preschool education (Özoğlu, 2020). Additionally, in line with these subjects taught through science education, children gain the skills of observing by observing their environment through their sense organs; classifying the events and objects they observe by grouping them according to their characteristics; and measuring by expressing them numerically. They gain basic process skills such as recording data, recording the information they obtain about events and objects; predicting, making assumptions about the data they record; comparing, organising objects and events by considering their differences and similarities; inferring, evaluating and judging all the data they obtain (Behram, 2019; Tekerci & Kandır, 2017; Yaz, 2018). Science activities provide children with various skills such as learning through experience, being sensitive to their environment, establishing cause-effect relationships, reasoning, generating new ideas, being flexible, cooperating, expressing their ideas, being organized, and having self-confidence as well as scientific process skills (MEB, 2013). The acquisition of these skills is provided through a qualified science education, in other words, by creating a content-rich environment for children, ensuring their active participation and preparing child-oriented activities (Akyol, Birinci Konur, 2018; Saygılı, Ercan Yalman,

2021). According to Harlen (2013), the absence of science process skills in learning assessments will lead to dangerous neglect.

The way the knowledge and the skills are taught in preschool education is also very important (Gezgin and Kılıç, 2015). Especially in science teaching, since there are abstract or more difficult skills to comprehend, it is recommended to facilitate the process by choosing convenient methods for the teaching process (Can and Yıldırım, 2017). In this context, educators should encourage children to initiate and maintain the scientific process by creating a safe environment that increases children's productivity and allows them to research and investigate (Ünal and Akman, 2006). As a matter of fact, the skills necessary for scientific process skills are learned more easily by children in line with the methods, techniques, materials and activities preferred by educators (Ölçer and Aşıkoğlu Özdemir, 2018). Presenting science education with methods in which children actively participate in the process facilitates their acquisition of concepts. One of the methods that enable active participation and interaction of children in early years is drama (Curtis et al., 2013). In a discussion on creativity and thinking skills, Horikami and Takahashi (2022) stated that, creativity is revealed through the mutual exchange of thinking skills. Drama is one of the main creative learning methods that will enable children to learn easily (Kula, 2011). As in the definiton, "Drama; improvisation, role-playing, etc. is the interpretation and performance of an experience, an event, an idea, sometimes an abstract concept or a behavior, by way of the reorganization of old cognitive patterns and in 'playful' processes in which observations, practices, feelings and experiences are reviewed, using theater or drama techniques within a group work" the questioning process of the observations and experiences reflects its relationship with scientific process skills (Köse, 2018). Drama, which is included in preschool education, reveals the active power hidden in children (Akar Gençer and Akman, 2016). Thus, while children observe and analyze their environment through drama, they also gain experience by being active (Kara and Aslan, 2018). In addition to that, drama facilitates the acquisition of concepts in science by developing children's imagination and individuality (Kula, 2011). In addition to that, as a result of practicing science activities through drama, the individual assimilates information more easily by concretizing and experiencing abstract science concepts such as natural phenomena, heat, light, air, animals, plants, human voices (crying, laughing, angry, old, baby, sick people), using their sense organs (Altıntaş, 2012; Bakkaloğlu, 2017; Karaman Eflatun, 2021). In this context, including drama in science education facilitates science teaching that children acquire through their senses, as well as supporting their basic process skills such as observation, classification, comparing information, making assumptions and associating the acquired information in itself (Delihasanoğlu, 2021).

Children learn how to cope with the situations they encounter through drama, which is based on play (Bilgiş, 2019). The drama method involves presenting a problem from daily life to children and allowing them to explore it while also finding the cause of the problem, bringing a solution to the problem they find by acting it out (Can Yaşar, 2009). In this way, while investigating the problem, children actively use the skills of observation, by exploring their surroundings; classification, by grouping the results of observations in themselves; comparison, by analyzing the classified information according to their different and the same characteristics; making inferences, by making assumptions about the information they find and measuring, by putting all the results in numbers; in other words, the scientific process skills (Kefi, 2014). In this sense, drama differs from other teaching methods as it is based on interaction and life experiences and enables people to see the world from a different perspective (Adıyaman, 2019; Yıldırım, 2021). Stephenson (2023), based on a qualitative case study, states that, drama method increases creativity and well-being in the classroom, in comparison to national education systems. Additionally, while science education given to children through drama supports their basic process skills such as observation and prediction, it also prepares them for high-level scientific process skills such as hypothesizing, recognizing and controlling the variables and testing and interpreting data (Tan and Temiz, 2003). Therefore, gaining children science process skills through science activities in preschool period is very important (Başkan Takaoğlu and Demir, 2018).

Alternative science education programmes not only increase children's science achievement but also contribute to the development of science process skills. Teaching these skills through drama can provide a unique approach as it facilitates children's participation and attracts their attention. Thanks to its creative and multi-layered structure, integrating drama into science education will facilitate children's understanding of scientific concepts (Barakat, 2023). Considering that activities through drama develop scientific inquiry skills, it can be accepted as a method that encourages active learning (Kasbary, 2024). Practicing science activities through drama method both facilitates science teaching and provides the acquisition of scientific process skills, the prerequisites for learning science (Yıldırım, 2021; Aksan & Çelikler, 2016). Therefore, this study focuses on the preschool period, where the effect of teaching science through dramatic activities on scientific process skills has been less studied.

Considering this framework, this study aimed to determine the effect of science education given to 60-72-month-old children through dramatic activities on their science process skills. In line with this objective it is aimed to;

- Create a science education program delivered through dramatic activities
- Investigate the effect 60-72-month-old children's science process skills by the science education delivered to them through dramatic activities.

METHOD

Research Design

In the study, a quasi-experimental design with pre-test, post-test and retention test control group was used to determine the effect of the science process skills support program, which was prepared through dramatic activities for 60-72-month-old children, on children's science process skills.

Participants

The participants consisted of 36 60-72-month-old children who were attending kindergartens. Children attend public kindergartens in Kırıkkale province. After obtaining the necessary permissions for non-interventional research from the ethics committee in line with the Declaration of Helsinki, two groups of children with similar social, cultural and economic characteristics were selected. The criteria for the selection of the children were, being in the desired age group, not having a special needs report issued by the counceling and research center and volunteering to participate in the study. The experimental and control groups were determined by chance among the groups within the criteria determined by the systematic random sampling method. In order to prove that the experimental group and the control group had similar demographic characteristics, the distribution of demographic characteristics according to the groups was analyzed by using chi-square analysis, in Table 1. In the cases in which a significant relationship between variables was detected, the Phi coefficient (ϕ) was reported for variables with a degree of freedom of 1 to reveal the strength of the relationship, and in the cases in which the degree of freedom was greater than 1, the Cramer coefficient (V) was reported (Bursal, 2017). If the expected value was below five in less than 80% of the subgroups, the exact test was performed, and in the cases in which the degree of freedom was 1, the data were analyzed under appropriate conditions by paying attention to the continuity correction (Can, 2019).

Table 1. Analysis of Demographic Characteristics According to Participants

Group	Variable	Experimental		Control		ϕ	V	X^2	p
		n	%	n	%				
Sex	Girl	6	16.7	9	25.0	-0.17	-	.46	.49
	Boy	12	33.3	9	25.0				
Birth Order	First child	8	22.2	11	31.4	-	.18	1.17	.56
	Middle child	2	5.6	2	5.6				
	Last child	8	22.2	5	13.9				
Mother Education	Primary education	5	13.9	5	13.9	-	.21	1.65	.65
	High school	8	22.2	6	16.7				
	Undergraduate	3	8.3	6	16.7				
	Graduate	2	5.6	1	2.8				
Father Education	Primary education	4	11.1	2	5.6	-	.19	1.26	.74
	High school	6	16.7	8	22.2				
	Undergraduate	6	16.7	5	13.9				
	Graduate	2	5.6	3	8.3				
Number of siblings	Only child	5	13.9	5	13.9	-	.07	.19	.91
	Two siblings	9	25.0	10	27.8				
	Three or more siblings	4	11.1	3	8.3				

Income rate	Less than expense	7	19.4	7	19.4	-	.08	.21	.90
	Equivalent to expense	8	22.2	7	19.4				
	More than expense	3	8.3	4	11.1				
School attendance time	1 year and less	15	41.7	14	38.9	-	.17	1.42	.60
	1-2 years	3	8.3	3	8,3				
	More than 2 years	0	0	1	2,8				

It is observed that, the p value is greater than .05 in all of the chi-square significance values in Table 2. This means that, the children in the experimental group and the control group are similarly distributed.

Data Collection

"General Information Form" and "Scientific Process Skills Test" were used to collect data in the study. The general information form includes questions about children's gender, birth order, duration of preschool attendance, parental education level, number of siblings, income status, etc.

The Scientific Process Skills Test (SPST) was developed to assess the scientific process skill levels of preschool students (Şahin, Yıldırım, Sürmeli, & Güven, 2018). The SPST consists of six sub-dimensions which are; observation, measurement, classification, prediction, inference and communication. The normative sample for the development of the SPST consisted of 212 60-72-months-old children, who were attending to four different kindergartens in İstanbul. The average duration required to complete the SPST is 10 minutes at most. The multiple-choice items had four options. The correct answers of the multiple-choice items got 1 (one) point while the items with incorrect or no answers got 0 (zero) points. In the scoring of open-ended items and performance questions, the correct answers got 1 (one) points while the incorrect answers got 0 (zero) points. Şahin et al. used the internal consistency analysis method to find the reliability of the SPST. Therefore, Kuder Richardson-20 (0.68) and Cronbach's alpha (0.68) reliability coefficients were used. As a result of the study, Cronbach's alpha was 0.683 and KR-20 was 0.683 (Şahin et al., 2018).

The difficulty and distinctiveness scores of the items were calculated by using item analysis. In the item analysis, children's test scores were sorted in descending order and scores were calculated by determining the upper and lower groups. Özdamar (2004) defines the range of $0.60 \leq \alpha < 0.80$ as "highly reliable" in the process of evaluating the alpha reliability coefficient (Özdamar, 2004; cited in Şahin et al. 2018). When the analysis results of the items were reviewed, the power of distinctiveness of the items are, 0.436, 0.327, 0.236, 0.309, 0.400, 0.218, 0.273, 0.327, 0.745, 0.727, 0.636, 0.345, 0.545, 0.400, 0.473, 0.582, respectively. Based on this data, only items 3, 6 and 7 were observed to have distinctiveness between 0.20-.29. These items were corrected following the analysis. The average difficulty of the 16 items was approximately 0.70 and the average distinctiveness was around 0.44.

Planned as 14 activities by the researchers, SEP-DA includes Classification, Observation, Comparison, Measurement, Prediction, Data Recording and Inference skills. These science process skills are presented to children through role playing, improvisation, creating plays from stories, and pantomime techniques in the program. Each drama activity consists of warm-up, role-playing, relaxation and evaluation stages. The draft training program created after planning was presented to field experts to receive their opinions and was finalized in line with the corrections received. The training program was examined in terms of drama techniques, suitability for children, and program structure and was deemed appropriate. The Activity Example is presented below.

Week 2 - Activity 2:	How come it won't sink?
Date: **Age Group:** **Activity Type:** **Word:** **Concept:** **Material:**	- 60-72 Months Science and Drama Activity (Integrated Large Group Activity) Sinking, swimming, density. Heavy-Light Various objects sinking and not sinking in water, basin, water, bag, photographs of various sea creatures, bucket, glass, cup, mashapa, jug, plate, three-dimensional fish, bottle, letter, ribbon, pencil.
Scientific Process Skills:	• Classification • Observation • Comparison • Inference Making • Forecasting • Data Recording/Scientific Communication
Drama Technique:	• Pantomime
Pre-Activity Preparation:	The trainer covers the floor with a blue bag and puts materials such as seashells, stones, etc. on it. He/she makes algae out of krapon paper. At the same time, he/she creates an underwater view by putting photos of various sea creatures such as fish, whales, mussels. The educator places two basins filled with water in certain places in the classroom. In one of the basins, he/she puts map bottles as many as the number of children. In the other basin, various floating and diving merry-makers are placed. Various sea creature photographs are placed in envelopes as many as the number of children. A fish costume is made from cardboard. Colourful photos of fish are put in the envelopes.
Learning Process:	**Warm-up:** The trainer enters the classroom with a fish costume made of cardboard. He/she turns on a wordless, rhythmic music in the background and says "Hello, my little fish babies, I thought I lost you. I am so happy to find you; come on, follow me so that we can catch the dance competition as soon as possible" and gives each child a sealed envelope. The envelopes contain photographs of fish in various colours. The children pair up in pairs according to the colours of the fish in the envelopes. Then the children take a position back to back and dance to the rhythm of the music without losing contact with each other. **Animation:** The trainer shows the children a photograph of a ship captain and chats with the children about what he/she might be doing. Then, he/she starts to give instructions by playing rhythmic music, stating that they will be captains themselves today and that they will act out what they do at sea for a day with their bodies and facial expressions without talking. All captains put on their trousers, shirts and hats. Then they slowly started to move towards the ship. He walked and walked and got on the ship and started to turn the deck. When the ship moved, the captains saw what they saw, a giant shark. The captains were so scared that they said to each other

	hugging each other. When they passed the shark, they got stuck in a big storm ahead.

	The storm was so strong that it started to turn the ship around. It spun and spun and tossed the ship forwards. The captains almost fell off the ship. The ship, which was damaged in the storm, started to move more slowly in the sea. As the ship was moving forward, they saw a bottle in the middle of the sea and they jumped into the water and started swimming towards the bottle. After taking the bottle, they returned to the ship and everyone opened their own bottle. A map came out of the bottle, the captains were very excited and changed the route to go to the place marked on the map. On the way to the new route, the captains saw various fish such as puffer fish and eels in the sea and decided to take photos of them for a memory. After taking the photographs, the captains continued on their way and saw a huge ship ahead, with children on board. They immediately honked the horn and waved cheerfully. As the ship was travelling, they saw that the sea suddenly started to ripple. The waves got bigger and bigger and the ship started to sway left and right. The captains started to go round the sea to escape from the waves. But no matter how much they went around, they could not get rid of the waves. Then something happened that the ship suddenly overturned and the captains fell into the sea. The ship sank slowly because it was damaged, but the captains realised something at this time. They saw that some of the objects on the ship were sinking while others were floating, and they went to the side of the objects to see what was sinking and what was floating. Then the captains saw a huge ship ahead and tried to show themselves by shining a torch. When they boarded the new ship, one of the captains thought of something and took a basin and filled it with sea water. He threw various objects such as keys, stones, plastic cups, beads, cars, leaves and pencils into the basin. Some of the objects sank and some floated, and the captains who saw this were very surprised. The captain of the ship they were on at that time gave them an explanation (the educator states that water and objects have different densities, when the density of the object in the water is higher than the density of the water, it sinks; when the density of the object in the water is less than the density of the water, it floats). Thanking the captains for the explanation, they decided to do an experiment with the objects on the ship to see which objects would sink or float. Therefore, they started to examine the objects on the table on the ship. All captains took their own charts and started to stick stars on the objects they thought would sink and hearts on the objects they thought would float. Then the captains examined the objects by throwing them into the water in turn and checked them on their charts. Thus, they determined the objects that sank and did not sink in the water. While all the objects were analysed, the ship approached the land and the captains got off the ship. They hugged each other for accompanying them in this challenging and fun adventure and went home.
	Relaxation: The trainer asks the children to lie on the floor and close their eyes. He asks them to imagine that they are an octopus living in the sea. He asks them to briefly describe what colours it is, how many arms it has and how it swims. He/she asks them to tell what they see by saying that they start swimming in the sea. They say that the octopus comes home from work and buys something from the market for his family, that there is something different in each arm, and asks them to tell what they have in their arms. She tells them that the octopus is very tired so his mum massages him. Each child massages each other and relaxation is finalised. **Evaluation:**The trainer distributes A4 paper and colouring pencils to the children and asks them to draw their own sea creatures by asking questions such as "If you were a creature living in the sea, what colour would you be? Would you be big or small? How would your shape be?". Then each child briefly tells the name and characteristics of the sea creature to his/her friends. • Where did you have the most fun/difficulty during the activity? • Which objects sank / floated in the water? Why? • Which objects in your home do you think sink/swim in water? • If you were a fish, what would your name be? Why? • How did you feel when you had a massage?
Family Participation:	By selecting from the objects available at home with their children from the family, They are asked to talk about which ones will sink and which ones will float and to try them in the basin.

Figure 1. *"How come it doesn't sink?" Example Activity Plan*

After obtaining the necessary permissions, the researcher conducted a preliminary study in the classrooms of these groups to facilitate the adaptation of the children. Pretests were first administered to the experimental and control groups. After the pretests, the science education program (SEP-DA) planned for 7 weeks was implemented with dramatic activities. While the experimental group participated in the education program, the control group continued with the existing curriculum. After the education program, post-tests were administered to both experimental and control groups. Three weeks after the post-test, only the experimental group was given a retention test.

Data Analysis

In order to decide on parametric/nonparametric tests with the data obtained in the study, it was checked whether the normality and homogeneity assumptions of the pre-test, post-test and retention test scores of the SPST sub-dimensions of the experimental group and the control group were met.

As a criterion for meeting the normality assumption, the coefficients of skewness and kurtosis were examined and observed to be within the range of ± 2. The values within this range in Table 2 were considered to meet the normality assumption (George and Mallery, 2016). The homogeneity assumption was tested by using Levene's test and the variances were checked for a significant difference.

Table 2. Normality Assumptions Related to the Measurement Scores

	Group	n	Z Score		Skewness		Kurtosis	
			Min.	Max.	Statistic	Std. error	Statistic	Std. error
Total pre-test	Experiment	20	-1.75	2.21	-.87	.54	1.02	1.03
	Control	20	-0.86	2.21	1.75	.54	1.5	1.03
Toplam post-test	Experiment	20	-0.81	1.82	-.08	.54	-.72	1.03
	Control	20	-1.69	1.52	.75	.54	.43	1.03
Total retention test	Experiment	20	-1.74	1.59	.17	.54	-.93	1.03

Independent samples t test analysis was used to show that the children had similar baseline levels and characteristics before starting the experimental process. A retention test was applied to determine the long-term results of the experimental effect. Repeated measures ANOVA analysis was used to reveal the effect at the end of the experimental process. The effect size of the results was examined through the eta square values. The effect size was based on the criteria (.01=small effect; .06=medium effect; .16=large effect).

FINDINGS

The analysis of the pre-test scores of the experimental group and the control group before the study is presented in Table 3.

Table 3. Comparison of Pretest Scores of Children in the Experimental and Control Groups

	Group	n	$\bar{x}$	t	df	$\acute{\eta}^2$	p
Total pre-test	Experimental	18	7.22	0.65	34	.01	.52
	Control	18	6.72				

When the pre-test scores were compared, the mean score of the experimental group was ($\bar{x} = 7.22$), and the mean score of the control group was ($\bar{x} = 6.72$). There was no significant difference between the initial scores of science process skills of the two groups [t(34)= 0.65 p=.52]. This indicates that, the two groups were selected at similar science process skill levels.

Table 4. Repeated Measures ANOVA Results of Children in Experimental and Control Groups

	Group	n	$\bar{X}$	sd		
Total pre-test	Experimental	18	7.22	2.73		
	Control	18	6.72	1.74		
	Total	36	6.97	2.27		
Total post-test	Experimental	18	11.72	2.67		
	Control	18	7.83	2.97		
	Total	36	9.78	3.41		
Source of Variance		SS	df	MS	F	p	ή2
Between group							
Group (E, C)		43.340	1	43.340	8.332	.007	.197
Error		176.847	34	5.201			
Within group							
Measurement (Posttest-Pretest)		141.681	1	141.681	49.590	.000	.593
Group*Measurement		51.681	1	51.681	18.089	.000	.347
Error		97.139	34	2.857			

According to Table 4, following the experimental procedure, there are significant differences between the pre-test and post-test scores of the children in the experimental group and the control group [F(1,34)=18.089, p<.001, $\acute{\eta}^2$=.347]. Considering the eta squared value, it is possible to say that, science education delivered through dramatic activities is highly effective on children's science process skills.

Figure 2 shows the significant difference between the score increase levels of the experimental group and the control group.

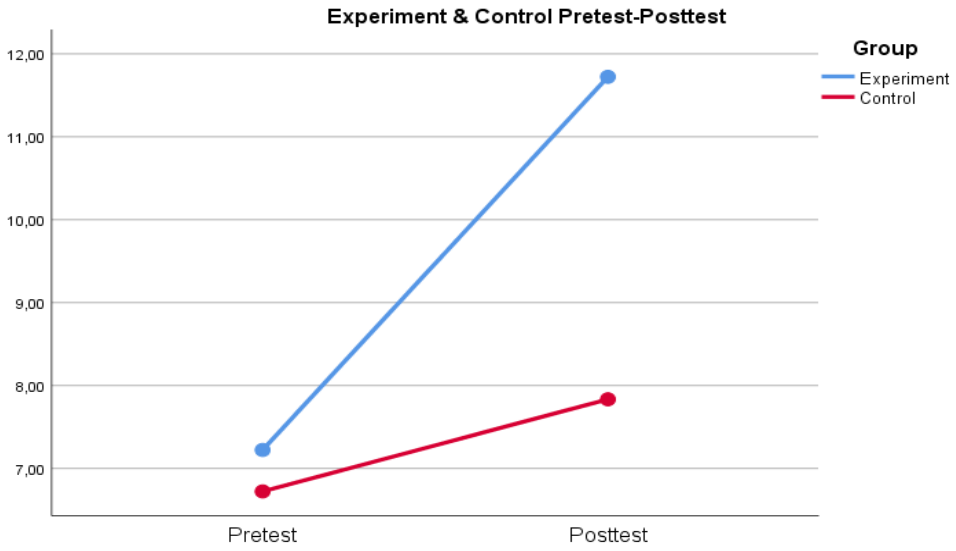

Figure 2. *Pre-test Post-test Comparison of the Children in the Experimental Group and the Control Group*

The analyses related to the comparison of the difference scores between the post-tests and pre-tests of the children in the experimental group and the control group are presented in Table 5.

Table 5. Comparison of Pre-test and Post-test Difference Scores of Children in the Experimental and Control Groups

(Posttest-Pretest)	Group	n	X̄	t	df	ή²	p
Total Difference	Experimental	18	4.50	4.25	34	.35	.000
	Control	18	1.11				

According to Table 5, the mean difference between the post-test and pre-test scores of the children in the experimental group was ($\bar{x} = 4.50$), while it was ($\bar{x} = 1.11$) for the control group was. The mean difference between the post-test and pre-test scores of the children in the experimental group differed significantly compared to the control group [t (34)=4.25, p<.001, $\acute{\eta}^2$=.35].

The results of the comparison of repeated measures in the experimental group and the control group are presented in Table 6.

Table 6. Repeated Measures ANOVA Results of Children in the Experimental Group

	Group	n	X̄	sd			
Total point	Pretest	18	7.22	2.73			
	Posttest	18	11.72	2.67			
	Retention	18	11.22	3.00			
Source of Variance	SS	df	MS	F	p	ή2	Diff.
Measurement	219.000	2	109.500	42.793	.000	.716	2>1 3>1
Error	87.000	34	2.559				
Total	306.000	36	112.059				

Table 6 demonstrates that the scores of science process skills of the children in the experimental group showed significant differences in the pre-test, post-test and retention tests [F (2,34)= 42.793, p<.001, $\acute{\eta}^2$=.716]. Comparison analysis revealed that, the scores of post-test ($\bar{x}$ =11.72) and retention ($\bar{x}$ =11.22) significantly increased compared to the scores of pre-test ($\bar{x}$ =7.22). This indicates that, there is a ongoing experimental effect.

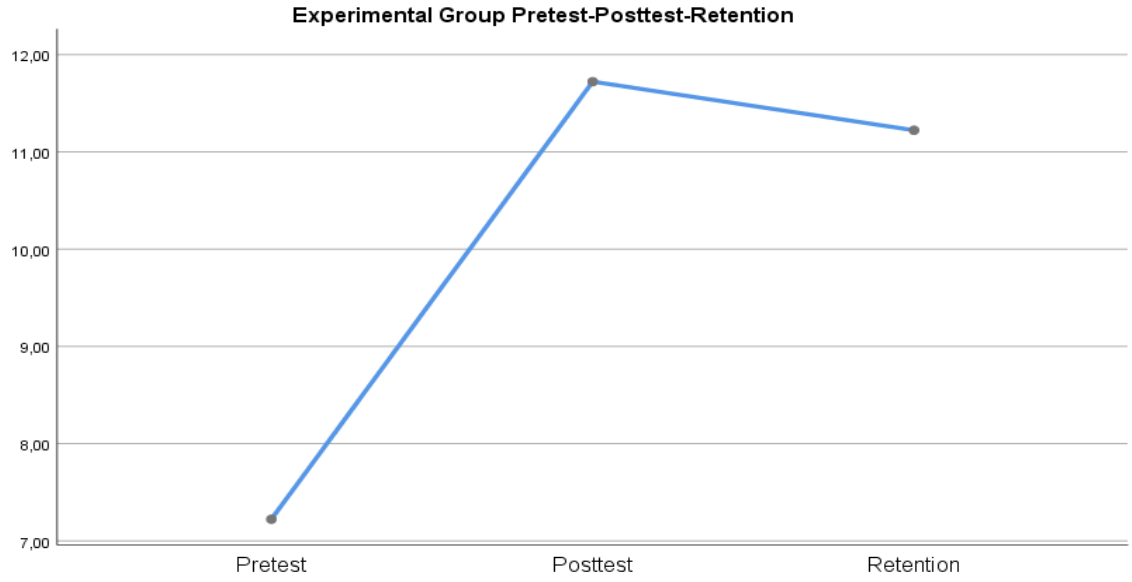

Figure 3. *Comparison of Pre-test, Post-test Retention of Children in the Experimental Group*

In Figure 3, the increase from the pre-test through the post-test is clearly visible. The fact that the decrease observed following the post-test is not significant can be considered as a reflection of the ongoing effect.

DISCUSSION & CONCLUSION

In this study, the fact that the initial levels and characteristics of the children in the experimental group and the control group were similar shows that there was no difference between the pre-test scores of the experimental group and the control group. At the end of the experimental process, the difference between the science process skill scores of the children in the experimental group and the science process skill scores of the children in the control group increased. It was revealed that science education through dramatic activities had a strong effect on the science process skills of the children in the experimental group and this effect was long-term as a result of the retention test. The effect of science education on scientific process skills was also clearly proved in the preschool period. The use of drama, one of the creative methods, in the delivery of science education both facilitated the concretization for preschool children and enabled them to be directly involved in the process as active participants. Due to the relationship between creativity and scientific process skills, it is possible to say that, drama has a direct effect on thinking skills. It is known that, especially in early years, there is a significant relationship between creative learning and scientific process skills (Bahakti and Astuti, 2018). In a study conducted by Yıldız and Yıldız (2021) with 70 60-66-month-old children, a moderate significant relationship was found between children's creative thinking and science process skills. Yalçın and Erden (2021) concluded that, STEM activities increase creativity and problem solving skills. In a similar study, Dhir (2014) found a positive relationship between creativity and science process skills. Although mostly the effect of science activities on creativity is observed in the literature, there are also studies which demonstrate that creative activities improve science process skills (Astutik et al., 2019; Stephenson, 2023). Compared to traditional methods, the use of innovative and imaginative methods in preschool has an important role in the development of the scientific process (Bagherpour and Shamshiri, 2018; Yıldız and Yıldız, 2021). Considering that, scientific process skills are included in the preschool education, this study similarly reveals that, the drama method is greatly effective compared to the traditional method (MEB, 2013). Karakelle (2009) focused on the effect of creative drama process on thinking skills in an experimental group of 30 adults. As a result of the research, he determined that, creative drama was effective in improving the fluency and flexibility of thinking. Using the Collaborative Creative Learning (CCL) method, Astutik et al. (2019) worked with 144 secondary school students in an experimental design. As a result of the study, it was proved that, it affects science process skills while learning physics. Tekerci and Kandır (2017) found that, the sensory-based science education program they carried out with 60-66-month-old children made a difference as a result of the experimental effect. Similarly, this study proved that, including creative methods in science education improves science process skills of preschool children. In addition to that, the fact that the role-playing method included in the dramatic activities used in the study is a combinational skill based on functionality, communication and thinking, increases the effectiveness in the acquisition of scientific process skills (Vyas et al.,

2013). While this study contributes theoretically and practically to the relationship between creativity and science process skills, it also maintains its originality as it is one of the few studies that reveal this effect in preschool period through experimental methods. Teaching the skills that are necessary but difficult to comprehend such as science education through creative ways such as drama, not only improves the science process skills but also increases the retention of science education. The limitations of the study such as the fact that it was conducted in a semi-experimental design and with a limited sample and that it was not compared with other alternative methods should be taken into consideration. However, considering the limitations of this study, it is expected that, a similar study in a full experimental design will be produced more explicitly by delivering science education in different ways.

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Statements of Publication Ethics

All processes in this study comply with the organization's code of ethics, the 1964 Helsinki Declaration and its subsequent amendments.

This study was conducted with the approval of Kırıkkale University Non-Interventional Research Ethics Committee. Ethics committee approval was obtained from the Ethics Committee with the decision dated 12.01.2022 and numbered 2022.01.21. Consent forms were obtained from all teachers and parents of the children included in the study.

Researchers' Contribution Rate

Authors	Literature review	Method	Data Collection	Data Analysis	Results	Conclusion
Gamze İncesu	☒	☒	☒	☐	☒	☒
Mehmet Güney	☒	☒	☐	☒	☒	☒
Aygen Çakmak	☒	☐	☐	☐	☐	☒

Conflict of Interest

The authors declare that they have no relevant or material financial interests that relate to the research described in this paper.

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Examining the Relationship Between Social-Emotional Adaptation and Competition Types of Children Aged 60-72 Months

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Abstract

Social-emotional development plays a crucial role in an individual's life. Social-emotional adaptation and a positive feeling of competition are elements of social-emotional development that intensively progress at early ages. The purpose of this study is to analyze the relationship between social-emotional adaptation and competition types of 60–72-month-old children. In this study, the survey model was applied, and the sample was selected via convenience sampling. 110 children who attended preschool education institutions in the 2018-2019 academic year participated in this research after participation approval forms were obtained. "Marmara Social Emotional Adaptation Scale" and "Preschool Competition Questionnaire" were data collection tools. After convenient statistical tests were performed, a statistically significant relationship between social-emotional adaptation and competition types of children was explored. Additionally, a significant relationship was observed in social-emotional adaptation with regard to gender and the mother's educational background, and a significant relationship was found in competition types with regard to the mother's and father's educational background. Recommendations were provided for preschool teachers and further research.

Keywords: preschool education, social-emotional adaptation, competition in preschool.

60-72 Aylık Çocukların Sosyal Duygusal Uyumları ve Rekabet Türleri Arasındaki İlişkinin İncelenmesi

Öz

Sosyal duygusal gelişim, bireyin yaşamında önemli bir rol oynamaktadır. Sosyal duygusal uyum ve olumlu bir rekabet duygusu, erken yaşlarda yoğun bir şekilde ilerleyen sosyal duygusal gelişimin unsurları arasındadır. Bu çalışmanın amacı, 60-72 aylık çocukların sosyal duygusal uyumları ile rekabet türleri arasındaki ilişkiyi incelemektir. Tarama modeli kullanılan çalışmanın örneklemi kolay erişilebilirlik esasına göre uygun örnekleme yoluyla belirlenmiştir. Bu çalışmaya 2018-2019 eğitim-öğretim yılında İstanbul ilindeki anaokullarında öğrenim görmekte olan 110 çocuk "Katılım Onam Formu" temin edildikten sonra katılmıştır. "Marmara Sosyal Duygusal Uyum Ölçeği" ve "Okul Öncesi Rekabet Ölçeği" araştırmada kullanılan veri toplama araçlarıdır. Uygun istatistiksel analizler yapıldıktan sonra çocukların sosyal duygusal uyumları ve rekabet türleri arasında istatistiksel olarak anlamlı bir ilişki olduğu tespit edilmiştir. Cinsiyet ve anne eğitim durumu değişkenlerine göre sosyal duygusal uyumda, anne ve baba eğitim durumu değişkenlerine göre ise rekabet türlerinde anlamlı ilişkiler saptanmıştır. Okul öncesi öğretmenleri için ve gelecek araştırmalar için öneriler sunulmuştur.

Anahtar kelimeler: okul öncesi eğitim, sosyal duygusal uyum, okul öncesinde rekabet.

This article was produced from the first author's master's thesis titled "Investigation of the Relationship Between Social Emotional Adaptation, Social Problem-Solving Skills and Competition Styles of 60–72-Month-Old Children Attending Preschool Education Institutions" which was carried out at Marmara University, Institute of Educational Sciences.

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INTRODUCTION

Development follows a holistic path (Karatel, 2019). Cognitive, physical, social-emotional, and language development phases are not separated domains; they have impacts on each other in both positive and negative ways. Social-emotional development, just like the other developmental areas, starts to emerge at an early age (Kargı, 2016). Establishing relations with people, choosing environmentally compatible behaviors, understanding social clues and responding to them appropriately, and recognizing, understanding, and naming the emotions are some abilities of a child in social-emotional development phase. Children who have completed their social-emotional development in a healthy way can successfully establish relationships with peers and other people and live in harmony with society (Kargı, 2016; Bakioğlu, 2014). Considering that developmental areas grow in a holistic way, it is very important for children to experience social-emotional development in a healthy and successful manner (Yeşilyaprak, 2018; Kargı, 2016; Bakioğlu, 2014).

One of the skills regulated in connection with social-emotional development is social-emotional adaptation (Kargı, 2016). As a social being, a child needs to establish a balance between personal needs, urges, intents and conditions, and expectations of the social environment (Sevgi-Özden, 2006; Gençöz, 1998). These personal needs or urges, which can be emotional or physical, are not stable. Considering that the social environment also carries conditions that are prone to change, balancing individual needs and environmental conditions is an active process. The conceptual definition of this balancing task is the adaptation process (Sevgi-Özden, 2006). Experiencing the adaptation process in a healthy way would support social-emotional development (Gençöz, 1998). Social-emotional adaptation develops in the preschool period (Bağcı-Çetin, 2021) in which personality begins to emerge and get formed (Özdemir et al., 2012). Social relations and interpersonal interactions have an impact on personality development at early ages. Social-emotional adaptation experiences are built on the child's past adaptation experiences, and the care and education given to the child at early ages. The adaptation behaviors and patterns in the preschool period also give clues about the adaptation processes likely to be experienced in the future (Sroufe et al., 2005). Adaptation is a concept that will be encountered not only in the preschool period but throughout life (Senemoğlu, 2015). The care given to the child in early ages has an effective power in the adaptation processes in adulthood (Cornell, 2006-2007).

Children interact with their social environment and especially with their peers (Cowie, 2012). This interaction is an attempt to socialize for the child, and the child who shows social enterprise behaviors makes an effort to communicate with and reach and adapt to his/her peers. According to Erikson, this sense of entrepreneurship experienced at early ages is valuable in terms of development of self, as it will make children feel succeed (Trawick-Smith, 2014). Therefore, it is known that social-emotional adaptation skills also have an effect on a child's perception and development of self (Özkan & Aksoy, 2017).

Another element of social-emotional development is competition behaviors at early ages. If the environment includes the competitive factors that result in success, it contributes to the development of a child's self (Ames et al., 1977). The feeling of competition, which is becoming much more common in today's societies and educational environments, is an emotion and a type of behavior that exists in human nature (Kargı, 2016; Sönmez, 2016). It is known that competitive attitude affects human behavior and life from many dimensions (Martin & Larsen, 1976). Competitive behavior, which is also seen in the socialization processes of children (Sheridan & Williams, 2006), is defined as the tendency to perform an action better (Tsiakara & Digelidis, 2012). While the feeling of competition enables a child to concentrate on a task better, being exposed to a competitive environment over a long period may negatively affect the child's social-emotional adaptation (Sönmez, 2016).

Research on competitive behavior seen in preschool children is quite limited (Uyanık-Balat et al., 2017). Paquette et al. (2013) developed The Preschool Competition Questionnaire to evaluate competitive behavior in preschool-aged children. They categorize children's competition styles into four. Other-referenced competition is comparing one's own performance with the success of another. This type of competition motivates children to perform better than others. Task-oriented competition includes competitive behaviors exhibited by children to improve and develop themselves by comparing with their own performances. Another competition style is conceptualized as the maintenance of dominance hierarchy. The maintenance of dominance hierarchy which is directly related to the social status of children, can be defined as the effort to protect the priority of children in accessing the resources they want to achieve.

Supporting the social and emotional development of children is very valuable both in terms of their individual and social beings (Kargı, 2016). According to social learning theory, observation and role modeling are the ways of learning for children (Bandura, 1977). If the child cannot witness and observe good examples of social

behaviors in the home environment, being motivated from the outside will not be enough. If there are no adults in the family from whom the child can learn social behaviors by taking role models, it becomes very difficult for the child to adapt to social contexts (Yavuzer, 2018). At this point, preschool education plays a critical role in the socialization process in which all these adaptations and competition styles take place (Bakioğlu, 2014). There are various studies on social-emotional adaptation of preschool children (Bilici, 2019; Aydın, 2018; Durmuşoğlu-Saltalı et al., 2018; Maliyok, 2018; Zelyurt & Göktürk-İnce, 2018; Buluş & Öztürk-Samur, 2017; Günindi, 2013; Ramazan & Ünsal, 2012); while the number of studies examining the competition behavior observed in preschool children is relatively higher abroad, the literature is quite limited in Türkiye. Yet, no research examining the relationship between social adaptation and competition at early ages exists in the literature as to the knowledge of the author. There may be a relationship between the social-emotional adaptation, which is directly related to the social-emotional development of the child, and the competition style of the child. Therefore, it is thought that examining the relationship between these variables would contribute to the field.

The Aim of the Study

This research aims to analyze the relationship between the social-emotional adaptation and competition styles of 60–72-month-old children, and the social-emotional adaptation and competition styles of children with regard to various variables.

Research Questions

The questions to be answered in this research are as follows:

1. Do the social-emotional adaptation and competition styles of 60–72-month-old children differ significantly in terms of their demographic characteristics (gender, age, parental educational level)?
2. Is there a significant relationship between the social-emotional adaptation and competition styles of 60–72-month-old children?

METHOD

Research Design

This research was based on a quantitative model. The descriptive survey model, which aims to define and determine the problem situation (Erkuş, 2013), was used since the study aimed to explore the relationship between the social-emotional adaptation and competition styles of children. The relational survey model, which is a subtype of the descriptive survey model, was used in this study. The relational survey model is used in studies conducted to explore if there is a relationship between two or more variables or not, and if there is one, to determine the strength of the relationship (Büyüköztürk et al., 2016).

Population and Sample

60-72-month-old children who attended preschool education institutions in the 2018-2019 academic year in Üsküdar district of Istanbul were the population of the research. The sample of the study was determined based on the convenience sampling method. Convenience sampling is a type of sampling method that enables researchers to reach the volunteers who want to participate in the research (Aziz, 2014; Erkuş, 2013). 110 children who were randomly selected from 12 classes of 7 preschools participated in the research. A total of 10 students, 5 girls and 5 boys from each class, participated in the study. The demographic information of the participated children is presented in Table 1.

Table 1. Frequency and Percentages of Children's Demographic Information

Groups		*f*	%	Groups		*f*	%
Gender	Girl	54	49.09	Age	60 to 66 months old children	56	50.91
	Boy	56	50.91		67 to 72 months old children	54	49.09
	Total	110	100		Total	110	100
Mother's Educational Level	Middle School	22	20.00	Father's Educational Level	Middle School	20	18.20
	High School	31	28.20		High School	36	32.70
	Undergraduate and Graduate	54	49.10		Undergraduate and Graduate	51	46.40
	Total	107	97.30		Total	107	97.30

As presented in Table 1, 49.09% (N=54) of the children were girls, while 50.91% (N =56) were boys. While 50.91% (N=56.00) were 60 to 66 months old children, 49,09% (N=54) were 67 to 72 months old children. 20% (N=22) of the mothers are middle school graduates, 28.20% (N=31) are high school graduates, 49.10% (N=54) are undergraduate and graduates. While 18.20% (N=20) of the fathers are middle school graduates, 32.70% (N=36) are high school graduates, 46.40% (N=51) are undergraduate and graduates.

Data Collection Tools

A personal information form was used to receive the demographic information of the children, the Marmara Social Emotional Adaptation Scale (MSEAS) was used to evaluate social-emotional adaptation of children, and the Preschool Competition Questionnaire was used to evaluate competition styles of children. The personal information form, which includes items about the demographic characteristics of the children (gender, age, and education level of the parents), was prepared by the researcher.

The original MSEAS was developed by Önder et al. (2004) to decide social-emotional adaptation of children aged 6.0-6.11 years. Güven and Işık (2006) made an adaptation study of the MSEAS for 5-year-olds. The study group consisted of 405 girls and 471 boys, a total of 876 children. The adapted scale consists of 19 items. The teacher is expected to evaluate a child's observable behaviors according to the 3-point likert rating scale. The reliability coefficient of the scale was found to be high. While performing MSEAS reliability analysis, resistance was also made. The findings revealed that the test-retest reliability of the scale is at a satisfactory level. While there were 6 factors in the original scale, 4 factors were included as a result of factor analysis in the adapted scale: Acting in compliance with the requirements of social life (ACRSL, 9 items), reacting compliance with social life (RCSL, 4 items), interaction with peers (IP, 3 items), and treating the social environment positively (TSEP, 3 items).

The Preschool Competition Questionnaire was developed by Paquette et al. (2013) to evaluate the competition styles of children aged 3-6. The scale consists of 17 items expressing observable competitive behaviors. In the scale which needs to be filled by teachers, participants are expected to evaluate children's behavior according to the 6-point rating scale. The scale consists of three sub-scales: other-referenced competition (ORC, 8 items), task-oriented competition (TOC, 6 items), and maintenance of dominance hierarchy (MDH, 3 items). In this scale, children's scores are evaluated for each sub-scale separately (Uyanık-Balat et al., 2017; Paquette et al., 2013). Preschool Competition Questionnaire was adapted into Turkish by Uyanık-Balat et al. (2017) and Cronbach's alpha reliability coefficients were found as .96, .92 and .91 for each sub-scale, respectively. As a result of the test-retest reliability coefficient calculation, .95, .92 and .85 values were obtained for each sub-scale, respectively. Findings reveal that the reliability of the scale is at a very good level.

Data Collection Procedure

Data collection procedure began with obtaining the necessary permissions. First, permission for the use of MSEAS and the Preschool Competition Questionnaire were obtained. After selecting the preschools, the school principals and teachers were informed about the research, and it was clarified that the participation would be on a voluntary basis. A total of 10 students, 5 girls and 5 boys, were randomly selected from each class. The purpose of randomly selecting students was to eliminate the possible judgments that teachers may have. After the children were selected, the participation approval forms were sent to their parents. The participation approval forms that informed parents about the research and were filled by parents were received back. Personal information form, the MSEAS and the Preschool Competition Questionnaire were introduced to the teachers, and they were asked to fill the forms for each child. After the forms were received from the teachers, the data were examined and checked for missing data. The missing information was completed with the help of negotiation with teachers.

Data Analysis

Data were analyzed by using the Statistical Package for the Social Sciences (SPSS 23.0). To determine which statistical analyses need to be conducted, the Kolmogorov-Smirnov test was performed to find out whether the data were normally distributed or not. The results of the Kolmogorov-Smirnov test performed on MEAS and the Preschool Competition Questionnaire showed that the data from MEAS and its sub-scales did not have a normal distribution since $p<.05$. On the other hand, total scores for the Preschool Competition Questionnaire according to gender variable (girl=.200, boy=.200; $p>.05$), age variable (60-66 months=.200, 67-72 months=.200; $p>.05$), mother's educational level variable (middle school=.200, high school=.200; $p>.05$), and father's educational level variable (middle school=.200, high school=.200, undergraduate and graduate=.200; $p>.05$) were found to be normally distributed. According to age variable the TOC sub-scale for the Preschool Competition Questionnaire was also found to be normally distributed (60-66 months=.189, 67-72 months=.200; $p>.05$). In accordance with the results of Kolmogorov-Smirnov test, for the data which was normally distributed ($p>.05$), parametric tests were used and, for the data which was not normally distributed ($p<.05$), non-parametric tests were used.

Descriptive statistics were used while examining the social-emotional adaptation and competition styles of children. Percentages, frequencies, means, and standard deviations were used as descriptive statistics to analyze

the relationship between children's social-emotional adaptation and competition styles with demographic variables; t-test, one-way analysis of variance (ANOVA), Kruskal-Wallis H test, and Mann-Whitney U test were used to examine how social-emotional adaptation and competition styles of children differed according to demographic variables. After the tests were conducted, post hoc analyses were carried out when necessary. The Spearman rank correlation coefficient analysis was conducted to test whether there was a relationship between children's social-emotional adaptation and competition styles.

Research Ethics

To carry out this research at preschools in Üsküdar district of Istanbul, research consent was received from the Istanbul Provincial Directorate of National Education. Preschool principals, teachers, and parents were informed about the purpose of the study and research procedure. Data were obtained from voluntary participants. Parents' approval was obtained through participation approval forms, and data were collected after receiving approval from parents. Universal ethical rules were followed by the researchers in this study. However, approval of an ethics committee could not be obtained since the data were collected in 2019.

FINDINGS

Five tables presented below (Table 2 to Table 6) show the results of the tests that were carried out to determine whether social-emotional adaptation varies according to demographic variables such as gender, age, and parental educational level of children.

Table 2. Mann-Whitney U Results for the Relationship Between Social-Emotional Adaptation and Gender

Sub-scale	Gender	N	Order Mean	Order Total	U	Z	p
ACRSL	Girl	54	66.70	3602.00	907.00	-3.71	.000*
	Boy	56	44.70	2503.00			
RCSL	Girl	54	52.89	2856.00	1371.00	-0.86	.388
	Boy	56	58.02	3249.00			
IP	Girl	54	53.39	2883.00	1398.00	-0.75	.452
	Boy	56	57.54	3222.00			
TSEP	Girl	54	54.59	2967.00	1482.00	-0.21	.833
	Boy	56	56.04	3138.00			
MSEAS Total	Girl	54	60.04	3242.00	1267.00	-1.47	.141
	Boy	56	51.13	2863.00			

As presented in Table 2, the ACRSL sub-scale of 60–72-month-old children differs significantly according to gender (z-3.71; p<.05). Girls were found to be more inclined to ACSRL when compared to boys ($\bar{X}$girl>$\bar{X}$boy). A statistically non-significant difference was found for other sub-scales.

Table 3. Mann-Whitney U Results for the Relationship Between Social-Emotional Adaptation and Age

Sub-scale	Age	N	Order Mean	Order Total	U	Z	p
ACRSL	60-66 months	56	59.58	3336.50	1283.50	-1.40	.161
	60-72 months	54	51.27	2768.50			
RCSL	60-66 months	56	53.42	2991.50	1395.50	-0.71	.476
	60-72 months	54	57.66	3113.50			
IP	60-66 months	56	54.26	3038.50	1442.50	-0.45	.646
	60-72 months	54	56.79	3066.50			
TSEP	60-66 months	56	54.21	3036.00	1440.00	-0.50	.613
	60-72 months	54	56.83	3069.00			
MSEAS Total	60-66 months	56	55.79	3124.00	1496.00	-0.09	.923
	60-72 months	54	55.20	2981.00			

As presented in Table 3, social-emotional adaptation of children aged 60–72 months did not differ significantly according to their ages.

Table 4. Kruskal-Wallis H Analysis Results for the Relationship Between Social-Emotional Adaptation and Mother's Educational Level

Sub-scale	Mother's Educational Level	N	Order Mean	X^2	df	p
ACRSL	Middle School	22	57.45	0.36	2	.832
	High School	31	53.45			
	Undergraduate and Graduate	54	52.91			
	Total	107				
RCSL	Middle School	22	62.23	2.17	2	.338
	High School	31	50.31			
	Undergraduate and Graduate	54	52.77			
	Total	107				
IP	Middle School	22	67.16	6.05	2	.048*
	High School	31	50.90			
	Undergraduate and Graduate	54	50.42			
	Total	107				
TSEP	Middle School	22	60.50	1.69	2	.428
	High School	31	53.10			
	Undergraduate and Graduate	54	51.87			
	Total	107				
MSEAS Total	Middle School	22	64.14	3.20	2	.202
	High School	31	49.29			
	Undergraduate and Graduate	54	52.57			
	Total	107				

As presented in Table 4, the social-emotional adaptations of 60-72-month-old children differ significantly according to mother's educational level in the IP sub-scale (x2=6.05; df=2; p<.05). After this finding, post-hoc analyzes were applied to further understand which group differed significantly from the others. The homogeneity of the variances test did not show a homogeneous distribution; therefore, the Tamhane's T2 test was used. The Tamhane's T2 test results are demonstrated in Table 5.

Table 5. Tamhane's T2 Test Results for the Relationship Between Social-Emotional Adaptation and Mother's Educational Level

(I) Mother's Educational Level	(J) Mother's Educational Level	Mean Difference (I-J)	p
Middle School	High School	.60	.060
	Undergraduate and Graduate	.80	.008*
High School	Middle School	-.60	.060
	Undergraduate and Graduate	.19	.867
Undergraduate and Graduate	Middle School	.25	.008*
	High School	.28	.867

As presented in Table 5, the significant difference between IP sub-scale of children and their mother's educational level was between mothers with middle school degrees and mothers with undergraduate and graduate degrees. Children with mothers who graduated from middle school were found to have more interactions with peers when compared to children with mothers who graduated from undergraduate and graduate school. A statistically non-significant difference was observed between the other groups.

Table 6. Kruskal-Wallis H Analysis Results for the Relationship Between Social-Emotional Adaptation and Father's Educational Level

Sub-scale	Father's Educational Level	N	Order Mean	X^2	df	p
ACRSL	Middle School	20	57.55	0.35	2	.836
	High School	36	53.72			
	Undergraduate and Graduate	51	52.80			
	Total	107				
RSCL	Middle School	20	55.58	1.00	2	.606
	High School	36	57.38			
	Undergraduate and Graduate	51	51.00			
	Total	107				
IP	Middle School	20	56.88	2.26	2	.322
	High School	36	58.43			
	Undergraduate and Graduate	51	49.75			
	Total	107				

TSEP	Middle School	20	58.53	1.24	2	.536
	High School	36	55.44			
	Undergraduate and Graduate	51	51.21			
	Total	107				
MSEAS Total	Middle School	20	58.13	0.63	2	.729
	High School	36	54.79			
	Undergraduate and Graduate	51	51.82			
	Total	107				

As presented in Table 6, social-emotional adaptation of 60-72-month-old children did not differ significantly according to father's educational level. The tables given below (Table 7 to Table 17) show the results of the tests that were carried out to determine whether competition styles of children aged 60-72 months vary accordance with their demographic characteristics such as gender, age, and parental educational level.

Table 7. Mann-Whitney U Results for the Relationship Between Competition Styles and Gender

Sub-scale	Gender	N	Order Mean	Order Total	U	Z	p
ORC	Girl	54	52.27	2822.50	1337.50	-1.04	.296
	Boy	56	58.62	3282.50			
TOC	Girl	54	61.26	3308.00	1201.00	-1.86	.062
	Boy	56	49.95	2797.00			
MDH	Girl	54	50.30	2716.00	1231.00	-1.69	.089
	Boy	56	60.52	3389.00			

As presented in Table 7, a statistically non-significant difference was found between the sub-scales of competition styles of children and gender variable.

Table 8. Mann-Whitney U Results for the Relationship Between Competition Styles and Gender

Score	Gender	N	x̄	ss	t Test		
					t	sd	p
Total Preschool Competition Questionnaire	Girl	54	65.42	9.47	-.684	108	.495
	Boy	56	66.73	10.50			

As presented in Table 8, a statistically non-significant difference was found between the total score of competition styles of children and gender.

Table 9. Mann-Whitney U Results for the Relationship Between Competition Styles and Age

Sub-scale	Age	N	Order Mean	Order Total	U	Z	p
ORC	60-66 months	56	50.91	2822.50	1255.00	-1.53	.124
	67-72 months	54	60.26	3282.50			
MDH	60-66 months	56	54.42	3308.00	1451.50	-0.36	.714
	67-72 months	54	56.62	2797.00			

As presented in Table 9, a statistically non-significant difference was found between gender and the ORC and MDH sub-scales.

Table 10. Independent Group t-Test Results for the Relationship Between Competition Styles and Age

Score	Age	N	x̄	ss	t Test		
					t	sd	p
TOC	60-66 months	56	27.37	4.82	.456	108	.649
	67-72 months	54	26.96	4.63			
Preschool Competition Questionnaire Total	60-66 months	56	65.42	9.47	-.592	108	.555
	67-72 months	54	66.73	10.50			

As presented in Table 10, a statistically non-significant difference was found between gender and the TOC sub-scale and total scores.

Table 11. Kruskal-Wallis H Analysis Results for the Relationship Between Competition Styles and Mother's Educational Level

Score	Mother's Educational Level	N	Order Mean	X^2	df	p
ORC	Middle School	22	58.48	1,93	2	.380
	High School	31	47.68			
	Undergraduate and Graduate	54	55.81			
	Total	107				
MDH	Middle School	22	74.55	12.44	2	.002*
	High School	31	48.18			
	Undergraduate and Graduate	54	48.97			
	Total	107				
Preschool Competition Questionnaire Total	Middle School	22	65.80	7.61	2	.022*
	High School	31	42.52			
	Undergraduate and Graduate	54	55.79			
	Total	107				

As presented in Table 11, the MDH sub-scale differs significantly in accordance with the mother's educational level (x^2=12,44; df=2; p<.05). Competition styles differ significantly according to the mother's educational level (x^2=7.61; df=2; p<.05). After this finding, post-hoc analyzes were applied to further understand which group differed significantly from the others. After checking the homogeneity of the variances, the homogeneous distribution was not detected, and the Tamhane's T2 test was applied. Tamhane's T2 test results are presented in Table 12 and Table 13.

Table 12. Tamhane's T2 Test Results for the Relationship Between Competition Styles and Mother's Educational Level

(I) Mother's Educational Level	(J) Mother's Educational Level	Mean Difference (I-J)	p
Middle School	High School	2.66	.002*
	Undergraduate and Graduate	2.61	.000*
High School	Middle School	-2.66	.002*
	Undergraduate and Graduate	-.05	1.000
Undergraduate and Graduate	Middle School	-2.61	.000*
	High School	.05	1.000

As presented in Table 12, the scores in MDH sub-scale differs between the children whose mothers with high school degree and middle school degree. A significant difference was found between mothers who graduated from high school and mothers who graduated from middle school, in favor of mothers who graduated from middle school. The MDH sub-scale differs between the children's competition styles of children whose mothers with undergraduate and graduate degree and with middle school degree. The significant difference was in favor of mothers who graduated from middle school.

Table 13. Tamhane's T2 Test Results for the Relationship Between Competition Styles and Mother's Educational Level

(I) Mother's Educational Level	(J) Mother's Educational Level	Mean Difference (I-J)	p
Middle School	High School	7.28	.035*
	Undergraduate and Graduate	3.08	.543
High School	Middle School	-7.28	.035*
	Undergraduate and Graduate	-4.20	.173
Undergraduate and Graduate	Middle School	-3.08	.543
	High School	4.20	.173

As presented in Table 13, there is a significant difference between the total score of preschool competition questionnaire of children whose mothers with high school degree and middle school degree in favor of mothers who have high school degree.

Table 14. One-Way Analysis of Variance (ANOVA) Results for the Relationship Between Competition Styles and Mother's Educational Level

Source of Variation	Sums of Squares	df	Mean Square	F	p
Between Groups	83.30	2	41.65		
Within Groups	2182.11	104	20.98	1.985	.143
Total	2265.42	106			

As presented in Table 14, a statistically non-significant difference was found between the competition styles and the mother's educational level.

Table 15. Kruskal-Wallis H Analysis Results for the Relationship Between Competition Styles and Father's Educational Level

Score	Father's Educational Level	N	Order Mean	X^2	df	p
ORC	Middle School	20	60.93	1.24	2	.536
	High School	36	51.86			
	Undergraduate and Graduate	51	52.79			
	Total	107				
MDH	Middle School	20	70.23	7.24	2	.027*
	High School	36	52.64			
	Undergraduate and Graduate	51	48.60			
	Total	107				
TOC	Middle School	20	58.23	1.79	2	.409
	High School	36	48.47			
	Undergraduate and Graduate	51	56.25			
	Total	107				

As presented in Table 15, the MDH sub-scale differs significantly according to the father's educational level variable (x^2=7.24; df=2; p<.05). After this finding, post-hoc analyses were applied to explore which groups caused the significant difference. After checking the homogeneity of the variances, the homogeneous distribution was not detected, and the Tamhane's T2 test was used. Tamhane's T2 test results are presented in Table 16.

Table 16. Tamhane's T2 Test Results for the Relationship Between Competition Styles and Father's Educational Level

(I) Father's Educational Level	(J) Father's Educational Level	Mean Difference (I-J)	p
Middle School	High School	1.86	.062
	Undergraduate and Graduate	2.17	.008*
High School	Middle School	-1.86	.062
	Undergraduate and Graduate	.31	.962
Undergraduate and Graduate	Middle School	-2.17	.008*
	High School	-.31	.962

As presented in Table 16, a statistically significant difference was found between the scores of MDH sub-scale of children with fathers whose educational level is middle school and whose educational level is undergraduate and graduate. The children with fathers who graduated from middle school were found to have more MDH when compared to other groups.

Table 17. One-Way Analysis of Variance (ANOVA) Analysis Results for the Relationship Between Competition Styles and Father's Educational Level

Source of Variation	Sums of Squares	df	Mean Square	F	p
Between Groups	256.08	2	128.04		
Within Groups	10474.81	104	100.71	1.271	.285
Total	10730.89	106			

As presented in Table 17, a statistically non-significant difference was found between the total scores of competition styles of children and the variable of father's educational level.

Table 18. Spearman Rank Differences Correlation Coefficient Analysis Related to the Relationship Between Social-Emotional Adaptation and Competition Styles

Sub-scales	ORC			TOC			MDH		
	N	r	p	N	r	p	N	r	p
ACRSL	110	-.541	.000*	110	.475	.000*	110	-.287	.002*
RCSL	110	.204	.032*	110	.453	.000*	110	.46	.000*
IP	110	.028	.770	110	.222	.020*	110	.31	.001*
TSEP	110	-.090	.349	110	.385	.000*	110	.215	.024*

*p<,05

As presented in Table 18, a moderate and negative relationship was found at a statistically significant level of .05 between ACSRL life sub-scale and ORC sub-scale (p=.05, r=-.541). With this finding, as the children's level of behaving in compliance with the requirements of social life increases, their competition focused on others

decreases. There was a positive and weak correlation at a statistically significant level of .05 between the ACSRL sub-scale and ORC sub-scale (p=.05, r=.204). With this finding, as the children's level of appropriate response according to the social situation increases, their competition focused on others decreases. Statistically, a moderate and positive relationship was found at .05 significance level between ACSRL sub-scale and TOC sub-scale (p<.05, r=.475). With this finding, the level of children's behavior in compliance with the requirements of social life increases, their competitiveness for the task increases. Statistically, a moderate and positive relationship was found at .05 significance level between RCSL sub-scale and TOC sub-scale (p<.05, r=.453). With this finding, as the children's level of appropriate response according to the social situation increases, their competitiveness for the task increases. There was a weak and positive relationship at a statistically significant level of 0.05 between IP sub-scale and TOC sub-scale (p<.05, r=.222). With this finding, as children's interaction levels with peers increase, their competitiveness for the task increases. Statistically, a moderate relationship was found between TSEP sub-scale and TOC sub-scale (p<.05, r=.385). With this finding, it can be concluded that as the level of children's positive approach to the social environment increases, their competitiveness for the task increases. A negative and weak correlation was found at .05 significance level between ACSRL sub-scale and MDH sub-scale (p<.05, r=-.287). With this finding, it can be concluded that as the level of children's behavior in compliance with the requirements of social life increases, their rivalry in the hierarchy of dominance decreases. Statistically, a moderate and positive correlation was found at .05 significance level between RCSL sub-scale and MDH sub-scale (p<.05, r=.46). With this finding, as the children's level of appropriate response according to the social situation increases, their competitiveness in the hierarchy of dominance protection increases. Statistically, a weak and positive relationship was found at .05 significance level between IP sub-scale and MDH sub-scale (p<.05, r=.31). With this finding, as children's interaction levels with peers increase, their competitiveness in the hierarchy of dominance protection increases. It was explored that there is a moderate and positive relationship at a significance level of .05 between TSEP sub-scale and MDH sub-scale (p<.05, r=.215). With this finding, children's level of positive approach to the social environment increases, their competitiveness in the hierarchy of dominance protection increases.

DISCUSSION & CONCLUSION

This research was carried out with the aim of examining the relationship between social-emotional adaptation and competition styles of children aged between 60 and 72 months and examining children's social-emotional adaptation and competition styles in terms of demographic variables.

In this study, it is found that the ACSRL sub-scale differed significantly according to the gender variable. The participants' level of behaving in compliance with the requirements of the social life was found to be higher for boys than girls. Based on this result, it can be said that boys' ability to behave in compliance with the requirements of social life, which is one of their social-emotional adaptation skills, is higher compared to girls. There are several research studies in the literature showing that the social-emotional adaptation of children in the preschool period differs according to gender; and these studies support the findings of this research. (Arabacıoğlu & Bağçeli-Kahraman, 2021; Çetinkaya, 2016; Kacır, 2015; Kurtulan, 2015). There are also studies showing that the level of social-emotional adaptation does not differ in accordance with gender (Malıyok, 2018). This finding in this current study is thought to be encouraging when the differences in the way boys and girls are brought up in our society are considered. The fact that the participating boys have role models that develop their social-emotional adaptation skills and support their aspects of behaving in compliance with the necessities of life and that these aspects are supported in the classroom can be seen among the possible reasons for this result.

In this research, the social-emotional adaptation of children did not differ significantly according to children's age. Studies showing both similarities (Ünsal, 2010) and differences (Alwaely, Yousif, & Mikhaylov, 2021; Kurtulan, 2015) with this finding are available in the literature. In Kurtulan (2015), participants' social-emotional adaptation differs according to their ages, and it is thought that carrying out research with children between the ages of 4-7 formed the basis for the difference. It might be thought that the fact that the age range of the children participating in the current research is very close and that only 60-72 months old children are included, the social-emotional adaptation of the children does not vary according to age.

Another finding of the study is that IP sub-scale differs significantly in accordance with the mother's educational level variable. This statistically significant difference was explored between mothers who graduated from middle school and mothers with undergraduate and graduate degrees, in favor of mothers with middle school degree. In line with this result, it can be said that the interactions of children with mothers having middle school degree are better than the children with mothers having undergraduate or graduate degrees. Çetinkaya (2016) and Arabacıoğlu and Bağçeli-Kahraman (2021) found that mother's educational level does not affect children's social-

emotional adaptation. In the current study, it was explored that the children of mothers who graduated from middle school were at a better level in peer interaction. It is thought that this difference is related to the changes in the occupations of the mothers and the amount of time they can spend at home. With the increase in the level of education, the time for mothers to be more involved in working life and to spend time with their children and other families with children may decrease. Significant difference was not found between the social-emotional adaptation of children and father's educational level variable. The current findings were supported by the research of Çetinkaya (2016), in which no difference was found according to the father's educational level variable.

Competition styles of children, which is another variable of the study, did not differ according to the gender variable. There are studies that reached similar findings (Doğan, 2022; Uyanık-Balat et al., 2017; Sönmez, 2016). However, it is thought that the fact that children's competition styles do not differ significantly according to age is since the ages of the participating children are very close to each other.

Statistically significant difference between the children's preschool competition questionnaire total score and MDH sub-scale with mother's educational level variable was explored. The total scores of the children with high school graduate mothers are significantly higher than the scores of the children whose mothers graduated from middle school. In the MDH sub-scale, the scores of the children of mothers with middle school degree are significantly higher than the scores of the children of mothers with high school degree. It can be interpreted as the difference detected in the current study is due to the life experiences parents offer to their children and the expectations of the family. The expectation of the family and the experiences provided to the child affect the competition style of the child (Sönmez, 2016). Based on this information, it is expected that the change in the education level of the mother would cause a difference in the life experiences that the mother would provide to the child and in the expectations from the child.

It is among the findings of the research that there is a significant difference between the MDH sub-scale and the father's educational level variable. There was a significant difference between the fathers with undergraduate and graduate degrees and fathers with middle school degree, in favor of fathers who graduated from middle school. There was no significant difference between the other graduation groups. The difference found in this study is thought to be related to the effect of the mother's educational level on the child's competition behavior in a similar way. It is thought that a significant difference arises because of the change in the father's educational level, causing differentiation in the life experiences that the father would provide to the child and in the expectations from the child.

Within the scope of this research, it was explored that there were significant differences between social-emotional adaptation and competition styles. As the level of children's behaving in compliance with the requirements of social life increases, their competition for others decreases, as the level of appropriate response according to the social situation of children increases, their competition for others decreases, and as the level of children's behavior in compliance with the requirements of social life increases, their competitiveness for the task increases. The MSEAS includes items that evaluate skills such as acting in compliance with the requirements of social life, obeying rules and being sensitive to others. It is understandable that children with such skills prefer not to compete with others. At the same time, since the maintenance of dominance hierarchy is a competitive style for accessing resources, it may not be a style that can be adopted for a child who is sensitive to the rights of others. TOC, on the other hand, is thought to be positively related to the ability to acting in compliance with the requirements of social life, as it includes the healthy adaptation process and the goals that will lead the child to success in his own development.

As the children's reactions in compliance with social life increased, the results showed that other-referenced competition, task-oriented competition, and maintenance of dominance hierarchy increased. Since the MSEAS includes items, such as reacting in compliance with social life, obtaining the right when necessary, reacting to injustice and gaining admiration, it is thought that it may be related to three competition styles.

As the children's interaction levels with their peers increased, the results showed that their task-oriented competition and the maintenance of dominance hierarchy increased. It is understandable that children with a good level of interaction with peers adopt task-oriented competition, which is a desired competitive style. The fact that their interaction with peers has a positive effect on status and resource access also explains their adoption of a maintenance of dominance hierarchy.

As the children's level of treating the social environment positively increases, it has been concluded that the situation of task-oriented competition and maintenance of dominance hierarchy increases. Since the MSEAS includes items, such as treating the social environment positively, being a happy individual, having a positive face,

and respecting the common goods, it can be interpreted as an indicator of social status required for the maintenance of dominance hierarchy. It is also understandable that the child, who can establish a positive relationship with his social environment, adopts competition for the task, which is the desired competitive style.

Recommendations

Considering the findings of this study, suggestions for researchers and preschool teachers are presented. It is recommended to study the social-emotional adaptation and competitive styles of preschool children with randomly selected sample from a wider population. There is little research on the competition styles of preschool children; thus, it is recommended to conduct in-depth qualitative research that includes methods such as observations and interviews to shed better light on the subject. It is recommended that preschool teachers be provided with educational opportunities that support their professional development in terms of understanding children and responding to their needs and be aware of the existence of the relationship between social-emotional adaptation and competing styles that take place in the social development of children. It is recommended to consider the frequency and duration of playing digital games that trigger children's sense of competition. For children who play competitive digital games at an unfavorable level, it is recommended to create a plan to increase the duration and entertainment level of in-class games and game-based activities.

Statements of Publication Ethics

The consent for this research was received from the Istanbul Provincial Directorate of National Education and authors admit that this study was conducted considering ethical rules.

Researchers' Contribution Rate

The first author conducted the research and the second author contributed to the whole process. The final manuscript was read and approved by each author.

Conflict of Interest

This study contains no conflict of interest.

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Examination of Gifted Students' Perceptions Regarding Air Pollution, A Socio-Scientific Issue

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Abstract

This study, which examined gifted students' perceptions of air pollution, was conducted using a phenomenological design, a qualitative research method. This study was conducted with 23 gifted students. Data were collected using the draw-write-tell method. Data were collected two hours a week for a total of eight hours. In the first and second weeks, data on the causes of air pollution were collected, and in the third and fourth weeks, data on the solution of air pollution were collected. An inductive content analysis method was used to analyze the data. According to gifted students, smoke from chimneys of factories and residences, gases emitted from car exhaust, forest fires, cutting down forests/trees, industrial and domestic wastes, use of non-renewable energy sources, uncontrolled fires, ship wastes, water pollution, airplane fuels, running generators, and smoking cause air pollution. In addition, they think that installing filters on car exhausts and residential/factory chimneys, afforestation, not cutting down forests, limiting the use of cosmetic products or not using these products, recycling, using renewable environmentally friendly energy sources, reducing or eliminating smoking, using public transportation, and using bicycles instead of motor vehicles can be reasonable solutions to reduce air pollution.

Keywords: Socio-scientific issues, air pollution, gifted students.

Sosyo-Bilimsel Konulardan Biri Olan Hava Kirliliğine Yönelik Özel Yetenekli Öğrencilerin Algılarının İncelenmesi

Öz

Özel yetenekli öğrencilerin hava kirliliğine yönelik algılarının incelendiği bu çalışma, nitel araştırma yöntemlerinden fenomenolojik desen kapsamında gerçekleştirilmiştir. Araştırma 23 özel yetenekli öğrenci ile gerçekleştirilmiştir. Veriler Çiz-Yaz-Anlat tekniği ile toplanmıştır. Veriler haftada iki saat olmak üzere toplam sekiz saat toplanmıştır. Birinci ve ikinci haftalarda hava kirliliğinin nedenlerine ilişkin veriler, üçüncü ve dördüncü haftalarda ise hava kirliliğinin çözümüne ilişkin veriler toplandı. Verilerin analizinde tümevarımsal içerik analizi yöntemi kullanılmıştır. Özel yetenekli öğrencilere göre fabrika ve konut bacalarından çıkan dumanlar, araba egzozlarından çıkan gazlar, orman yangınları, ormanların/ağaçların kesilmesi, endüstriyel ve evsel atıklar, yenilenemeyen enerji kaynaklarının kullanımı, kontrolsüz yangınlar, gemi atıkları, su kirliliği, uçak yakıtları, çalışan jeneratörler ve sigara içmek hava kirliliğine neden olur. Ayrıca araba egzozlarına ve konut/fabrika bacalarına filtre takılması, ağaçlandırma, ormanların kesilmemesi, kozmetik ürünlerin kullanımının sınırlandırılması veya kullanılmaması, geri dönüşüm, yenilenebilir çevre dostu enerji kaynaklarının kullanılması, sigaranın azaltılması veya ortadan kaldırılması, toplu taşıma araçlarını kullanmak, motorlu taşıtlar yerine bisiklet kullanmak hava kirliliğini azaltmak için makul çözümler olabilir.

Anahtar kelimeler: Sosyobilimsel sorunlar, hava kirliliği, üstün yetenekli öğrenciler.

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INTRODUCTION

Air Pollution

Individuals need a variety of experiences regarding different settings and versions of nature to explore, reflect on, and understand how they perceive, comprehend, construct, compare, act, and relate to nature and the environment (Jickling, 2003). Environmental education plays an essential role in this regard. Environmental education aims to provide direct experiences with the environment, develop positive feelings and attitudes towards nature, foster empathy, and practically explore environmental conflicts and problems. Environmental education encourages students to understand how natural systems function. Environmental education involves children, teachers, and communities working collectively and democratically to address environmental issues and their solutions (Julie, 1998). Another focus of environmental education is social scientific issues. Socioscientific issues concern society; These are complex, open-ended and often controversial issues with no definitive answer. In addition, technological issues that have social dimensions and on which there are disagreements among scientists are referred to as socioscientific issues. Socio-scientific topics include phenomena experienced by humans in nature (such as climate change, alternative fuels) (Chen & Xiao, 2021) . Since socioscientific issues derive their content from situations that may be encountered in daily life, understanding these issues and teaching them to students are among the important goals of science/environmental education. For example, ethical dilemmas and social concerns addressed in the context of socioscientific issues should not be considered separate from science/environmental education classes. Therefore, it is aimed to improve students' understanding of these issues. Understanding socioscientific issues plays an important role in students' conscious decision-making by helping them perceive the actions and processes underlying the decisions they make on dilemmas that they may encounter in daily life (Wahono, et al, 2021). Therefore, students, teachers, and researchers must understand the nature of their environmental experiences and the natural environment (home, school, playground, river, shopping mall, etc.) in which they occur (Payne, 2006). Environmental science is already available as a separate subject in many universities worldwide, and naturally, it should be included in primary and secondary education as well as sustainability education. Major environmental issues, such as the greenhouse effect, ozone depletion, acid rain, and air pollution, are of great educational importance (Mandrikas et al., 2017). How students understand global environmental concepts (e.g., global warming and air pollution) has been the focus of empirical research for more than a decade. There is a need to focus on how children conceptualize scientific concepts and phenomena in alternative, unique ways (especially in science education) regarding global warming and air pollution. Given the popularity and topicality of contemporary environmental issues, students' understanding and conceptualization of phenomena in this area should be an essential component of their educational programs (Dimitriou & Christidou, 2007). However, environmental issues are not away from everyday life; in particular, environmental degradation (air, water pollution, etc.) is increasingly affecting the quality of life of the planet. Moreover, in the case of air pollution, the adverse effects of this pollution are also directly experienced by humans. Therefore, knowing what students' perceptions of the occurrence and effects of air pollution are and how they are shaped is essential in shaping their daily life behaviors in the future (Thornberg et al., 1999). Moreover, regarding problems such as air pollution, it is unlikely that the impact on students' thinking is limited to the cognitive domain. Therefore, students may form perceptions of air pollution based on ideas from the school curriculum or from out-of-school environments. It is essential to reveal such perceptions. Even if the links between knowledge, perception, and behavior are far from direct, these three areas undoubtedly interact. This interaction is essential for students to perceive their environment, develop an understanding, and shape their behavior (Myers et al., 2004).

Millions of people are exposed to the adverse effects of air pollution annually. Air pollution poses severe risks to human health and other living conditions. To prevent air pollution, which is one of the leading causes of both acute and chronic health problems (Rakwongwan et al., 2021), doctors should cooperate with environmental organizations and lead actions to reduce air pollution and global warming to protect human health (D'Amato &Akdis, 2020).

Gifted Students and Environmental Education

Science education enables individuals to understand the environmental phenomena they encounter, which positively or negatively affects them through observations and experiments (Meador, 2003). For this reason, gifted students are often highly interested in science because of their intense curiosity about the objects they use daily, and what is happening in their natural environment stimulates their imagination (Smutny & Von-Fremd, 2004). Gifted students' sensitivity to environmental problems, such as air pollution, their interest in the natural environment, and their advanced problem-solving and reasoning skills make them efficient resources for solving

environmental issues. It has also been claimed that gifted students are more sensitive to the environment than their peers and can take more responsibility for solving environmental problems (Tarık-Önal, 2021). In addition, before organizing activities and training to support gifted students in developing positive behaviors and attitudes toward the environment, it is crucial to determine their thoughts and perceptions of the environment and environmental problems (Özarslan et al., 2017). Another important reason for determining the perceptions of gifted students about environmental events - socio-scientific issues such as air, water, soil pollution, etc.–is to develop the interests and curiosity of gifted individuals and directing them to work on environmental and global problems, and solutions to these problems in the future are considered very important for the development of countries and societies (Saraç & Özarslan, 2018).

Gifted students are highly successful in solving global problems. These special children, who can change their world, produce solutions to many environmental problems and threats that occur spontaneously or are created by human beings. For example, gifted individuals have different perspectives on social and environmental issues. These characteristics enable them to think more creatively than their peers in analyzing changes in their environment and finding solutions to problems. Therefore, determining what kind of understanding gifted students develop towards solving environmental problems will provide fundamental data for shaping their future education (Hotoman, 2020).

Studies Conducted on Air Pollution and Socioscientific Issues

There are many studies on how students are motivated towards socio-scientific issues and how they use advanced thinking skills such as problem solving, creative thinking, discussion, decision making and critical thinking in the process of solving these issues (Herman, et al, 2021; Baytelman, et al, 2020). However, more focus has been placed on studies on air pollution under the heading of Socioscientific issues. When the related literature is reviewed, Özarslan (2022) conducted a study to determine the views of gifted students on environmental problems and their suggestions for solutions. It was found that students mainly emphasized current environmental issues, such as water and air pollution, and global warming. The students stated that environmental problems are mainly caused by society's lack of education and awareness of society and environmental pollutants. Students suggested recycling and waste treatment, educating individuals about the environment, reorganizing laws, and increasing inspections to solve environmental problems. Tanık-Önal (2021) aimed to describe the environmental education provided to gifted students and to determine their views on this issue. In his study, students reported that they should act more environmentally friendly and actively participate in environmental education in order to solve environmental problems. In Dimitriou & Christidou's (2007) study, which aimed to determine students' perceptions of air pollution, students held the production process (industry), transportation (both of which are significant contributors to air pollution caused by the combustion of fossil fuels), and solid waste responsible for air pollution. They added human activities, such as using insecticides and fertilizers in agriculture, spray use, and forest fires, as other sources of air pollution. These views of pollution were based on their concrete experiences linked to "bad smells." It also enables students to recognize, to some extent, the interdependence of different environmental factors and the link between air pollution and human health, flora, and fauna. Thornber et al. (1999) aimed to determine students' views of air pollution. It was found that students thought that transport and industry were the main causes of air pollution. Due to air pollution, plants and animals will die, and people will get sick due to air pollution. The study also concluded that pollution is most easily perceived in concrete terms by students of this age.

Air pollution is one of the main causes of both acute and chronic health problems (Rakwongwan et al., 2021). In addition, the World Health Organization (WHO) reported in 2012 that approximately 7 million people died as a result of exposure to air pollution (WHO, 2014). It is important to explore students' views about this phenomenon, which negatively affects the lives of humans and other living things, thus raising their awareness of this environmental problem.

Purpose of the Study

This study aimed to determine gifted students' perceptions towards air pollution, a socio-scientific issue, using the draw-write-tell technique. In this context, answers to the following questions were sought.

1. What are the perceptions of gifted students about the causes of air pollution?
2. What are the perceptions of gifted students towards the solution to air pollution?

METHOD

Research Design

This study was designed according to a phenomenological design, a qualitative research method. In phenomenological design, the lived experiences of several people about a phenomenon or concept are examined (Creswell, 2013). This design focuses on the phenomena we are aware of, but does not have an in-depth and detailed thought (Patton, 2014).

Research Group

The research group consisted of 23 gifted students studying at the Science and Art Center during the 2022-2023 academic year. The participants were recruited using convenience sampling, which is a non-random sampling method. The ages of the students ranged from 10-11 to years old.

Data Collection Tools and Data Collection

The study data were collected using the draw-write-tell technique. Various techniques need to be used to determine students' perceptions of concepts. One of these techniques is the draw-write-tell technique, which involves students drawing, writing and explaining the concept while explaining the concepts. The draw-write-tell technique is based on the principle that students first draw around certain concepts, then write their thoughts about this concept, and finally express their thoughts about the concepts (Dinç & Üztemur, 2017). Data were collected for a total of eight hours, two hours per week. In the first and second weeks, data on the causes of air pollution were collected, and in the third and fourth weeks, data on the solutions to air pollution were collected. Three stages of "Draw, Write, and Tell" were followed in the data collection process. In the first week, students were given A4 papers divided into four equal sections and asked to make four separate drawings about the causes of air pollution in this study. For this purpose, students were given the required materials such as pencils and paints. The students were told that they should not have aesthetic concerns while making drawings, because their drawing skills were not measured. Students were given 40 min to make their drawings. They were then asked to write their drawings. At this stage, the students wrote what they drew and what they wanted to explain in their drawings. Finally, focus group interviews were conducted with the students. In the interviews, students were asked to read the texts they wrote about air pollution and explain the critical parts they wanted to explain in the texts, the reasons for their thoughts, and the issues they wanted to emphasize. Through interviews, students' perceptions of the causes of air pollution were revealed in detail. The focus group interviews were conducted in two separate groups and lasted approximately 40 minutes. The same procedures in the first two weeks were also carried out in the third and fourth weeks, within the scope of the solution suggestions for air pollution.

Data Analysis

An inductive content analysis method was used to analyze the data. In this content analysis, the themes and categories were sourced from the dataset. Patterns, themes, and categories have been discovered in the data (Patton, 2014). In the content analysis, codes were developed based on the participants' views, and categories or themes were formed by combining the generated codes. For this purpose, the data obtained from students' drawings, writings, and interviews were transferred to a computer environment, and codes were created by reading them. Codes were created according to the participants' statements. Two independent researchers created the code list. Similar codes are created within a specific category and theme framework. Thus, we tried to determine the participants' perceptions of the causes of air pollution and their suggestions for solutions. Within the framework of ethical principles, the participants' real names were not used; instead, they were given codes such as Example-1, Example-2,…, and Example-23.

Validity and Reliability

Various strategies have been suggested to improve the quality of qualitative research (Creswell, 2013; Patton, 2014). In this study, the credibility, transferability, confirmability, and consistency strategies were used. To increase the credibility of the study, depth-oriented data were collected, expert opinions were obtained in the preparation of the questions to be included in the interview form, and participant confirmation was obtained regarding the data obtained. To increase the transferability of the study, rich and intensive definitions were made and explained in detail, the data obtained were described in detail, and direct quotations were used. To increase the confirmability of the research, all data were computerized and stored in a digital environment. The results obtained were confirmed with continuously collected data, and a logical explanation was provided to the reader in this context. Different coders were responsible for analyzing the data to ensure consistency in the research, and inter-coder consistency was calculated. Two researchers coded the data and the codes obtained were compared.

Coder reliability was calculated using the reliability formula suggested by Miles & Huberman (1994), and the agreement between the researchers was 92%.

FINDINGS

These findings were interpreted with two main headings. The first main heading includes findings on the causes of air pollution, and the second main heading consists of findings on the solution of air pollution.

Findings on the Causes of Air Pollution

To determine the students' perceptions towards the causes of air pollution, the drawings they made, the writings they wrote about their drawings, and the thoughts they shared during the interviews were used. The findings are presented in Figure 1.

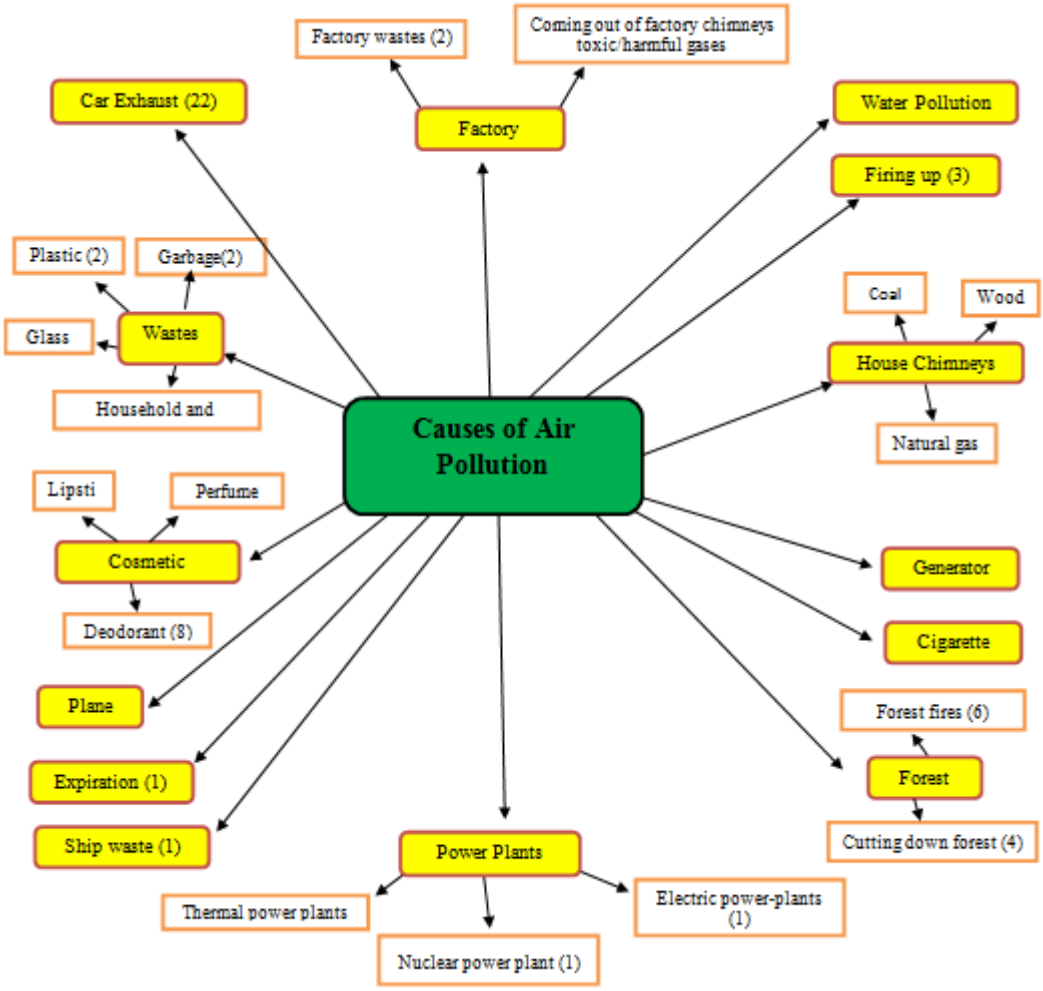

Figure 1. *Students' Views on the Causes of Air Pollution*

As shown in Figure 1, 14 themes were formed in line with the students' views on the causes of air pollution. These themes were car exhaust, cosmetic products, factories, forests, house chimneys, waste, cigarettes, power plants, firing up, generators, planes, water pollution, expiration, and ship waste. The theme, cosmetic products, includes deodorants, perfumes, and lipsticks; the theme and factory includes toxic/harmful gases from factory chimneys and factory waste; the theme, forest, includes forest fires and cutting down forests; the theme, house chimney, includes coal, wood, and natural gas; the theme, waste, includes household and industrial waste, plastic, garbage, and glass; and the theme, power plants, including nuclear, thermal, and electric power plants.

Car Exhaust

Twenty-two participants stated that the gases emitted from car exhaust were an essential cause of air pollution by drawing and expressing their views. The drawings made by some participants are shown in Figure 2.

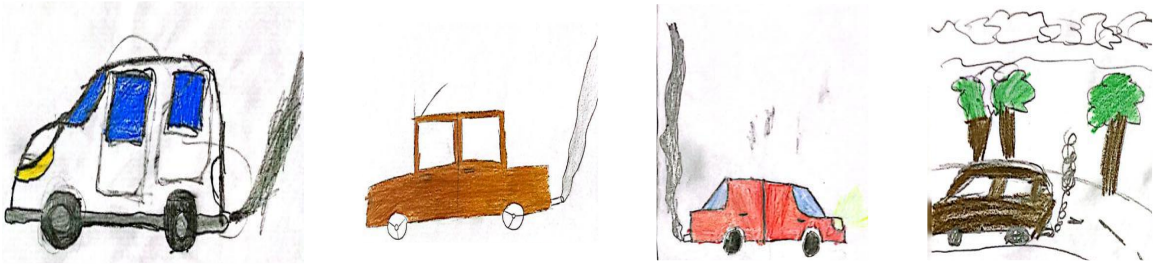

Figure 2. *The Drawings of Students*

When the writings and views of the participants were examined, the students stated that vehicles running on fossil fuels such as diesel, gasoline, and LPG emit harmful gases from their exhaust, which mix into the air and cause air pollution. Some students' views on this theme are as follows.

(E1) LPG, diesel fuel, and gasoline are used as fuel in cars. As a result of using these, dirty smokes come out of the car's exhaust. When this dirty smoke is released outside, the air is polluted.

(E10) As a result of the running of vehicles such as cars, buses, and minibuses, harmful gases are released from their exhausts into the air. These gases both pollute the air and cause damage to human health.

Cosmetic Products

Deodorant, perfume, and lipstick codes have been created for cosmetic products. Within the scope of this theme, eight students stated that deodorants, seven stated perfumes, and two stated that lipsticks cause air pollution, drawing and expressing their views. The drawings made by some participants are shown in Figure 3.

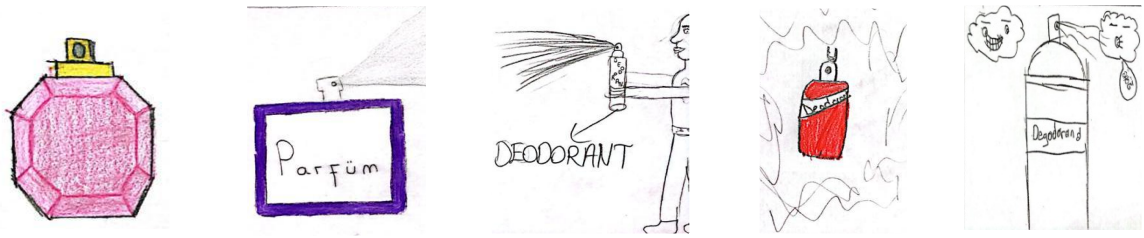

Figure 3. *The Drawings of Students*

When the writings and views of the participants were examined, students stated that there are chemical substances in cosmetic products, such as deodorants, perfumes, and lipsticks, that people use for care in their daily lives. According to the students, when these products are used, these harmful substances mix into the air and cause air pollution. Some students' opinions on this theme are as follows.

(E7) There are various chemical substances in cosmetic products, such as perfume, lipstick, nail polish, and deodorant, which people use. When people use these products, these chemicals inevitably mix into the air, thus polluting the air.

(E11) There are harmful chemicals in substances, such as deodorant, perfume, and nail polish, that people use. These harmful chemicals cause the ozone layer to thin. As the ozone layer becomes thinner, it becomes easier for harmful rays from the sun to reach the Earth. All these cause pollution of the air we breathe.

Factory

The codes of toxic/harmful gases emitted from factory chimneys and factory waste were created in the factory theme. Within the scope of this theme, 13 students stated that toxic/harmful gases were emitted from factory chimneys, and two stated that factory wastes cause air pollution and drew and expressed their views. The drawings made by some participants are shown in Figure 4.

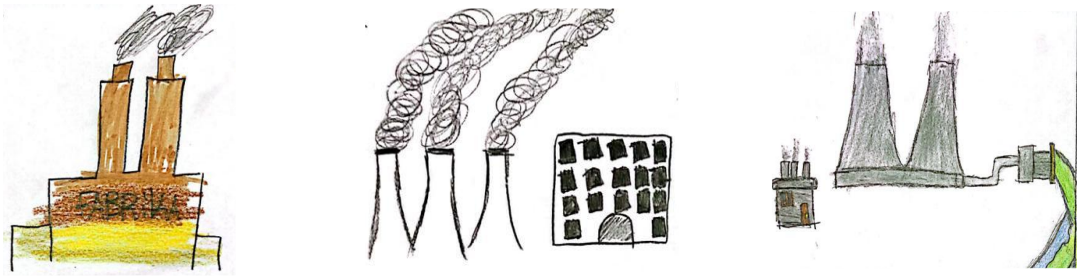

Figure 4. *The Drawings of Students*

According to the students' views, factory waste and the toxic/harmful gases coming out of the factory chimneys mix into the air and cause air pollution. Some students' opinions on this theme are as follows.

(E1) Factories use fuels such as natural gas, coal, and fuel oil. As a result, very harmful gases (carbon dioxide) are released into the air. Air pollution occurs when factories release that dirty smoke into the air.

(E13) There are many factories in industrial zones. Fossil fuels are used to run these factories. As a result of using these fossil fuels, the chimneys of the factories emit smoke. Where does this smoke go? Of course, it mixes with the air. This causes air pollution.

Forest

Forest fires and cutting-down forest/tree codes were created in the forest theme. Within the scope of this theme, while six students drew and expressed their views that forest fires caused air pollution, four students drew and expressed their views that cutting forests/trees caused air pollution. The drawings made by some participants are shown in Figure 5.

Figure 5. *The Drawings of Students*

When the writings and views of the participants were analyzed, the students stated that forest fires and forest/tree cutting caused air pollution. Some students' opinions on this theme are as follows.

(E5) People cut down forests for mining, tourism, and transportation. Desertification occurs as a result of cutting down forests. As forests are destroyed, the amount of oxygen decreases, and this causes an increase in air pollution.

(E8) If forests burn for any reason, there is much smoke. This smoke contains very harmful gases. These gases pollute nature. As the number of trees decreases, oxygen decreases, and carbon dioxide increases. This causes pollution of the air.

House Chimneys

The theme of "house chimneys" was formed in light of the students' responses from their drawings, writings, and views on the causes of air pollution. Eight participants stated that smoke coming out of house chimneys caused air pollution. The drawings made by some participants are shown in Figure 6.

Figure 6. *The Drawings of Students*

When the writings and views of the participants were analyzed, the students stated that the smoke coming out of the house chimneys was harmful and caused air pollution by mixing into the air. Some students' opinions on this theme are as follows.

(E2) The air is polluted due to bad and toxic smoke from the chimneys of houses. Especially coal smoke increases this even more. In fact, we can prevent air pollution by not releasing this toxic smoke from our homes into the air.

(E4) Today, many homes and workplaces are still heated with coal. As a result of coal burning, harmful gases are dispersed into the air and cause air pollution.

Wastes

Garbage, plastic, and glass codes were created for this waste theme. Within the scope of this theme, two students stated that garbage, two students stated that plastic waste, and one stated that glass waste causes air pollution, drawing and expressing their views. The drawings made by some of the participants are shown in Figure 7.

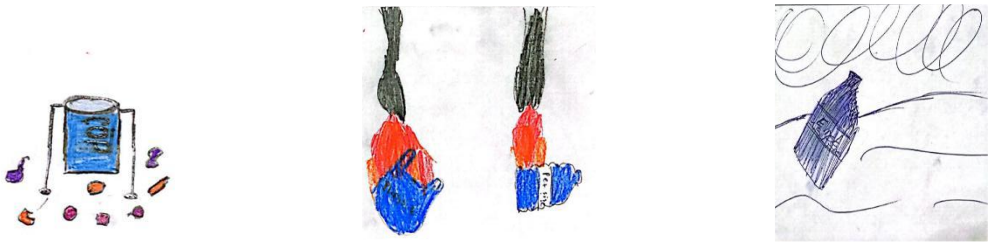

Figure 7. *The Drawings of Students*

When the writings and views of the participants were analyzed, it was found that the students stated that garbage, plastic, and glass waste caused air pollution. Some students' opinions on this theme are as follows.

(E3) When people throw glass waste, such as bottles, glasses, etc., into nature, they break. These broken glasses act as a lens. As a result of the sun's rays hitting these glass particles, all the rays gather at one point, and a fire starts. The fire grows, and forest fires occur.

(E9) People throw plastic bottles, beverage cans, cups, spoons, and forks into the environment. As such wastes pollute the environment, they also pollute the air.

Power Plants

In the theme of power plants, codes were created for nuclear, thermal, and electric power plants. Within the scope of this theme, one student for each code expressed their views that the aforementioned power plants increased air pollution. The drawings made by some participants are shown in Figure 8.

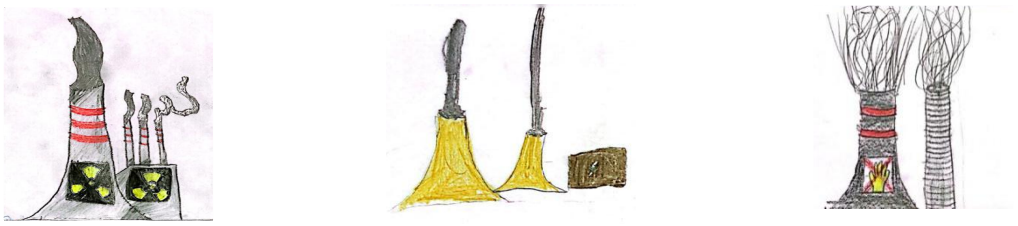

Figure 8. *The Drawings of Students*

When the writings and views of the participants were analyzed, it was observed that the students stated that nuclear, thermal, and electric power plants emitted harmful gases. These harmful gases mix with the air, causing air pollution. Some students' opinions on this theme are as follows:

(E8) Unfortunately, the materials used as fuel materials in nuclear power plants emit toxic gases. These toxic gases mix into the air, damaging the atmosphere and the ozone layer.

(E12) Coal is used in thermal power plants to generate electricity. As a result of the burning of coal used in power plants, carbon dioxide, carbon monoxide, methane, etc. gases are emitted; these gases pollute the air and cause the ozone layer to be depleted. These toxic gases also cause global warm in.

Cigarette, Fire, Generator, Airplane, Water Pollution, Exhalation, and Ship Waste

Participants also created themes such as cigarettes, fires, generators, planes, water pollution, exhalation, and ship waste. Within the scope of this theme, while seven students drew a drawing and expressed their opinion that cigarettes cause air pollution, three students drew and expressed their views that fire caused air pollution. For each remaining code, generators, airplanes, water pollution, exhalation, and ship waste, one student drew and expressed their views that these codes have an essential role in air pollution. The drawings made by some participants are shown in Figure 9.

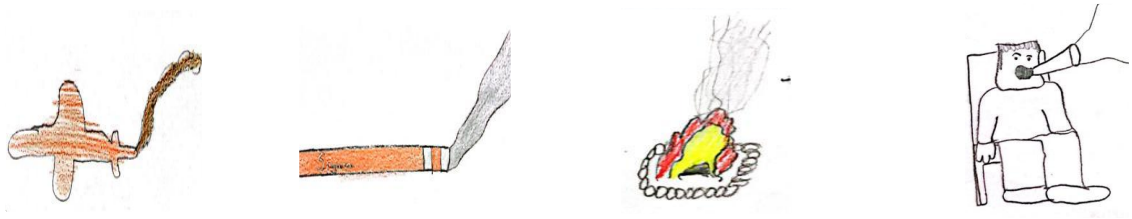

Figure 9. *The Drawings of Students*

When the writings and views of the participants were examined, the students stated that air pollution occurred because of the negative situations caused by cigarettes, fire, generators, airplanes, water pollution, exhalation, and ship waste. Some student opinions were as follows.

(E1) Gasoline is used when generators work. Therefore, toxic smoke comes out of their chimneys. This smoke pollutes the air.

(E7) When smoking, the toxic substances in the cigarette cause pollution.

(E17) When people have picnics, set up camps, and have barbecues, they light a fire. The smoke of these fires contains substances that harm the air. This is very damaging to the air.

Findings on Solutions to Air Pollution

In this part of the findings, to determine the students' perceptions of the solutions to air pollution, the drawings they made, the writings they wrote about their drawings, and the thoughts they expressed during the interviews were used. The results are shown in Figure 10.

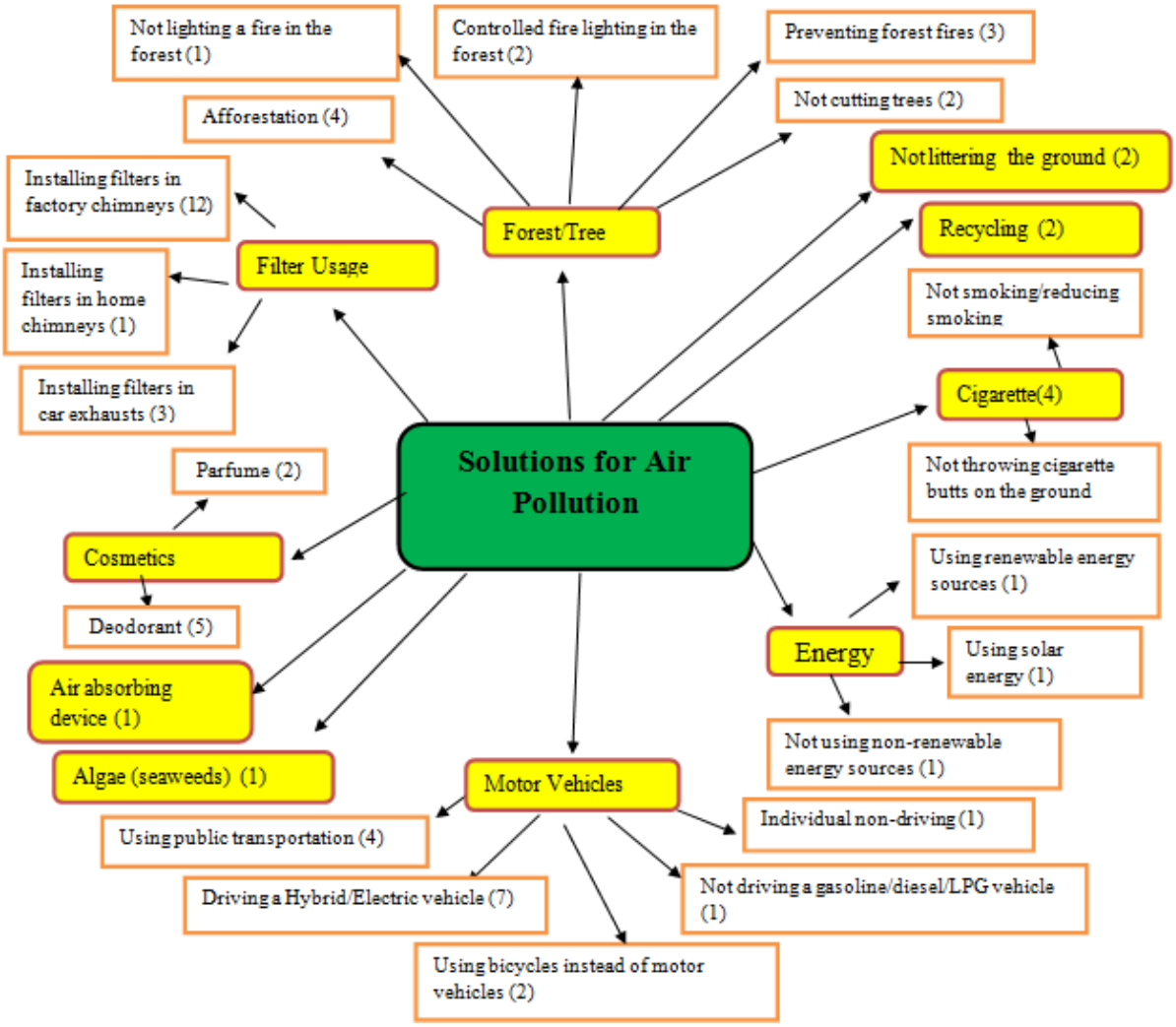

Figure 10. *Students' Views on Solutions to Air Pollution*

As seen in Figure 10, 11 themes were formed in line with the students' views on solutions to air pollution. These themes were motor vehicles, forests/trees, filter use, cigarettes, cosmetic products, energy, recycling, not throwing garbage, algae, and air-absorbing devices. While the motor vehicle theme includes codes for using public transportation, using electric/hybrid vehicles, not using gasoline/diesel/LPG vehicles, not using individual vehicles, and using bicycles instead of motor vehicles, the forest/tree theme includes codes for afforestation, not cutting down trees, not burning fires in forests, controlling fires in forests, and preventing forest fires. In the filter usage theme, there are codes for installing filters on factory chimneys, installing filters on car exhausts, and installing filters on home chimneys; in the cigarette theme, there are codes for not smoking/reducing smoking and not throwing cigarette butts on the ground; in the cosmetic products theme, there are codes for deodorants and perfumes; and in the energy theme, there are codes for using renewable energy sources, non-renewable energy sources, and solar power.

Motor Vehicles

In the theme of motor vehicles, four participants expressed their opinion that using public transportation would be an excellent solution to prevent air pollution. Codes for the use of electric/hybrid vehicles, not using gasoline/diesel/LPG vehicles, not using individual vehicles, and using bicycles instead of motor vehicles were also drawn and expressed by seven, one, one, and two participants, respectively. The drawings made by some participants are shown in Figure 11.

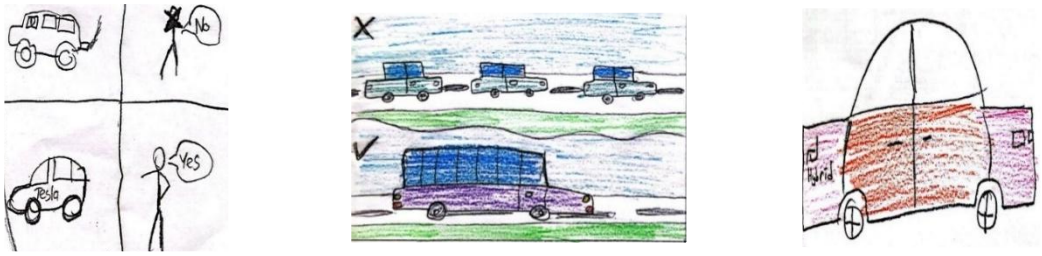

Figure 11. *The Drawings of Students*

When the writings and views of the participants were examined, it was found that the students stated that the use of individual cars might cause an increase in the rate of harmful gases in the air, so the use of public vehicles will play an essential role in reducing air pollution rather than using individual vehicles. In addition, students stated that harmful gases from the exhaust of gasoline/diesel/LPG-powered vehicles increase air pollution; therefore, using electric/hybrid vehicles will play an essential role in reducing air pollution. Some students' opinions on this theme are as follows:

(E2) Toxic gases from the exhausts of cars pollute the air. Therefore, if each person starts his/her automobile, there will be an increase in the amount of harmful gases entering the air. Instead, people should use public transportation.

(E6) Vehicles running on gasoline, diesel, and LPG release highly harmful gases into the air. These fuels increase air pollution. Using electric vehicles instead of these vehicles decreases air pollution because electric vehicles do not release harmful gases into the air like these vehicles.

(E23) People should use bicycles for transportation instead of motor vehicles. If they go somewhere, they should go by bicycle.

Forest/Tree

In the forest/tree theme, four participants made a drawing about and expressed their views on afforestation: three students on preventing forest fires, two students on not cutting trees and making controlled fires in the forest, and one student on not making fires in the forest as an essential method in solving air pollution. The drawings made by some participants are shown in Figure 12.

Figure 12. *The Drawings of Students*

When the writings and views of the participants were analyzed, it was found that the students stated that afforestation, not cutting trees/forests, preventing forest fires, not burning fires in the forest, and controlling fires in the forest would play an essential role in solving air pollution. Some students' opinions on this theme are as follows:

(E6) Air pollution will decrease if afforestation is done in places with no trees because the tree takes carbon dioxide gas and gives oxygen gas to the air. People should be made aware of afforestation.

(E17) When we go to forested lands, we must be cautious when lighting a fire. Because the fire we burn in the forest can splatter on the trees, and this fire can go out of control and turn into a big forest fire. If there is a forest fire or the trees are burned, oxygen production will decrease, resulting in air pollution.

Filter Usage

With regard to the use of filters, 12 participants drew a drawing. They expressed their views on installing filters in factory chimneys; three participants on car exhausts and one participant on house chimneys would be an excellent solution to prevent air pollution. The drawings made by some participants are shown in Figure 13.

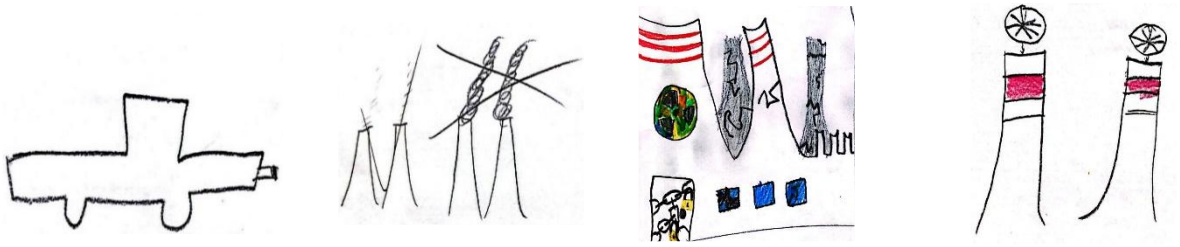

Figure 13. *The Drawings of Students*

When the writings and views of the participants were examined, the students stated that the installation of filters in the chimneys of factories, houses, and vehicles was an essential factor in the solution of air pollution to prevent toxic gases from polluting the air. Some students' views on this theme are as follows.

(E3) Fossil fuels are used in factories. Harmful gases are released as a result of their burning. Installing filters in the chimneys of factories will significantly reduce the rate of harmful gases entering the air because installing filters reduces air pollution by 90%.

(E13) The chimneys of coal-heated houses emit much harmful smoke into the air, and air pollution occurs. If filters are installed in the chimneys of the houses to reduce the harm of this smoke, further pollution of the air will be prevented.

Cigarette

Regarding the theme of cigarettes, four students made drawings about and expressed their views that not smoking or reducing the use of cigarettes, and not throwing cigarette butts on the ground would be excellent solutions to prevent air pollution. The drawings made by some participants are shown in Figure 14.

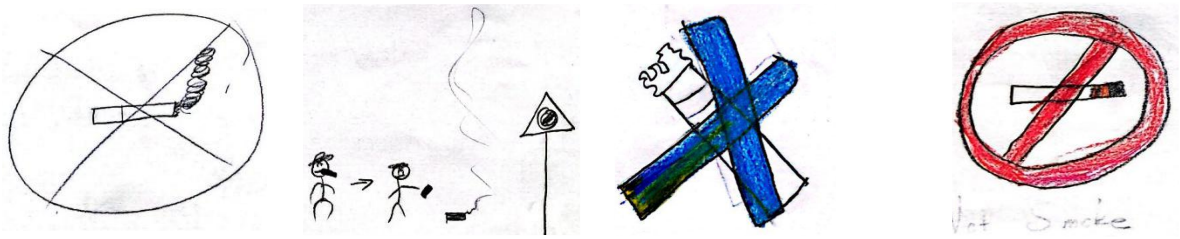

Figure 14. *The Drawings of Students*

When the writings and views of the participants were analyzed, the students stated that not smoking, reducing smoking, not throwing cigarette butts on the ground, and raising awareness among people about smoking were effective in reducing air pollution. Some students' opinions on this theme are as follows.

(E2) Air pollution will decrease if people reduce cigarette consumption and do not smoke because the chemicals in cigarette smoke pollute the air considerably. If cigarettes are reduced or smoking is stopped, the air will not be polluted, and human health will be positively affected.

(E17) Harmful chemicals in cigarettes cause severe damage to nature and air. Unconscious people throw cigarette butts on the ground. This situation pollutes the environment and causes the harmful substances in those cigarettes to mix into the air.

Cosmetic Products

In the cosmetics theme, six students expressed their views on not using or reducing the use of deodorants, and one student expressed that not using or reducing the use of perfume is an essential factor in solving air pollution. The drawings made by some of the participants are shown in Figure 15.

Figure 15. *The Drawings of Students*

Students stated that cosmetic products, such as deodorants and perfumes, contain various chemicals, that harmful chemicals are mixed into the air because of the use of these products, and that not using or reducing the use of these products effectively reduces air pollution. Some students' opinions on this theme are as follows.

(E6) The chemicals in cosmetic products such as perfume and deodorant that people use pollute the air by mixing into the air. This can be very harmful to humans and other living things. For this reason, we should not use such cosmetic products.

(E18) Deodorants pollute the air considerably because deodorants contain harmful gases and chemicals. These harmful gases and chemicals pollute the air.

Energy

Each code under the energy theme–not using renewable energy sources, non-renewable energy sources, and solar power–was drawn and expressed as an essential factor in solving air pollution. The drawings made by some participants are shown in Figure 16.

Figure 16. *The Drawings of Students*

Students stated that using non-renewable energy sources increases air pollution; therefore, renewable energy sources should be used instead of non-renewable energy sources. Some students' opinions on this theme are as follows.

(E12) Due to using fossil fuels, such as coal, oil, etc., very harmful and toxic gases are released into the air. If renewable energy sources, such as water, sun, and wind, are used instead, air pollution will be reduced.

(E18) Fossil fuels are non-renewable energy sources. Very harmful gases are released into the air when these energy sources are used. When we use these fossil fuels, greenhouse gases are produced, which are very harmful to the air.

Recycling, Not littering, Air Absorbing Devices, and Algae

When the students' drawings, writings, and views were analyzed, the themes of "recycling," "not littering," "air absorbing device," and "algae" were formed. Two students stated the theme of recycling, two stated the theme of not throwing garbage on the ground, one stated the theme of absorbing devices, and one stated that the theme of algae would have essential effects on the solution of air pollution. The drawings made by some participants are shown in Figure 17.

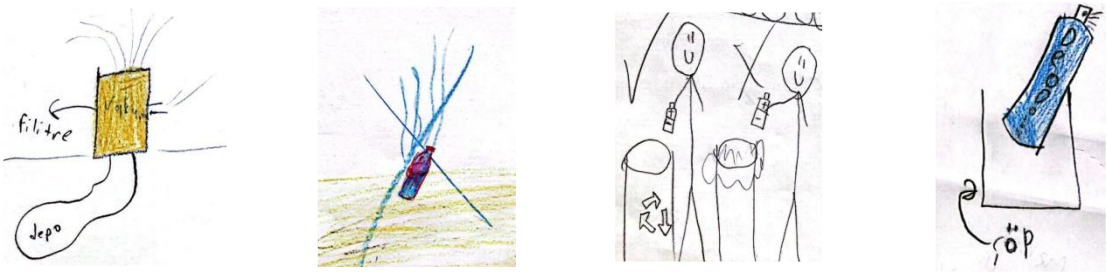

Figure 17. *The Drawings of Students*

When the writings and views of the participants were analyzed, the students stated that not throwing garbage on the ground, throwing batteries into recycling bins instead of garbage, and using a device that absorbs polluted air would effectively prevent air pollution. Some students' opinions on these themes are as follows.

(E2) Algae are photosynthesizing organisms. With photosynthesis, these creatures take carbon dioxide from the environment and provide oxygen to the environment. They can reduce air pollution because they provide oxygen to the environment. Also, an air vacuum device can be made. This device absorbs and cleans the polluted air. Then, it releases the cleaned air to the outside. Thus, air pollution is reduced.

(E8) Air pollution occurs when plastic, glass, chemical, and medical wastes are thrown into the environment. If such materials are recycled, the harmful gases they release into the air are prevented. Also, when the paper is recycled, the cutting of trees is reduced. Since the cutting of trees decreases, air pollution decreases.

DISCUSSION & CONCLUSION

According to gifted students, many factors cause air pollution, the most frequently mentioned of which are transportation and factory-related causes. The participants stated that gases and chemicals in fossil fuels directly enter the air and cause air pollution. Students stated that harmful gases are emitted from the exhaust of cars running on fuels such as gasoline, diesel, and LPG, and these gases cause air pollution. At this point, the students drew attention to air pollution caused by transportation. Varaden et al. (2021) found that most participants understood the effects of traffic-related air pollution. Similarly, they believed that harmful gases emitted from the chimneys of factories using fossil fuels cause air pollution.

The results revealed that the students believed that these harmful gases mixed with the air from cars and factories negatively affected the lives and health of people and other living things. Experts at the International Agency for Research on Cancer recently assessed the carcinogenicity of diesel and gasoline engine exhausts and some nitroarenes (Benbrahim-Tallaa et al., 2012). Air pollution poses a significant risk to the environment and living conditions (Sadatshojaie & Rahimpour, 2020). Air pollution has long-lasting effects, increasing the global incidence of the disease to approximately 147.42 million citizens. Air pollution has become a global problem (Elsaid & Ahmed, 2021). For example, in 2012, 193,000 people in developed countries in Europe died of airborne particles (Ortiz et al., 2017). Air pollution and human exposure to poor-quality air are currently the most critical environmental threats to public health worldwide (WHO, 2016). These findings support the views.

In addition to determining that using transportation and industrial sources increases air pollution, students suggested solutions for air pollution caused by these two sources. The participants put forward various suggestions related to motor vehicles and factories, and they think that air pollution will not occur, will be prevented, or will be reduced thanks to the solution suggestions they put forward. According to the students, using hybrid vehicles powered by batteries instead of gasoline, diesel, and LPG-powered vehicles, preferring public transportation instead of individual driving, and using bicycles instead of motor vehicles can be effective solutions to prevent air pollution. For example, S23 stated that using bicycles instead of motorized vehicles would reduce air pollution. Similarly, in a study conducted by Varaden et al. (2021) with students aged 5-11, one student stated that he started riding a bicycle to school regularly. With the increase in the use of motor vehicles, the amount of exhaust gas emitted increases. In addition, air pollutants emitted from chimneys in factories, residences, and workplaces pose significant risks to the lives of humans and other living organisms. Students put forward ideas to eliminate or reduce the adverse conditions created by this situation. The students in the study group thought that installing filters on car exhausts, chimneys of factories, and residences had an essential effect on the solution of air pollution. In his study, Uyanık (2017) reported that participants expressed opinions on air pollution caused by car exhaust

and residential chimneys. In addition, Kirilmazkaya (2022) reported that the participants stated that factory smoke causes air pollution. These findings are similar to those obtained in our study.

According to the students, cosmetic products such as deodorants, perfumes, and nail polishes contain harmful chemicals and gases. They stated that air pollution occurs when harmful substances in these products are mixed into the air. Researchers believe that chemicals in personal care products, such as deodorants, makeup, and hairspray, may increase air pollution levels (Behal & Behal, 2020). Similarly, Kilicoglu and Yilmaz (2021) stated in their study that students see deodorants as a cause of global warming. The students in our study think that not using or reducing deodorants, perfumes, makeup products, etc., is an excellent solution to prevent air pollution.

Air pollution is one of the biggest killers of our time (Landrigan, 2017). Forest fires are among the most significant contributors to pollution. Biomass burning is one of the most important sources of air pollution worldwide (Yarragunda et al., 2020). In parallel with these explanations, the students in the research study group stated that air pollution occurs when harmful and dirty smoke mixes with air during forest fires. In addition, they believe that cutting forests or trees for tourism, industry, transportation, etc., has a severe role in creating air pollution. Students developed solutions for air pollution caused by forest fires. Students thought that afforestation, not cutting trees in forested lands, burning fires in forests and picnic areas, or controlled fires are essential to reducing air pollution. In a study conducted by Kirilmazkaya (2022) with secondary school students, it was concluded that the students responded as "agree" with a mean of 3.96 to the item "I do not burn a fire in forested lands or at picnics" on their attitude towards the environment scale. In our research, it was found that students stated that making a fire in forestlands or picnic areas poses a significant risk for a fire, and for this reason, either no fire should be burned in these areas or controlled fires should be burned.

One of the critical pollutants that pollute the air is waste. Wastes that pollute the environment and the air can be very diverse. Industrial and domestic activities cause air pollution (Sadatshojaie & Rahimpour, 2020). Garbage, medical and chemical waste, plastics, glass and paper, electronic, sewage, and factory waste that people throw into the environment can cause significant environmental problems. According to the students in the study group, garbage, plastics, and glass waste thrown into the environment cause air pollution. It has even been observed that some glass shards cause forest fires in forested land. In the study by Kiliçoglu and Yilmaz (2021), participants stated that they considered waste an essential cause of global warming. Within the scope of this issue, students argued that people should not throw garbage uncontrollably and should raise awareness. Similarly, in the study by Uyanık (2017), the participants emphasized that awareness should first be raised to prevent environmental pollution.

According to gifted students, power plants are an important cause of air pollution. Coal-fired thermal power plants play an important role in air pollution. After using fossil fuels, harmful gases are emitted into the air, polluting clean air. In particular, using fossil fuels in industries, power plants, construction, quarries, and transportation causes air pollution (Sadatshojaie & Rahimpour, 2020). In this regard, students think using renewable energy sources instead of non-renewable ones will be beneficial in preventing air pollution. It is thought that using environmentally friendly energy sources will be effective in solving the major environmental problems of our age.

The students stated that cigarettes contain harmful chemicals that mix with the air when they smoke. Therefore, they stated that reducing or eliminating cigarette use plays a role in reducing air pollution. They also believed that the fuel used by airplanes, ships-wastes, water pollution, and generators increased air pollution. In addition, they emphasized that uncontrolled fires in outdoor activities, such as camping and picnics, are risky. Gifted students thought that recycling and not throwing garbage on the ground would positively affect their solutions to air pollution.

It was found that gifted students primarily mentioned transport, industry, forest fires, and cosmetic products as causes of air pollution. In addition, they believe that installing filters on chimneys, protecting forests, limiting or not using cosmetic products, recycling, using environmentally friendly energy sources, and using public transport can be efficient solutions to reduce air pollution. From this point of view, gifted students correctly defined the causes of air pollution and suggested solutions to eliminate or reduce air pollution

Statements of Publication Ethics

Ethics Committee approval for the study was obtained from the Ethics Committee of the affiliated Istanbul 29 Mayıs University with the dates 02.01.2023 and 2023/01-3.

Researchers' Contribution Rate

Authors	Literature review	Method	Data Collection	Data Analysis	Results	Conclusion
Author 1's name	☒	☒	☒	☒	☒	☒
Author2's name	☒	☒	☒	☒	☒	☒

Conflict of Interest

This study has no conflict of interest.

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Adapting the Parental Attachment Recognition Scale for Parents Nurturing Preschool Children into Turkish

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Abstract

This study aimed to conduct a validity and reliability study by adapting the "Parent Attachment Recognition Scale" developed by Tanaka (2020) to determine the early attachment experiences of mothers with preschool-aged children. The study group consisted of 565 parents, including 321 mothers and 244 fathers with preschool-aged children. The data for the study were collected through the "Personal Information Form" and the "Parent Attachment Recognition Scale" developed by Tanaka (2020). The scale comprises three subscales: parent-child communication, emotional attachment and parent impressions with a total of 27 items. Content and construct validity were examined in the validity study of the scale, while in the reliability study, analyses related to internal consistency were conducted. Expert opinions were utilized for the scale's content validity and both exploratory and confirmatory factor analysis techniques were employed for construct validity. The analyses indicated that the scale maintains its three-subscale structure as in the original form and the fit indices were acceptable. As a result of the analyzes regarding the reliability of the scale, the Cronbach Alpha reliability coefficient for the "Parent-Child Communication" subscale was calculated as 0.966 for mothers and 0.960 for fathers. Alpha reliability coefficient for the "Emotional Attachment" subscale was calculated as 0.960 the mother form and 0.968 the father form. For the "Parental Impressions" subscale, the Cronbach's Alpha reliability coefficient was calculated as 0.875 for mothers and 0.933 for fathers. The scale's overall Cronbach's Alpha value was calculated as (α)=0.979 for mothers and (α)=0.972 for fathers. In conclusion, the scale was determined to be a valid and reliable measurement tool.

Keywords: Attachment, parent, preschool period, validity, reliability.

Okul Öncesi Çocuğu Olan Ebeveynlerin Bağlanma Tanıma Ölçeğinin Türkçeye Uyarlaması

Öz

Bu çalışmada okul öncesi dönemde çocuğu bulunan annelerin kendi ebeveynleriyle olan erken bağlanma deneyimlerini belirlemek amacıyla Tanaka (2020) tarafından geliştirilmiş olan Ebeveyn Bağlanma Tanıma Ölçeği'nin Türkçeye uyarlaması yapılmaktadır. Araştırma okul öncesi dönemde çocuğu bulunan 321 anne ve 244 baba olmak üzere toplamda 565 ebeveyn ile yürütülmüştür. Araştırmanın verileri "Kişisel Bilgi Formu" ve Tanaka (2020) tarafından geliştirilen "Ebeveyn Bağlanma Tanıma Ölçeği" aracılığıyla toplanmıştır. Ölçek; ebeveyn-çocuk iletişimi, duygusal bağ ve ebeveyn izlenimleri olmak üzere üç alt boyut ve 27 maddeden oluşmaktadır. Ölçeğin geçerlik çalışmalarında; kapsam ve yapı geçerliği, güvenirlik çalışması kapsamında ise; iç tutarlık yöntemi ile ilgili analizler yapılmıştır. Ölçeğin kapsam geçerliğine yönelik analizlerde uzman görüşlerinden yararlanılmış olup, yapı geçerliği kapsamında açımlayıcı ve doğrulayıcı faktör analizi tekniğinden yararlanılmıştır. Yapılan analizler sonucunda ölçeğin orijinal formundaki gibi üç alt boyuttan oluştuğu ve uyum indeks değerlerinin kabul edilebilir düzeyde olduğu belirlenmiştir. Ölçeğin güvenirliğine yönelik yapılan analizler sonucunda ise, ölçeğin "ebeveyn çocuk iletişimi" alt boyutunda anneye ait Cronbach Alpha iç tutarlılık katsayısı 0.966 iken, babaya ait iç tutarlılık katsayısı ise 0.960,"Duygusal Bağ" alt boyutunda anneye ait Cronbach Alpha iç tutarlılık katsayısı 0.960 iken, babaya ait iç tutarlılık katsayısı ise 0.968, "Ebeveyn izlenimleri" alt boyutunda anneye ait Cronbach Alpha iç tutarlılık katsayısı 0.875 iken, babaya ait iç tutarlılık katsayısı ise 0.933 olarak hesaplanmıştır. Ölçeğin anne boyutunda toplam Cronbach Alpha değeri (α)=0.979 olarak hesaplanmış iken baba boyutunda ise (α)=0.972 olarak hesaplanmıştır. Sonuç olarak ölçeğin geçerli ve güvenilir bir ölçme aracı olduğu belirlenmiştir.

Anahtar kelimeler: bağlanma, ebeveyn, okul öncesi dönem, geçerlik, güvenirlik.

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INTRODUCTION

While Bowlby (1982, 1980) primarily focused on infants' attachment to their primary caregivers when defining attachment theory, he clearly stated that attachment is viewed as a lifelong framework and the attachment behavioral system guides thoughts, emotions and behaviors in adult close relationships. According to Bowlby, the newborn establishes his/her first relationship with his/her caring mother or another caregiver who can replace her/his mother. When this relationship progresses in a positive process such as meeting the needs of the baby, feeling safe, and receiving emotional closeness, it will enable the person to feel important by thinking that he/she is worthy of being loved, and to perceive other adults who care for him/her and the world as a safe and positive place. This secure foundation creates a basic structure for the person to develop positive models about himself/herself and others, and these models are defined as mental representations (Diehl et al., 1998). Specifically, he assumed that an adult's attachment orientation would influence how they interact with and provide care for their own children (Bowlby, 1988). In other words, attachment theory emphasizes the continuity between an individual's attachment representations and subsequent caregiver representations (Collins & Ford, 2010; Collins et al., 2009). It is accepted that parents' relationships with their attachment figures influence their behavior towards their own children and thus affect the quality of the attachment relationship (Main & Hesse, 1990). Accordingly, since parents with secure attachment representations have positive parenting cognitions, they exhibit positive emotions and behaviors and improve the parent's desire and ability to care for their baby (Jones et al., 2015; van IJzendoorn, 1995). On the other hand, it is noted that insecure attachment representations hinder the ability to provide sufficient care (George & Solomon, 1999; Jones et al., 2015) and the provision of sensitive support (Feeney et al., 2013). This is because caregivers' accessibility and responsiveness to their children are influenced by their mental representations of their relationships with their own caregivers during childhood (George & Solomon, 2008).

In the literature, individuals with insecure attachment are found to experience higher levels of parenting stress and depression (Stern et al., 2018; Jones et al., 2015), while mothers with secure attachment are observed to engage in more positive interactions with their infants (Crugnola et al., 2013; Verhage et al., 2016). Furthermore, research has shown similarities between a mother's attachment style towards her own parents and her attachment style towards her own baby. These studies suggest that mothers transmit their internal working models of attachment developed with their own parents to their own children, thereby passing on their attachment styles to future generations (Cozolino, 2014; Lippe et al., 2010). A meta-analysis study providing strong evidence for the transmission of attachment patterns from parents to their children also exists (Van Ijzendoor, 1995). However, some studies emphasize that parents' attachment styles can influence child-parent attachment styles through parental behaviors (Steele & Stelee, 1994; van Ijzendoor & Bakermans-Kranenburg, 1997).

Adult Attachment Interview Protocol used in these studies (George et al., 1985) allows testing the proposition of transmission from generation to generation, as it is developed based on the continuity of early attachment quality in interpersonal relationships in adulthood (Steele & Baradon, 2004). Within the framework of the interview evaluating the representations of early attachment experiences in adulthood, caregivers, secure/autonomous, defensive/avoidant, obsessive or unresolved trauma/loss-related representations are classified into attachment categories (Main et al., 2002). Caregivers who can speak about their childhood relationships with their parents openly, objectively and convincingly are classified as safe and it is noted that these caregivers are able to sense their children's distressing tips accurately and answer influentially (George & Solomon, 2008; van IJzendoorn, 1995). Therefore, caregivers' representations of their own internal working models of relationships have been accepted as a very strong predictor of the attachment relationship between infant and caregiver (Steele et al., 1996).

In our country, it is seen that the "Experiences in Close Relationships Inventory-II" is used in studies (Ahmadova, 2019; Güner-Algan & Şendil, 2013; Sımsıkı, 2011; Görgü, 2018) to determine adults' attachment relationships. The Experiences in Close Relationships Inventory II, developed by Fraley et al. (2000) and adapted to Turkish by Selçuk et al. (2005), was developed to gauge adult attachment dimensions. Validity and reliability studies of the scale were carried out on university students. Selçuk et al. (2005) emphasized in their study that the scale's lengthy format, the presence of some items with excessive semantic overlap leading to unnecessary repetition and the limitations of the sample consisting solely of university students were noteworthy aspects.

In addition, although many scales measuring adult attachment have been adapted into Turkish (Günaydın et al., 2005; Kırımer et al., 2014; Selçuk et al., 2005; Sümer, 2006; Sümer & Güngör 1999), especially when parents consider their own childhood, no measurement tool was found to determine attachment status. Therefore,

this study aims to adapt the "Parental Attachment Recognition Scale," developed by Tanaka (2020), into Turkish to determine the early attachment experiences of parents with children in the preschool period.

METHOD

Model of the Research

Adapting the Parental Attachment Recognition Scale into Turkish was designed in a general survey model for this study (Karasar, 1995).

Study Group

The study group of the research consists of 565 parents (321 mothers and 244 fathers) who have children in the preschool period. In determining the sample group of the research, the appropriate sampling method was utilized (Büyüköztürk et al., 2020). Among the participants in the study group, 321 (56.81%) are mothers, and 244 (43.18%) are fathers. Among the parents, 466 (82.5%) have children in the 5-year-old , and 99 (17.5%) have children in the 6-year-old. Among the fathers, 44 (18.03%) are aged 20-25, 118 (48.36%) are aged 26-35, and 82 (33.60%) are aged 36-45. Among the mothers, 54 (16.82%) are aged 20-25, 186 (58.40%) are aged 26-35, and 181 (57.94%) are aged 36-45. Among the fathers, 38 (15.57%) have a degree in elementary school, 47 (19.26%) in high school, 117 (47.95%) in undergraduate studies, and 42 (17.21%) in postgraduate studies. Among the mothers, 35 (10.90%) have completed middle school, 41 (12.77%) have completed high school, 203 (63.23%) have completed undergraduate studies, and 42 (13.08%) have completed postgraduate studies. Among the fathers, 165 (67.62%) are civil servants, 40 (16.39%) are laborers, and 39 (15.98%) are from other occupational groups. Among the mothers, 201 (62.61%) are civil servants and 120 (37.38%) are housewives.

Data Collection Tool

Parental Attachment Recognition Scale: Tanaka (2020) developed the scale to assess mothers' early experiences of attachment with their parents during the preschool period. The scale, which consists of three subscales: and parent-child communication, parental impressions, emotional attachment is a 7-point Likert type. The scale's higher scores indicate a stronger understanding of the parent's early childhood attachment experiences. The scale's items 1, 4, 25, 26 and 27 are reverse-coded.

The parent-child communication subscale includes items 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17 and 19 This subscale is related to close parent-child interactions that are important for attachment experience. The emotional attachment subscale includes items 11, 18, 20, 21, 22, 23, 24, 25, 26 and 27. This subscale reflects the attitudes of parents towards their children's initiatives as well as their unpleasant emotions and their behaviors in supporting their children's trust-building process. This subscale includes items like "My family has always given me a sense of confidence that I am loved" and "My family understood my feelings." The parental impressions subscale includes items 1, 2, 3 and 4. This subscale reflects parents' impressions of their own parents, providing descriptive information about the quality of attachment during their childhood. Items in this subscale include statements like "My family supported me / stood by me when I asked them" and "My family enjoyed playing with me or talking with me" (Tanaka, 2020).

The scale's validity and reliability studies were carried out with 639 parents. In the validity studies, it was revealed that the scale consists of three subscales and 27 items. Cronbach's Alpha coefficients for its parental impressions, parent-child communication emotional attachment subscales and whole scale were calculated as 0.83, 0.94, 0.93 and 0.83, respectively in the study. The correlation coefficient between the subscales of the scale is found to be in the range of 0.69 to 0.82. In the conducted confirmatory factor analysis, CFI was determined to be 0.90, and RMSEA was 0.08, indicating that the generated model shows a good fit (Tanaka, 2020).

Analysis of Data

Initial contact was made with the researcher who developed the scale as part of the study and necessary permissions were obtained. The first step was to translate the scale into Turkish and then back-translate it from Turkish to English to ensure linguistic equivalence. In the subsequent stage, the Turkish version was refined based on a comparison with the original scale items, ensuring linguistic validity. After the scale were translated into Turkish, they were further again translated into Turkish by experts of English. The items translated by three experts were then retranslated back into English and a comparison was made between the Turkish-English expressions. The equivalence between the Turkish and the original form has been verified by experts in the field and English language experts.

Content and construct validity analyses were conducted for the validity of the scale and analyses about internal consistency were carried out using Cronbach's alpha method within the reliability analysis. Content validity was ensured through expert opinions, while construct validity was established through exploratory and confirmatory factor analysis techniques. For the exploratory factor analysis on the collected dataset, the IBM SPSS Statistics 25 software package was utilized in the study. This study utilized the principal component method for factor extraction, considering the factor selection criteria to determine an appropriate number of factors. Additionally, a varimax rotation was conducted to enhance the clarity of variables contributing to the formation of each common factor. Confirmatory Factor Analysis was applied to assess whether the factors obtained through EFA are structurally appropriate (Brown, 2015).

Research Ethics

Before starting the research process, permission was obtained from the KTO Karatay University Scientific Research Ethics Committee (with a letter dated 08.10.2021 and reference number E-46409256-300-17338). In the subsequent phases, parents of preschool children residing in the city center and central districts of Konya were approached and provided with necessary information about the study, and those who willingly agreed to participate were involved in the research.

FINDINGS

Findings Related to Content Validity

After it was translated into Turkish by three experts in the field of child development who have a good command of English, the final version of the Turkish version was obtained by translating it back from Turkish to English. The linguistically equivalent scale in both its original and Turkish versions was presented to five academic experts in the field, who were asked to evaluate the appropriateness and comprehensibility of the scale items for the purpose of the study. The Content Validity Index (CVI) was determined using the Davis technique for content validity in the research. In the Davis technique, expert opinions are rated as "Appropriate," "Item needs slight revision," "Item needs major revision" and "Item is not appropriate." A value of 0.80 is accepted as the criterion (Yurdugül, 2005). The average Content Validity Index of the scale was calculated as 97%. Based on these results, it was determined that the inter-coder reliability criterion of 90% or higher specified for the five experts (Polit et al., 2007) was met. Thus, it can be concluded that the content validity is statistically sufficient.

Findings on Construct Validity

Findings Related to Exploratory Factor Analysis: Factor analysis was performed on the obtained data to determine the scale's construct validity.

Table 1. Common Factor Variances and Factor Loads for the Parental Attachment Recognition Scale

Item	Mother			Father		
	Parent-Child Communication	Emotional Attachment	Parental Impressions	Parent-Child Communication	Emotional Attachment	Parental Impressions
1 *			0.620			0.812
2			0.691			0.777
3			0.794			0.811
4 *			0.761			0.839
5	0.798			0.868		
6	0.632			0.761		
7	0.704			0.844		
8	0.701			0.755		
9	0.744			0.830		
10	0.739			0.878		
12	0.583			0.546		
13	0.596			0.832		
14	0.627			0.756		
15	0.643			0.693		
16	0.611			0.570		
17	0.520			0.601		
19	0.778			0.808		
11		0.795			0.813	
18		0.775			0.815	
20		0.750			0.769	
21		0.741			0.803	
22		0.689			0.837	
23		0.640			0.791	
24		0.522			0.658	

25 *		0.732			0.797	
26 *		0.763			0.851	
27 *		0.708			0.880	
Value	7.869	7.494	4.350	8.742	7.961	3.823
Ratio of Variance Explained	29.145	27.754	16.112	32.376	29.484	14.158
Cronbach's Alpha	0.966	0.960	0.875	0.960	0.968	0.933
	Total Explained Variance Rate = 73.011 (KMO) = 0.967 Bartlett Test Value = 9857.117 **p = 0.001** ** Total Cronbach's alpha (A)=0.979			Total Explained Variance Rate = 76.018 (KMO) = 0.949 Bartlett Test Value = 8208.972 **p = 0.001** ** Total Cronbach's alpha (A)=0.972		

p*<0.05; p**<0.01

Taking into account the differences in early attachment experiences to their own parents, the scale was evaluated separately for mothers and fathers in the study. The suitability of the distribution for factor analysis was tested using the KMO test, with a value above 0.80 being considered very good (Akgül & Çevik, 2003). In accordance with the data obtained from mothers in the study, the KMO value was determined as 0.967 and for fathers, it was 0.949. Thus, it can be stated that the obtained KMO values are at a very good level.

The Bartlett's test results were calculated as 9857.117 ($p<0.05$) for mothers and 8208.972 ($p<0.05$) for fathers. These values indicate that the multivariate nature of the measured variable in the population parameter is significant. In this research, no limitation was imposed on the number of factors and factors with eigenvalues greater than or equal to 1 were considered important factors (Büyüköztürk, 2002). Considering that variance ratios above 40% are ideally accepted (Scherer, 1988), the variance amounts obtained in this study are considered sufficient, with 73% for mothers and 76% for fathers.

As shown in Table 1, the "Parental Attachment Recognition Scale" consists of three subdimensions: parent-child communication, emotional attachment, and parental impressions.

Table 2. Parental Attachment Recognition Scale Item-Total Correlation Values

Item	Total Correlation		Item	Total Correlation		Item	Total Correlation	
	Mother	Father		Mother	Father		Mother	Father
1 *	0.740	0.598	10	0.855	0.828	18	0.855	0.770
2	0.681	0.706	12	0.705	0.451	20	0.766	0.804
3	0.661	0.725	13	0.776	0.806	21	0.777	0.795
4 *	0.733	0.701	14	0.784	0.827	22	0.801	0.785
5	0.862	0.826	15	0.781	0.815	23	0.830	0.793
6	0.795	0.783	16	0.716	0.596	24	0.659	0.755
7	0.822	0.809	17	0.763	0.764	25 *	0.843	0.652
8	0.866	0.703	19	0.916	0.869	26 *	0.792	0.682
9	0.809	0.730	11	0.826	0.797	27 *	0.805	0.730

According to Erkuş (2003), a factor with an item-total correlation value below 0.40 is considered not to contribute significantly to the measurement of the intended construct. In light of this, the total correlation values of the items in the scale range between 0.659 to 0.916 for mothers and between 0.451 and 0.869 for fathers. In this context, there was no need for any reduction in the scale items (Table 2).

Table 3. Statistical Values Regarding the Fit of the Model

Measurement	Fit Index Values of the Model
	2.164 **
RMSEA	0.046 **
SRMR	0.029 **
IFI	0.960 **
CFI	0.960 **
GFI	0.855 *
TLI	0.954 **

* Acceptable Fit; ** Good Fit (Şimşek, 2007).

The fit values of the model are observed to have acceptable and good fit values (Kline, 2011). The $\chi 2$ goodness-of-fit test determines whether the observed frequency distribution is equivalent to the expected distribution under the null hypothesis (Tekindal, 2021). RMSEA is a fit index that evaluates how distant a default

model is from a perfect model, whereas TLI and CFI are incremental fit indices that compare the fit of a default model to that of basic model (Xia & Yang, 2019). Standardized effect sizes are preferred over non-standardized measurements as they facilitate interpreting the magnitude of misfit. The most popular standardized effect size for misfit is SRMR, which can be interpreted roughly as the average standardized residual covariance. The main advantage of using SRMR over RMSEA is that its value can be interpreted to a significant extent (Shi et al., 2018). When analyzing the statistical values of the Parent Attachment Recognition Scale model, the following values were obtained: $\chi 2/df$ value of 2.164, RMSEA value of 0.046, SRMR value of 0.029, IFI value of 0.960, CFI value of 0.960, GFI value of 0.855, and TLI value of 0.954.

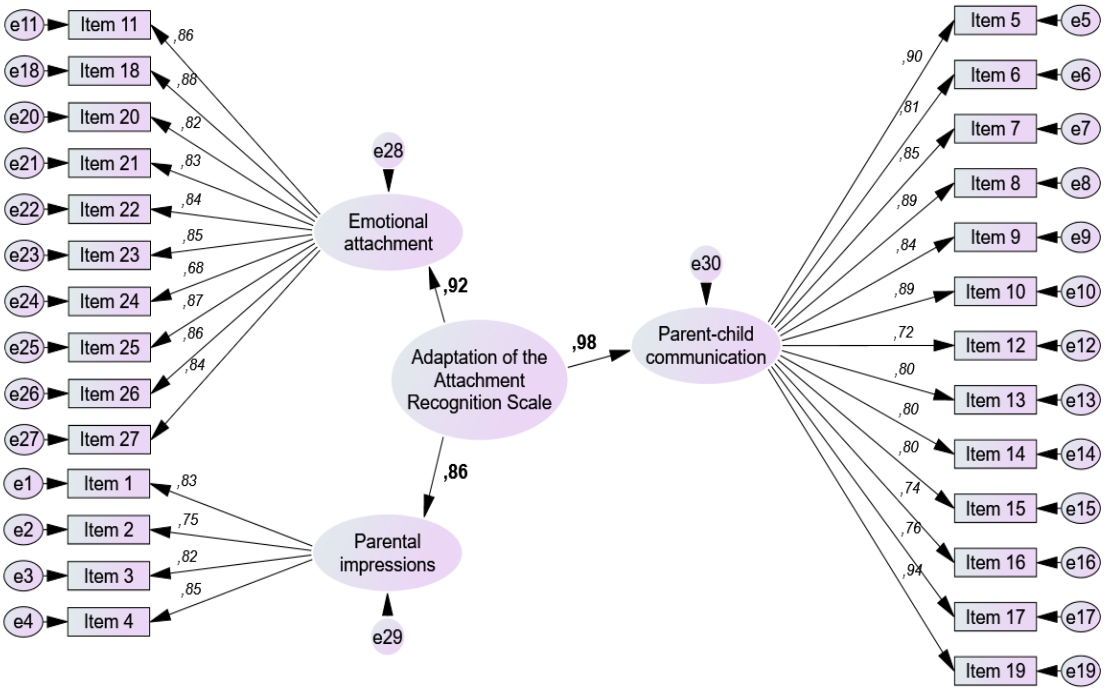

Figure 1. *The Parent Attachment Recognition Scale (a) Model Formed for Mothers*

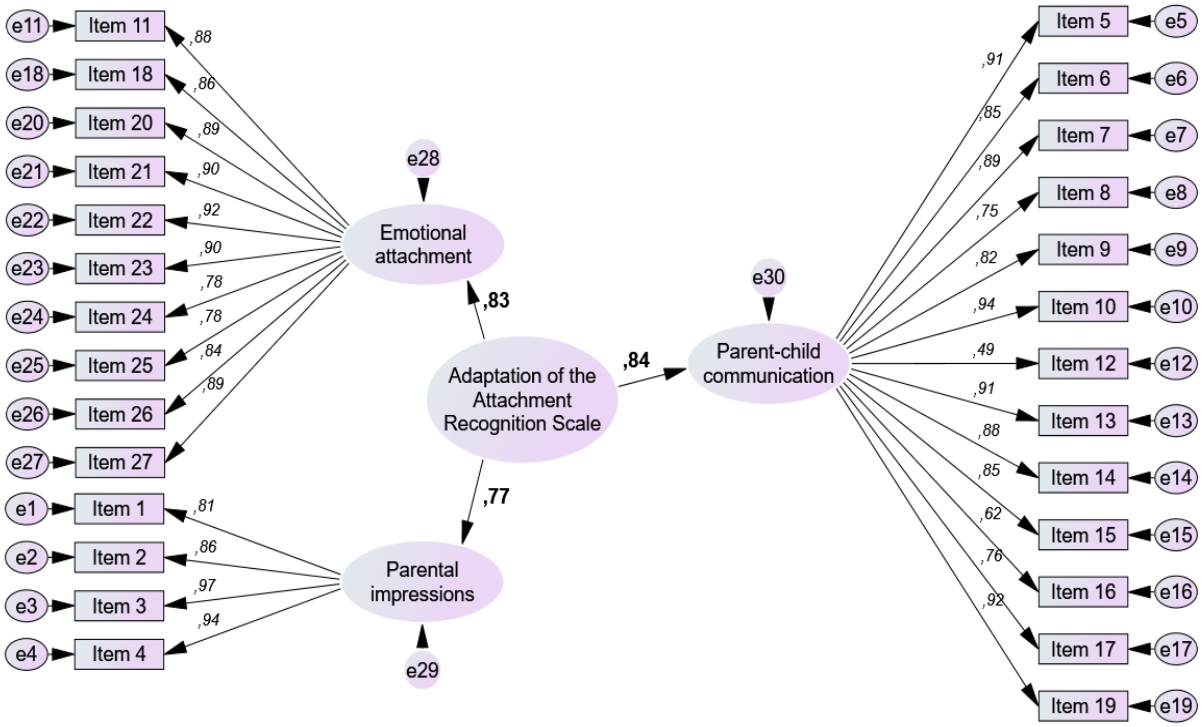

Figure 2. *The Parent Attachment Recognition Scale (b) Fathers*

After constructing the model, the relationships between the scale scores and the sub-dimensions are presented in Table 4, and the evaluation of the scale scores and sub-dimensions according to mothers and fathers is provided in Table 5.

The "Parent Attachment Recognition Scale" is a 27-item measurement tool developed to determine the early attachment experiences of mothers with preschool children. Higher scores indicate a stronger endorsement of mothers' early attachment experiences during their childhood, suggesting that the experiences are validated by the mothers themselves during the early childhood period. Scores that can be obtained from the scale range from 27 to 189. The "Parental Impressions" subscale consists of items 1, 2, 3 and 4. The "Parent-Child Communication" subscale includes items 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17 and 19. The "Emotional Attachment" subscale is composed of items 11, 18, 20, 21, 22, 23, 24, 25, 26 and 27.

Table 4. Evaluation of the Relationships between the Parent Attachment Recognition Scale and the Scale's Subscales (n=565)

	Mother (n=321)			Father (n=244)		
	Parent-Child Communication	Emotional Attachment	Parental Impressions	Parent-Child Communication	Emotional Attachment	Parental Impressions
Emotional Attachment	0.761			0.642		
Parental Impressions	0.705	0.864		0.611	0.672	
Parent Attachment Recognition Scale	0.819	0.973	0.947	0.776	0.931	0.879

When examining Table 4, relationships between the Parent Attachment Recognition Scale, its subscales, and the scores are observed as follows: For mothers, the emotional attachment subscale and parent-child communication subscale have a correlation of r=.76. The parental impressions subscale and parent-child communication subscale have a correlation of r=.70. The total scores of the scale and the parent-child communication subscale have a correlation of r=.81. The parental impressions subscale and emotional attachment subscale have a correlation of r=.86. The total scores of the scale and emotional attachment subscale have a correlation of r=.97. The total scores of the scale and parental impressions subscale have a correlation of r=.94. For fathers, the emotional attachment subscale and parent-child communication subscale have a correlation of r=.64. The parental impressions subscale and parent-child communication subscale have a correlation of r=.61. The total scores of the scale and the parent-child communication subscale have a correlation of r=.77. The parental impressions subscale and emotional attachment subscale have a correlation of r=.67. The total scores of the scale and emotional attachment subscale have a correlation of r=.93. The total scores of the scale and parental impressions subscale have a correlation of r=.87.

Table 5. Descriptive Statistics of the Parent Attachment Recognition Scale (n=565)

	Mother (n=321)		Father (n=244)		Test St.	p
	Mean±SD	Min-Max	Mean±SD	Min-Max		
Parent-Child Communication	25.72±3.33	27 (4-28)	21.79±6.30	24 (4-28)	9.558	0.001 **
Emotional Attachment	83.92±12.21	87 (13-91)	68.51±19.00	74 (13-91)	11.693	0.001 **
Parental Impressions	65.10±9.21	67 (12-70)	59.25±14.06	64 (10-70)	5.967	0.001 **
Parent Attachment Recognition Scale	174.74±23.33	179 (36-189)	149.55±34.93	159,5 (38-189)	10.259	0.001 **

When Table 5 was examined, it was determined that the mother's parent-child communication, emotional attachment, parental impressions sub-scales, and the total score averages of the scale were significantly higher than the fathers' mean scores ($p<0.05$).

Table 5. Cronbach Alpha Values of the Parent Attachment Recognition Scale

	Cronbach Alfa Values Mother dimension	Cronbach Alfa Values Father dimension
Parent-Child Communication	0.966	0.960
Emotional Attachment	0.960	0.968
Parental Impressions	0.875	0.933
Parent Attachment Recognition Scale	0.979	0.972

In the evaluations conducted within the scope of the research for mothers, a Cronbach's alpha the "parent-child communication" subscale has 0.966, the "emotional attachment" subscale has 0.960, and the "parental impressions" subscale has 0.875. The total Cronbach's alpha value of the scale is calculated as (α)=0.978. In the evaluations conducted for fathers, the "parent-child communication" subscale of the scale has a Cronbach's alpha internal consistency coefficient of 0.966, the "emotional attachment" subscale has 0.964, the "parental impressions" subscale has 0.933, and the total Cronbach's alpha value of the scale is calculated as (α)=0.971. In the evaluations regarding the father dimension, Cronbach Alpha was found to be 0.960, 0.968, 0.933 and 0.972 for the parent-child communication, emotional attachment, parental impressions sub-dimensions and total score, respectively. As a result of these evaluations, Cronbach's Alpha values are found to be above 0.70 in both groups, which is considered sufficient (Özdamar, 2002; Tavakol & Dennick, 2011). Furthermore, based on the evaluations, it is concluded that the scale measures distinct characteristics in three subscales and is a valid measurement tool separately for both mothers and fathers.

DISCUSSION & CONCLUSION

In the study, a reliability and validity study of the "Parent Attachment Recognition Scale" developed by Tanaka (2020) was conducted to adapt it into Turkish and assess its reliability and validity. As a result of exploratory factor analysis, it was determined that the scale retained its original structure, consisting of three sub-dimensions: parent-child communication, emotional attachment and parental impressions, along with 27 items.

In the research, the content validity index of the scale was determined using the Davis technique. A value of 0.80 is considered as the criterion for this index (Yurdugül, 2005). When looking at the average Content Validity Index of the scale, it was calculated as 97%. Based on these results, it has been determined that the scale meets the inter-rater reliability criterion of 90% or above, as specified for five experts (Polit et al., 2007).

The study utilized exploratory factor analysis to ascertain whether the scale's items would group into similar subscales as in the original form. The results of the exploratory factor analysis indicated that the scale consisted of three subscales: parent-child communication, emotional attachment and parental impressions. Considering the variations in early attachment experiences with their own parents, the scale was evaluated separately for mothers and fathers in the study.

In accordance with the data obtained from mothers, the Kaiser-Meyer-Olkin (KMO) value was determined as 0.967, and the KMO value was found to be 0.949 for data obtained from fathers. Therefore, it can be said that the obtained KMO values are at a very good level. For factor analysis to be appropriate, Bartlett's Test of Sphericity should be significant ($p<0.05$) (Akgül & Çevik, 2003; Williams et al., 2010). Therefore, in this study, it is observed that the Kaiser-Meyer-Olkin (KMO) value obtained from the evaluation of the scale by mothers and fathers is at a very good level. The Bartlett's Test of Sphericity resulted in 9857.117 ($p<0.05$) for mothers and 8208.972 ($p<0.05$) for fathers. In factor analysis, variance ratios above 40% are considered ideal (Scherer, 1988). Considering this criterion, the variance ratios of 73% for mothers and 76% for fathers obtained in this study can be considered sufficient.

Confirmatory factor analysis aims to test the adequacy of a model in explaining the relationships between items and underlying constructs of a measurement tool. The suitability of the results of the confirmatory factor analysis model needs to be tested, and the fitness of the model is assessed using fit indices (Özdamar, 2011; Çarkçı, 2020). Since the goodness of fit values as a result of the first analysis of this emerging lack of the desired level of the model, merging and corrections were carried out considering the improvement indexes. The fit indices of the sub-dimensions were examined, and the sub-dimensions were combined with each other.

In the resulting model ($\chi2$=1343.334 df=618), the Parent Attachment Recognition Scale consists of three sub-dimensions. When the statistical values of the Parent Attachment Recognition Scale were examined, the ($\chi2$/df) value was calculated as 2.164, RMSEA value as 0.046, SRMR value as 0.029, IFI value as 0.960, CFI value as 0.960, GFI value as 0.855, TLI value as 0.954. RMSEA, SRMR, CFI, ($\chi2$ /df), excess fit index (IFI), (GFI), these fit indices showed that the model was acceptable at an acceptable level (Çarkcı, 2020).

In the scope of the study, when the relationships between the Parent Attachment Recognition Scale and its sub-dimensions were examined, moderate to high-level positive correlations were observed in both the mother and father dimensions. In the study carried out by Cummings et al. (2003), the warm emotional attachment of the parent with the child affects the parent-child relationship. In Öztürk's (2006) study with adolescents, it was determined that family communication had an effect on adolescents' emotional health.

The Parent Attachment Recognition Scale consists of three subscales: “parent-child communication,” “emotional attachment,” and “parental impressions. Cronbach's alpha coefficient was found to be 0.966 for the mother and father form of the parent-child communication sub-dimension, and 0.960 for the mother and father form for the emotional attachment sub-dimension. The parental impressions subscale was found the mother form 0.875 the father form .93. These analyses revealed that both groups’ Cronbach’s Alpha values (), which are regarded as sufficient (Özdamar, 2002; Tavakol & Dennick, 2011), were higher than 0.70. The evaluations also showed that the scale is a reliable measurement tool for both mothers and fathers because it evaluates distinct characteristics in three subscales.

In conclusion, the obtained findings show that the scale is a valid and reliable measuring tool that can be used to determine the early attachment experiences of parents (both mothers and fathers) with preschool-aged children. Future studies can examine the relationships between parents’ attachment tendencies, communication with their children, parenting behaviors, and attachment styles with their own children. Moreover, a comparison of attachment orientations across different generations can also be investigated.

Statements of Publication Ethics

The authors of this article declare that this research has not any ethical conflicts or problems that may limit the publication of the article. Before starting the research process, permission was obtained from the KTO Karatay University Scientific Research Ethics Committee (with a letter dated 08.10.2021 and reference number E-46409256-300-17338).

Researchers’ Contribution Rate

The authors equally contributed to this study.

Conflict of Interest

There is no conflict of interest in this research. The research was carried out without any commercial or financial support from any legal person, institution or organization.

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Higher Education Learners' Perceptions of the Online Flipped Instruction

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Abstract

This qualitative study explored Iranian higher education learners' perceptions of the online flipped instruction. Participants were 25 Iranian undergraduates, aged 20 to 27 years, majoring in English Language Translation, selected through convenience sampling. They received flipped instruction in an online course titled 'Approaches and Methods in Language Teaching', which consisted of 14 sessions conducted in Iran. Data were collected through a structured interview that examined the benefits, drawbacks, and challenges of implementing online flipped instruction. It was found that all the participants were satisfied with their experience. Several benefits were stated, such as 'effective learning', 'interesting and motivating class', 'more interaction', 'more cooperation and collaboration', 'more engagement', 'useful class time', 'learning teamwork', 'control on time to learn', 'acquiring practical knowledge and skills', 'reducing stress', 'self-reflection and self-evaluation', 'learning to take responsibility', 'boosting self-confidence', 'more attention in class', 'receiving effective feedback', 'becoming autonomous', and 'satisfying all learning styles'. However, five students also complained that the approach put a heavy burden on students. Six students argued that poor internet connection and lack of adequate technological tools could cause difficulty for students who study in poor areas of the country. Therefore, positive outcomes can be achieved through the online flipped pedagogy, although careful planning is also required.

Keywords: flipped pedagogy, online classes, higher education learners' perceptions.

Yüksek Öğrenim Öğrencilerinin Çevrimiçi Ters Yüz Edilmiş Öğretime İlişkin Algıları

Öz

Bu nitel çalışma, İranlı yüksek öğretim öğrencilerinin çevrimiçi ters yüz edilmiş öğretime ilişkin algılarını araştırmayı amaçladı. Kolayda örnekleme yöntemiyle seçilen katılımcılar, 20 ile 27 yaşları arasında İngilizce Çeviribilim bölümünde öğrenim gören 25 İranlı lisans öğrencisinden oluşuyordu. Katılımcılar, İran'da 14 oturum süren çevrimiçi bir ders olan 'Dil Öğretiminde Yaklaşımlar ve Yöntemler' başlıklı ters yüz eğitimine katıldılar. Veriler yapılandırılmış bir görüşme yoluyla toplanmıştır. Tüm katılımcıların deneyimlerinden memnun oldukları belirlendi. 'Etkili öğrenme', 'ilginç ve motive edici sınıf', 'daha fazla etkileşim', 'daha fazla ortak çalışma ve işbirliği', 'daha fazla katılım', 'yararlı sınıf zamanı', takım çalışması öğrenme, 'öğrenme zamanı üzerinde kontrol', 'pratik bilgi ve beceriler edinme', 'stresi azaltma', 'öz yansıtma ve öz değerlendirme', 'sorumluluk almayı öğrenme', 'özgüveni artırma', 'sınıfta daha fazla dikkat', 'etkili geri bildirim alma', 'özerk olma' ve 'tüm öğrenme stillerini tatmin etme' gibi çeşitli faydalar belirtilmiştir. Ancak beş öğrenci yaklaşımın öğrencilere ağır bir yük getirdiğinden şikayetçi oldu. Altı öğrenci, zayıf internet bağlantısının ve yeterli teknolojik araçların bulunmamasının, ülkenin yoksul bölgelerinde eğitim gören öğrenciler için zorluk yaratabileceğini savundu. Bu nedenle, çevrimiçi ters çevrilmiş pedagoji yoluyla olumlu sonuçlar elde edilebilir, ancak dikkatli bir planlama da gereklidir.

Anahtar kelimeler: ters çevrilmiş pedagoji, çevrimiçi sınıflar, yükseköğretim öğrencilerinin algıları.

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INTRODUCTION

Online instruction has experienced rapid growth in recent years (Paechter & Maier, 2010). Some studies have proven benefits for online instruction, such as convenience (Fedynich, 2013) and reduced withdrawal or failure (Nguyen, 2015). However, the downsides of the online instruction include 'having difficulty understanding online course materials' (Alawamleh et al., 2022; Allo, 2020; Chung et al., 2020; Khalil et al., 2020; Subedi et al., 2020), 'inadequate active engagement in online class activities' (Sreehari, 2020; Valizadeh & Soltanpour, 2021; Xhelili et al., 2021), 'lack of sufficient interaction in online learning' (Adnan & Anwar, 2020; Alawamleh et al., 2022; Bączek et al., 2021; Tan, 2021; Valizadeh & Soltanpour, 2021), 'learners' lack of enough concentration' (Hussein et al., 2020; Subedi et al., 2020; Xhelili et al., 2021) and demotivation (Alawamleh et al., 2022; Xhelili et al., 2021).

The search for the most efficient and effective teaching methods is a primary concern for teachers, regardless of the subject being taught (Leis, 2022). To take precautions to avoid the aforementioned problems in online classes, the teacher-researcher of the present study sought a feasible and practical solution. Based on the review of the literature, it seemed that flipped instruction could be a solution, effective for several fields of study because as O'Shea (2020) truly stated, flipped models of teaching are flexible and have the potential to fulfill the learners' needs, especially in contexts where the learners are not satisfied with the amount of engagement in class activities and are merely passive recipients of the information.

In flipped pedagogy, learners do not receive the teachers' lectures first to learn the contents; rather, they usually obtain the content of instruction via online videos prepared or provided by the teacher before the class session. Students are required to watch the assigned instructional videos by themselves before class time (Tang et al., 2023). Then, class time incorporates a variety of communicative activities, such as group work and interactive discussion (Shih & Huang, 2020; Wang & Qi, 2018).

Studies on the effect of flipped instruction have indicated mostly promising results regarding academic performance and student perception in various fields of study (Dressler & Rachfall, 2020; Love et al., 2014; Pamuk & Alagözlü, 2024; Soltanpour & Valizadeh, 2018; Valizadeh & Soltanpour, 2020). For instance, it has already been proven that flipped instruction can enhance learners' retention (Velegol et al., 2015), content understanding (Love et al., 2014), and learner-instruction interaction (McLean et al., 2016). It can also increase learners' involvement, task orientation, innovation, meaningful learning, as well as motivation and engagement (Dressler & Rachfall, 2020; Leis, 2022; Smith & Khechara, 2020; Zhu & Xie, 2018); therefore, the learning environment can be more attractive and active for learners.

Collaborative learning approaches, where the instructor is not the sole source of knowledge, can be implemented through flipped classroom model (O'Shea, 2020). Furthermore, teachers' provision of different learning materials to the learners before class lectures, results in more time for learners' engagement during the lectures. Learners have knowledge about the lesson content; therefore, they can be active during the class lectures by asking their questions, practicing, and applying their already obtained knowledge during class. Additionally, using this new approach, the professor can identify the low-performing learners who need more help (Dressler & Rachfall, 2020; Klimplová, 2020).

In addition, as for tackling the challenges of online instruction, some researchers adopted flipped instruction and recommended it during the Covid-19 pandemic and found positive outcomes (Beason-Abmayr et al., 2021; Jia et al., 2022; Sanandaji & Ghanbartehrani, 2021). As a result, the teacher-researcher of the present study decided to adopt this approach in one of her university classes to investigate its efficacy. Consequently, this study addressed the following research questions:

1. What are the benefits of the online flipped instruction?
2. What are the drawbacks of the online flipped instruction?
3. Are there any issues that can cause difficulty in employing the online flipped instruction?

METHOD

Research Design

This study has a qualitative design. The purpose of the study was not to test objective theories, so quantitative research was not preferred. Qualitative research is a tool for investigating and thereby understanding the meaning people think and believe about an issue (Creswell, 2014). Convenience sampling was utilized as the sampling strategy. The only criterion for selecting such sampling was the convenience of the researchers (Dörnyei,

2007). In other words, the participants were selected based on their accessibility and availability to the researchers. Also, they were willing to participate in the study. In this study, time was a constraint on the researchers, which can be a reason for the researchers to select such sampling (Sim & Wright, 2000). Also, the research was not funded by any organizations. Therefore, low cost was another main reason why researchers adopted this technique (Johnson & Christensen, 2016). Based on Robinson (2014), convenience sampling in qualitative research is justified if the sample universe is defined as demographically and geographically local.

Research Instruments

The online classes were run on the Adobe Connect platform. Additionally, data were gathered via a structured interview, designed to collect qualitative data. The interview questions were exactly the three research questions of the study. No validity and reliability studies had been conducted for the interview form. The teacher-researcher sent the questions to the participants. They sent their responses via three voice messages.

Sampling or Study Group

The participants were 25 Iranian undergraduates who were majoring in English Language Translation and were selected by convenience sampling as was explained above in the Research Design section. They received the flipped instruction for the online course titled 'Approaches and Methods in Language Teaching'. Their ages ranged from 20 to 27 years old.

Implementation

The students experienced flipped instruction during 14 online sessions. At the end of each session, the participants would receive the materials of the next session in various formats: either teacher-made videos or the ones downloaded from YouTube, teacher-made PowerPoint and audio files, as well as some articles and book chapters in PDF. They were required to study the materials and be ready for group discussions or design lesson plans in class. From session 2, they were also required to select a language component and write a lesson plan based on what they had learned every session, so they would discuss the correctness of their work the next session. In class time, they were required to share whatever they understood with their partners or peers, ask their questions, and clear up their misunderstandings. They also received the professor's feedback whenever needed. Each session's topics are presented in Table 1.

Table 1. Course Plan

Weeks (Sessions)	Topics/Activities
1	CLT (Communicative Language Teaching)
2	a) What and How to Teach Grammar to Students aged over 13, that is, Teenagers and Adults b) Lesson plan Template and How to Write a Lesson Plan
3	Students shared their lesson plans with their peers, asked their questions to check their work, and clarified any misunderstanding in terms of the teaching practice of their selected grammatical structure.
4	a) What and How to Teach Reading to Students aged over 13, that is, Teenagers and Adults b) Lesson plan Template and How to Write a Lesson Plan
5	Students shared their lesson plans with their peers, asked their questions to check their work, and clarified any misunderstanding in terms of the teaching practice of their selected reading passage.
6	a) What and How to Teach Listening and Vocabulary to Students aged over 13, that is, Teenagers and Adults b) Lesson plan Template and How to Write a Lesson Plan As students had watched the required videos and articles, and wrote lesson plans for their selected listening skill and vocabulary, students shared their lesson plans with their peers, asked their questions to check their work, and clarified any misunderstanding in terms of the teaching practice of their selected vocabulary.
7	a) What and How to Teach Speaking (Conversation) to Students aged over 13, that is, Teenagers and Adults b) Lesson plan Template and How to Write a Lesson Plan As students had watched the required videos and articles, and wrote lesson plans for their selected listening skill and vocabulary, students shared their lesson plans with their peers, asked their questions to check their work, and clarified any misunderstanding in terms of the teaching practice of their selected conversation part.

8	Principles of Teaching English to Young Learners, aged between 7 to 12.
9	a) What and How to Teach Grammar to Young Learners, aged between 7 to 12. b) Lesson plan Template and How to Write a Lesson Plan
10	Students shared their lesson plans with their peers, asked their questions to check their work, and clarified any misunderstanding in terms of the teaching practice of their selected grammatical structure.
11	a) What and How to Teach Reading to Young Learners, aged between 7 to 12. b) Lesson plan Template and How to Write a Lesson Plan
12	Students shared their lesson plans with their peers, asked their questions to check their work, and clarified any misunderstanding in terms of the teaching practice of their selected reading passage.
13	a) What and How to Teach Vocabulary to Young Learners, aged between 7 to 12. b) Lesson plan Template and How to Write a Lesson Plan As students had watched the required videos and articles, and wrote lesson plans for their selected listening skill and vocabulary, students shared their lesson plans with their peers, asked their questions to check their work, and clarified any misunderstanding in terms of the teaching practice of their selected vocabulary.
14	a) What and How to Teach Conversation to Young Learners, aged between 7 to 12. b) Lesson plan Template and How to Write a Lesson Plan As students had watched the required videos and articles, and wrote lesson plans for their selected listening skill and vocabulary, students shared their lesson plans with their peers, asked their questions to check their work, and clarified any misunderstanding in terms of the teaching practice of their selected conversation part.

Data Collection

After the final exams, all candidates were asked the same questions, which included the three research questions of the present study. The interview questions were sent to the participants in PDF format. The questions were written in Persian, the official language of Iran. The participants were required to answer them orally, record their voice, and send the audio file to the researcher via e-mail, Telegram account, or WhatsApp account at their earliest convenience. They were told they were free to answer the questions in Persian. They had received their final test scores when they sent their answers to the interview questions.

Data Analysis

After receiving the audio files of the interview answers, both authors listened to the files and transcribed the answers separately. Then on a session, they checked the documents together to spot and fix any errors. Then both authors analyzed the data by a method of thematic analysis separately (Guest et al., 2012). First, they read the participants' responses to learn about the data. Then, using MAXQDA 2020 and via both inductive and deductive approaches (Reichertz, 2014), they identified several preliminary codes (themes) and assigned them to data. The codes (themes) included "effective learning", "interest", "motivation", "interaction", cooperation and collaboration", "engagement", "efficiency in using class time, "time management", "practical knowledge and skills", "easing stress", "relieving embarrassment", "self-reflection and self-evaluation", "learning responsibility", "boosting self-confidence", "attention", "feedback", "learning style", "autonomy", as well as "comparison and competition". Next, they reviewed and refined these preliminary themes by collecting relevant themes and referring to similar concepts. Finally, after finishing the categorization, both authors had a meeting to reach a consensus on all codes to achieve inter-rater reliability. They reviewed all the responses and codes, discussed the similarities and differences in their codes, and resolved any differences. Moreover, to incorporate the principle of credibility, concerning the truthfulness of the findings, the researchers used the member-checking strategy by sharing the data and interpretations with 5 participants in the research to check if they agree. As a result, it was assured that the researchers' understanding of the participants' perceptions was as accurate and complete as possible (Nassaji, 2020).

Research Ethics

The research was conducted with the voluntary participation of a group of Iranian undergraduates. Ethical approval for the study, under permission number 1401/6/1, was obtained from Mr. Hashem Mohebbi, the director of the ACECR: The English Language Teaching Department, Karaj, Iran, on August 29, 2022. All ethical guidelines were adhered to, and no ethical considerations were violated during the study.

FINDINGS

Benefits of the Flipped Instruction

The 1st research question inquired about the benefits of flipped instruction. A list of 20 benefits were identified, which are presented below in Table 2.

Table 1. Benefits of the Flipped Instruction

No.	Theme	Found Benefit	Frequency
1	Effective Learning	More effective learning takes place via online flipped instruction compared to the non-flipped online classrooms.	24
2	Interest and Motivation	Online flipped classroom is more interesting and motivating to learn than the other non-flipped online classrooms	19
3	Interaction	There exists more peer as well as student-teacher interaction in the flipped pedagogy.	11
4	Cooperation and Collaboration	There exist more students' cooperation and collaboration.	10
5		Students also learn teamwork, cooperation, and collaboration.	6
6	Engagement	Students are more engaged in learning.	10
7	Time Efficiency	Class time is used more usefully.	6
8	Time Management	Students can have control over their time to learn.	5
9	Practical Knowledge and Skills	Students acquire practical knowledge and skills.	5
10	Easing Stress	Students' stress level for exams is reduced.	5
11	Relieving Embarrassment	Shy students can open up.	5
12	Self-reflection and Self-evaluation	There exists an opportunity for more self-reflection and self-evaluation.	3
13	Learning Responsibility	Students learn to take responsibility for learning.	3
14	Boosting Self-Confidence	Students' self-confidence is boosted.	3
15	Attention	Students devote more attention in class.	3
16	Feedback	There exists an opportunity to offer/receive individualized feedback.	3
17	Learning Styles	Flipped instruction is more suitable for students with various learning styles.	2
18	Autonomy	Flipped instruction helps students be autonomous learners.	2
19	Competition	There exists the possibility of more positive competition.	1
20	Comparison	There exists no comparison or negative competition.	1

Out of 25 participants, 24 students believed that via the flipped instruction, more effective learning takes place. What follows includes some excerpts from the participants' statements.

"Unlike the non-flipped pedagogy, in the flipped pedagogy, the students are not preoccupied with only passing a course, taking an acceptable score, or getting a university degree. The students' concentration is on learning even if they have to do so. As a result, they really learn the matter in question."

"Whatever we had to do prior to class, such as studying, watching videos, listening to podcasts, doing some assignments as well as whatever we had to do in class, such as taking part in group work and group discussions in addition to designing some lesson plans cooperatively helped us keep the lesson better in our memory. I believe this technique helps the students learn better and remember everything that is learned forever."

"I think this flipped instruction is the best type of teaching to help the students learn everything perfectly. Personally, whenever I think of one of the class subjects, let's say CLIL, I remember everything we did in class, especially all the steps we followed to design a plan for it. I'm sure I'll never forget this class subjects. I have them in mind like some images, so I call it the best form of learning. However, in other classes, I don't have such experience. I always have to memorize a load of matters and forget them after the final exam."

"Flipped instruction includes a combination of good techniques: pre-studying, opportunity to watch videos of other teachers' teaching the point, listening to the related explanations, self-study, class discussions, and group cooperation. All these techniques help students to learn more effectively."

Moreover, 19 participants stated that this online flipped classroom was more interesting and motivating to learn than the other non-flipped online classrooms. The following are some quotations from the participants.

"In other non-flipped online classes, professors usually explain everything. While only listening online, we feel so bored. However, in this online flipped classrooms I myself never felt bored. I really liked this class very much, so I always looked forward to it."

"Because I knew I had time to discuss whatever I learned and I had enough time to ask my questions, I was very interested in this class. I was more motivated to learn. In other classes which are not flipped, I have to listen to professors' explanations, which are really long and tiring and then the short class time does not usually permit us to ask all our questions. Therefore, all our focus will be on studying on our own and memorizing everything. However, flipped is completely opposite."

"I felt very excited before each session of this online class. I remember I would check my microphone to see if it worked well because I really liked the group discussions. I liked it when I could speak about whatever I had learned by watching videos, studying the book chapters, etc. to my friends and I could listen to theirs. We learned with each other and with the help of our professor. I like studying in that way."

"In other online classes, which were/are not flipped, I usually felt/feel sleepy. To be honest, in some of them, I don't even listen carefully because I feel bored, so I prefer to be online, but do my other work. Then, I use the record of the class on platform to learn and be ready for exams. But in this online class, which was flipped, I was very happy. I was happily alert. I took part in class group discussions and activities, and I really liked the class. I wish all professors followed or would follow the same approach.

Furthermore, 11 participants referred to the existence of "More Peer as well as Student-Teacher Interaction" as another benefit of the flipped pedagogy. The following are some excerpts from the participants' statements.

"Before the class, we needed to spend time studying the next session lesson, so we watched videos, studied some articles, book chapters, listened to some podcasts prepared by professors, and did some assignments. My friends and I usually faced some problems and couldn't understand some parts well. But we had this chance to talk to each other about them. We asked each other our questions and tried to learn from each other. Then again in class, we had time to discuss the issue with other classmates and even the professor. These interactions were wonderful. I think these interactions can help even the least intelligent students learn the lessons well."

"To me, the best part of the flipped instruction is the class time when all the students interact with each other and with the professor. That's the best time to ask about, discuss, and learn whatever has been difficult to understand."

In addition, ten participants referred to "Students' More Cooperation and Collaboration" as another positive point of the flipped instruction. The following are some quotations from the participants' responses.

"As our course was about approaches and methods of teaching, we needed to design lesson plans based on specific methods or approaches cooperatively. We did it in groups with our friends and the professor supervised our work. It was very useful. In other non-flipped classes, these activities are required to be done only individually because the short class time does not permit."

"I really liked the course plans we designed either in a group in class or as pair work out of class. Doing that work together with another classmates or some other ones was very helpful because through that cooperation, it was easier for us to think of better ideas and be more creative."

Additionally, ten participating students referred to "Students' More Engagement" as another advantage of the flipped instruction. The following are examples of the participants' quotations.

"In the flipped classroom we had, no student was passive. During the class, everybody was active, even actively listening because we had lots of sharing information and discussions in our groups. However, in other classes, which are not flipped, we are mostly passive listeners. We listen and at the end of each part, the professors ask us if we have any questions. I liked the active moments of the flipped classroom a lot because it helps us learn very well."

"It was excellent that we had the opportunity of being involved in various activities. I myself hate it when I have to just sit somewhere and listen to the professor. When students are active, are busy with doing a variety of educational activities before and during the class, they will definitely enjoy learning and they will certainly learn the lesson."

Further, six participants referred to "More Useful Class Time" as one of the blessings of the flipped instruction. Given the current study, what follows includes some excerpts from the participants' comments.

"In non-flipped classrooms, the class time is spent mostly on listening to the lectures of the professor or lectures of other students. Very short time will be left for even answering other students' questions. In my opinion,

this is not the true learning. But in the flipped classroom, the class time is spent on true learning. The class time is not wasted at all. Students already studied everything and in class, they have enough time to ask all their questions and clarify every vague point in their mind. In my opinion, this is what class time must be like."

"Students attend classes to learn something, while in reality in traditional classrooms, we just receive some information, but learning hardly ever takes place during the class time. We have to spend a lot of time at home alone, studying, memorizing, and trying to learn something. I myself have to watch the recorded classes to review the lessons and try to learn them, but in the flipped classroom, learning occurs in class. The planning of the lesson is in a way that the class time is spent in the most efficient way to help students learn everything."

Moreover, six participating students mentioned "Learning Teamwork, Cooperation, and Collaboration" as one of the assets of the flipped instruction. What follows includes some excerpts from the participants' opinions.

"In my opinion, one of the best points about the flipped instruction is that students gradually learn how to cooperate or work as a teammate. This is an essential skill in which we Iranians are really weak. I think the flipped learning not only helps students learn the lessons through group work but also it helps them learn how to work with others."

"I remember when we started this approach, some students didn't know what to do or how to start a project which was intended to be done cooperatively. Students really learned to think, analyze the task, sharing responsibilities, helping other teammates, etc. while doing that project. It was very useful for all of us and I'm sure it will be useful for anybody who experiences this technique."

Furthermore, five students referred to "Control on Time to Learn" as one of the benefits of the flipped instruction. The following are some of the excerpts from the participants' responses.

"I think one of the best features of the flipped instruction is that students receive all instructional materials, especially the video or audio files some days before the class. In this way, students have enough time to watch the videos or listen to the audio files as many times as needed. We are not pressed for time. In non-flipped classrooms, professors sometimes provide us with some videos, for example, in class, but because of a shortage of time, the videos are not played more than one time, or the audio files of the listening sections, for example, are played at most twice. It is not enough for some students who have poor listening skills. But in flipped classroom, we have control over this issue. It makes the materials more useful, too."

"During the semester, we received the materials (videos, audio files, PowerPoint, etc.) some days before the class, so I myself planned to watch them at my convenience, whenever I felt fresh to study. It was very useful for me myself. I could learn them very well."

In addition, five students referred to "Acquiring Practical Knowledge and Skills" as one of the good points of the flipped instruction. What follows are some of the excerpts from the participants of this study.

"Because we were studying the course on approaches and methods of teaching languages, this flipped approach which we experienced taught us not only the contents of our book, which included both past and present approaches, but also we learned how to implement this modern approach in a real classroom."

"In our course, we practically planned some lessons with the help of other classmates and our professor. It was the practical aspect of our course, which prepared us for the position of a teacher for a real classroom. I think if the flipped instruction is used for other courses or other majors, the same benefit will be achieved. Other students will also learn some practical issues relevant to their courses and majors, too."

Additionally, five participants referred to "Reducing Students' Stress" as another advantage of the flipped instruction. What follows includes some excerpts from their answers.

"In other non-flipped classes, students usually don't learn many lessons perfectly during the term, so they have to cram before the tests. As a result, we are often stressed before each exam, but I am sure my classmates and I won't be stressed out before the exam of this course because I think we have learned everything. A short review will be enough to be ready for the exam and even get a high mark."

"In many other courses, I myself feel stressed during the class. Sometimes because some professors require us to pre-study the lesson, and during the class, they ask us some questions instead of teaching the lesson. I feel really stressed then because sometimes I cannot answer the questions and I'm scared of losing marks. But in this class, I never felt stressed. I felt very comfortable. I really like this method."

As another blessing of the flipped instruction, five participants pointed out that via the flipped instruction "Shy Students Can Open up." The following are some excerpts from the participants of this study.

"Some students are smart. They always study, learn, and like to answer the professors' questions, but they are usually silent because they are shy and they cannot speak in public. We have these kinds of people in our class, too. However, it was very interesting for me to see that even those shy students could easily speak in group work because they feel more relaxed among other friends. I got that the flipped instruction is even good for these types of people. They can show their abilities and whatever they understood."

"I am an introverted person. I prefer to listen to professors and think about the lessons. But this quality always makes problems for me. I sometimes lose marks because professors believe that I'm not active enough. Despite my personal trait, I liked this flipped instruction. I think everything was perfect. On the one hand, I had time to study on my own and think about the lessons and my understanding. On the other hand, I had time to discuss various points with my friends. Of course, at first, taking part in class discussions was difficult for me, as usual, but little by little, I felt more relaxed and I could participate in group work and group discussions."

Moreover, three participants referred to "Opportunity for More Self-Reflection and Self-Evaluation" as another good point of the flipped instruction. What follows is an excerpt from one of this study's participants.

"Via the flipped instruction, students have enough time to think about their learning. It is possible for them to think about what they understood or not when they are studying before the class. During the class, again they have time to think about their learning. So they themselves can assess their learning, too."

As another asset of the flipped instruction, three students stated that "Students Learn to Take on Responsibility for learning." What follows is an excerpt from one of this study's participants.

"One of the beneficial features of the flipped instruction is that students learn to accept responsibility for their learning. They understand that as students, they have to try hard to learn everything. Teachers are there to only facilitate their learning."

In addition, three participants referred to "Boosting Students' Self-Confidence" as another advantage of the flipped instruction. What follows is an excerpt from one of the participants of the present study.

"In class when I spoke with other classmates or presented my lesson plan, I felt so good. When the professor and other classmates listened carefully to my talks and confirmed my understanding, I felt more self-confident. I even think I have become more self-confident in other circumstances in society. I can talk with more confidence with others."

As another blessing of the flipped instruction, three students declared that "Students Devote More Attention in Class". What follows is an excerpt from the participants of the present study.

"In non-flipped classrooms, students' attention will be distracted easily because it is the professor who mostly speaks in class. However, in flipped classrooms, students always pay undivided attention to the activities. They cannot think about other things because they are always engaged in a type of activity."

Additionally, three participants referred to "Opportunity to Offer/Receive Individualized Feedback" as another benefit of the flipped instruction. What follows is an excerpt from one of the participants of the present study.

"In this flipped classroom, it was possible for every student in class to ask his/her questions. Either the professor or the other classmates would answer. Also, each person received comments about his/her mistakes, problems, misunderstandings, etc. It was perfect."

Furthermore, two participants asserted that the flipped instruction is fortunately "Suitable for Students with various Learning Styles". What follows is an excerpt from their responses.

"In this course, I mean 'Approaches and Methods in Teaching' we learned that learners have various learning styles which are God-given. … Through the flipped instruction, every individual student will be satisfied with his/her learning because there are various types of materials and activities. For example, those who like to study alone, those who like to study in groups, those who like watching videos, those who like listening to audio files, those who like reading printed materials, etc., everybody will have the opportunity of receiving or experiencing his/her favorite type."

Further, two participants stated that the flipped instruction helps students "Be Autonomous Learners". What follows is an excerpt from their responses.

"The whole process we followed taught us how to proceed with our learning independently. I think if students are taught by the flipped instruction, they will become familiar with different strategies, techniques, websites, search engines, educational channels, useful activities, to be ready to continue their learning even without the help of a teacher as a person."

One participant also referred to the possibility of "More Positive Competition" in the flipped instruction. The following is what the participants of the present study said.

"During the class discussions, I always attempted to perform better than my partners, and I think the others were also the same. We felt good. We didn't intend to downgrade others because we always helped each other to resolve their learning problems. But I myself. For example, felt good when I was that person who helped the others. That good feeling was rewarding. I think that the flipped instruction can create such spirit, I mean the desire for a positive competition."

One participant referred to "No Comparison or Negative Competition" as one of the good features of a flipped classroom. What follows is what she said.

"In some classes, some teachers compare the students in terms of their abilities, talents, and scores, which causes a kind of negative competition among the students. However, this negative feature has no place in a flipped classroom, which is awesome and can help all students progress in a friendly atmosphere and with the help of each other."

Inherent Drawbacks of Flipped Instruction

The 2nd research question investigated whether the participants found any drawbacks inherent in the flipped instruction. Two negative points were mentioned. Seventeen students stated that the flipped pedagogy puts a heavy burden on students as they have to watch videos, listen to audio files, and pre-study some materials before the class. They also added that due to the mentioned burden, the flipped pedagogy is time-consuming for the students. The following are some excerpts from the participants of the present study.

"I think the only problem with the flipped instruction is that students need to spend a lot of time before the class time studying and being ready for the class. It definitely takes a long time, which is not available sometimes."

"Being prepared for the next class needs doing a lot of activities, studying, watching videos, and doing assignments. It is sometimes tiring and it definitely needs a lot of time."

Problems for Adopting Online Flipped Instruction

The 3rd research question explored whether any issues can cause any difficulty in the implementation of online flipped instruction. Six students pinpointed the probable poor Internet speed which can create problems for downloading video files. What follows is an excerpt from their responses.

"One problem which students may face is poor Internet connection or speed. Sometimes it is very difficult to download some files, especially the videos."

DISCUSSION & CONCLUSION

One approach that has attracted researchers' attention for over a decade has been the flipped pedagogy. Given the unique features of this approach, which causes it to suit the online classes, the researchers of the present study employed it in a real online class for a semester.

Almost all participating students in this study believed that via the flipped instruction, more effective learning takes place. This finding of the present study supports that flipped instruction can enhance learners' retention (Noroozi et al., 2020; Velegol et al., 2015), content understanding (Kim, 2018; Love et al., 2014), and more effective learning (Alghasab, 2020; Cagande & Jugar, 2018; Colomo-Magaña et al., 2020; Hsieh et al., 2017; Ismail & Abdulla, 2019; Lai & Hwang, 2016; Ruiz-Jiméne et al., 2023; Yough et al., 2019).

Moreover, the majority of participants stated that this online flipped classroom was more interesting and motivating to learn than the other non-flipped online classrooms. This finding is in line with the previous studies which indicated the flipped instruction can increase learners' interest and motivation (Abdullah et al., 2019; Alghasab, 2020; Cagande & Jugar, 2018; Farrah & Qawasmeh, 2018; Ismail & Abdulla, 2019; Jia et al., 2022; Mitsiou, 2019; Tse et al., 2019; Yilmaz, 2023; Yough et al., 2019; Zainuddin, 2018).

Furthermore, 11 participants referred to the existence of "More Peer as well as Student-Teacher Interaction" as another benefit of the flipped pedagogy. This finding is consistent with the previous researchers' findings which showed the flipped instruction increases the learner-instructor as well as peers' interactions (Ansori & Nafi, 2019; He et al., 2016; Hussain et al., 2020; Kim, 2018; McLean et al., 2016).

In addition, ten participants referred to "Students' More Cooperation and Collaboration" as another positive point of the flipped instruction. In fact, collaborative approaches to learning are an integral part of the flipped

approach (O'Shea, 2020) and the literature includes some research showing this benefit for the flipped instruction. (Fernández-Martín et al., 2020; Ghufron & Nurdianingsih, 2021).

Additionally, ten participating students referred to "Students' More Engagement" as another advantage of the flipped instruction. This finding is in line with the previous studies which indicated the flipped instruction can increase learners' engagement (Abdullah et al., 2019; Ansori & Nafi, 2019; Ayçiçek & Yelken, 2018; Farrah & Qawasmeh, 2018; Ghufron & Nurdianingsih, 2021; Hodgson et al., 2017; Huang et al., 2019; Hussain et al., 2020; Lee & Wallace, 2018; Murillo-Zamorano et al., 2019; Nerantzi, 2020; Steen-Utheim & Foldnes, 2018; Subramaniam & Muniandy, 2019; Toivola et al., 2023).

Further, six participants referred to "More Useful Class Time" as one of the blessings of the flipped instruction. This positive point was also pinpointed by other scholars (Fulton, 2012; Kim, 2018; Li & Suwanthep, 2017).

Moreover, six participating students mentioned "Learning Teamwork, Cooperation, and Collaboration" as one of the assets of the flipped instruction. This point, which is also considered as an essential skill in the 21st century, was also found by other researchers (Ansori & Nafi, 2019; Baytiyeh & Naja, 2017; Latorre-Cosculluela et al., 2021; Mitsiou, 2019; Zainuddin, 2018).

Furthermore, five students referred to "Control on Time to Learn" as one of the benefits of the flipped instruction. This advantage was pinpointed by other scholars as well (Alghasab, 2020; Kim, 2018; Lai & Hwang, 2016; Shih & Huang, 2020).

In addition, five students referred to "Acquiring Practical Knowledge and Skills" as one of the good points of the flipped instruction. This benefit was also stated by other researchers (Bishnoi, 2020; Murillo-Zamorano et al., 2019).

Additionally, five participants referred to "Reducing Students' Stress" as another advantage of the flipped instruction. Marlowe (2012) also found this blessing.

As another blessing of the flipped instruction, five participants pointed out that via the flipped instruction "Shy Students Can Open up." This finding is in line with some previous researchers' (Hung, 2017; Latorre-Cosculluela et al., 2021; Zainuddin, 2018; Zainuddin & Attaran, 2016).

Moreover, three participants referred to "Opportunity for More Self-Reflection and Self-Evaluation" as another good point of the flipped instruction. This benefit was also pinpointed by previous researchers (Khodaei et al., 2022; Öztürk & Çakıroğlu, 2021).

As another asset of the flipped instruction, three students stated that "Students Learn to Take on Responsibility for learning." This asset was also found by previous researchers (Bursa & Kose, 2020; Ghufron & Nurdianingsih, 2021).

In addition, three participants referred to "Boosting Students' Self-Confidence" as another advantage of the flipped instruction. This benefit was pinpointed by other researchers, too (Abdullah et al., 2021; Baytiyeh & Naja, 2017; Lai & Hwang, 2016; Namaziandost & Çakmak, 2020; Tsai, 2021).

As another blessing of the flipped instruction, three students declared that "Students Devote More Attention in Class". This positive feature of the flipped instruction was also found by Tang et al., (2023).

Additionally, three participants referred to "Opportunity to Offer/Receive Individualized Feedback" as another benefit of the flipped instruction. This asset was also pinpointed by Thai et al., (2023).

Furthermore, two participants asserted that the flipped instruction is fortunately "Suitable for Students with various Learning Styles". As for this finding, Kim (2018) also found that students with various learning styles were satisfied with the flipped instruction. Tadayonifar and Entezari (2020) revealed that although all the students in their research benefited from the flipped instruction, significant differences were found "among learning style groups in favor of the visual style" (p. 324).

Further, two participants stated that the flipped instruction helps students "Be Autonomous Learners". This benefit was also revealed by other researchers (Ansori & Nafi, 2019; Colomo-Magaña et al., 2020; Farrah & Qawasmeh, 2018; Fernández-Martín et al., 2020; Ghufron & Nurdianingsih, 2021; Tsai, 2021; Zainuddin, 2018).

One participant also referred to the possibility of "More Positive Competition" in the flipped instruction. Another participant referred to "No Comparison or Negative Competition" as one of the good features of a flipped classroom. These positive points were found in previous research as well (Zainuddin, 2018).

The 2nd research question investigated whether the participants found any drawbacks inherent in the flipped instruction. Two negative points were mentioned. Seventeen students stated that the flipped pedagogy puts a heavy

burden on students as they have to watch videos, listen to audio files, and pre-study some materials before the class. They also added that due to the mentioned burden, the flipped pedagogy is time-consuming for the students. This problem was also found by Kim (2018).

The 3rd research question explored whether any issues can cause any difficulty in the implementation of online flipped instruction. Six students pinpointed the probable poor Internet speed which can create problems for downloading video files. In terms of the mentioned problem, previous studies have also found that the learners' perceptions of the online flipped classrooms are likely to be affected by technological difficulties that may occur; therefore, stakeholders and instructors must consider this issue and try to provide the necessary amenities before employing the online flipped instruction (Ansori & Nafi, 2019; Gündüz & Akkoyunlu, 2019; Lakarnchua et al., 2020).

In conclusion, the participants acknowledged that this approach was really beneficial. The mentioned advantages greatly outnumber the drawbacks. However, the flipped instruction needs careful planning and provision of required amenities to be implemented successfully to achieve positive outcomes.

Implications

Syllabus designers as well as teachers can gain insights from the results of this study. Adopting flipped instruction can be beneficial to learners worldwide.

Limitations

Out of 25 participants, there were 23 females and two males, so this study has limitations in terms of the gender of the participants.

Statements of Publication Ethics

The research was conducted with the voluntary participation of a group of Iranian undergraduates. Ethical approval for the study was first secured from the director of the institute. Subsequently, informed consent was obtained from all participants by the supervisor of the institute, who is also the second author of the study. The study strictly adhered to all ethical guidelines, and no ethical principles were violated.

Researchers' Contribution Rate

Authors	Literature review	Method	Data Collection	Data Analysis	Results	Conclusion
Mohammadreza Valizadeh	☒	☒	☐	☒	☒	☒
Fatemeh Soltanpour	☒	☒	☒	☒	☒	☐

Conflict of Interest

This study does not have any conflict of interest.

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