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Relationship to Burnout, Personality Traits, and Academic  
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## **FROM THE EDITOR**

Dear Colleagues,

The *Journal of Theoretical Educational Science* gives importance to a rigorous peer review process and endeavor to increase its quality every year as an open access and free journal. Now, we are evaluating the journal guidelines, policies and ethical principles, and we expect this evaluation process ameliorate the submission and review process. Certainly, we are not alone in this journey. Taking this opportunity, the editorial team would like to express the sincere appreciation for both the support of reviewers and for the ongoing contribution of academic community.

In the April issue of 2022, we have been publishing 10 research articles from 18 authors. We are glad that these articles represent the different disciplines of education. For this issue, the average time from submission to acceptance was 5.3 months (min. 2 months max. 9 months), and the average time from submission to publication was 7.1 months (min. 5 months max. 10 months). These statistics prove how our reviewing and publication process works equally for everyone.

Finally, we should also express our sincere thanks to the Editorial Board, reviewers and authors for their invaluable contributions.

We look forward to receiving submissions from different parts of the world!




Kindest regards,

Fatih GÜNGÖR, PhD  
Afyon Kocatepe University  
Faculty of Education



## Investigation of University Students' Engagement and Its Relationship to Burnout, Personality Traits, and Academic Achievement

### Üniversite Öğrencilerinin Okul Bağlılığı ile Tükenmişlik, Kişilik Özellikleri ve Akademik Başarıları Arasındaki İlişkinin İncelenmesi

Ezgi MOR-DİRLİK\*  Erkan KÜLEKÇİ\*\*  Mustafa Öztürk AKCAOĞLU\*\*\* 

Received: 15 June 2021

Research Article

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**ABSTRACT:** In the field of education, researchers have been studying individuals' psychological constructs such as burnout, engagement and personality traits to better understand their commitment. To this end, we examined the relationship among school engagement and burnout, personality traits and academic achievement in a sample of university students ( $N=301$ ). The data were collected through Maslach Burnout Inventory-Student Survey, Utrecht Work Engagement Scale-Students Form and The Quick Big Five Personality Test. In order to test the hypotheses of the study, descriptive statistics, zero-order correlations and multiple regression analyses were performed with SPSS 22.0. In the regression analyses, the stepwise method was preferred to find out the best-fitted method. Results indicated that the relationships among the dimensions of burnout and school engagement were the strongest. On the other hand, only Conscientiousness had a positive medium level of correlation with school engagement among the assessed personality traits. We also found out that school engagement was predicted by Efficacy, Exhaustion, Cynicism, Conscientiousness and emotional stability scores. The findings offered valuable insights to enhance our understanding of the relationships between school engagement and personality traits and burnout.

**Keywords:** Academic achievement, burnout, personality traits, school engagement.

**ÖZ:** Eğitim alanında, öğretme ve öğrenme sürecini daha iyi anlamak için araştırmacılar bireylerin tükenmişlik, bağlılık ve kişilik türleri gibi psikolojik özelliklerini incelemektedir. Bu çalışmada, üniversite öğrencilerinin ( $N=301$ ) okul bağlılığı ile tükenmişlik, kişilik özellikleri ve akademik başarı arasındaki ilişki incelenmiştir. Araştırma verileri Maslach Tükenmişlik Envanteri-Öğrenci Formu, Utrecht İşe Bağlılık Ölçeği-Öğrenci Formu ve Hızlı Büyük Beşli Kişilik Testi ile toplanmıştır. Araştırmanın hipotezlerini test etmek için betimsel istatistikler, basit korelasyon ve çoklu regresyon analizleri yapılmıştır. Veri setine en iyi uyum sağlayan modelin belirlenmesinde adimsal regresyon analizi kullanılmıştır. Araştırma bulguları, en güçlü ilişkinin tükenmişlik ve okul bağlılığı boyutları arasında olduğunu göstermiştir. Öte yandan, değerlendirilen kişilik özellikleri arasında sadece sorumluluk ile okula bağlılık arasında pozitif orta düzeyde bir ilişki bulunmuştur. Ayrıca okul bağlılığının yeterlik, tükenmişlik, duyarsızlaşma, sorumluluk ve duygusal denge puanları ile yordanabileceği bulunmuştur. Araştırma; okul bağlılığı ile kişilik özellikleri ve tükenmişlik arasındaki ilişkilere dair öğretme ve öğrenme sürecine katkı sağlayacak öneriler sunmaktadır.

**Anahtar kelimeler:** Akademik başarı, tükenmişlik, kişilik özellikleri, okula bağlılık.

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As a requirement of the modern world, individuals are expected to achieve more competencies than they had in previous decades. Today, acquiring the means to reach knowledge gains more importance than the knowledge itself in people's daily and academic lives. Moreover, individuals need to be more adaptive to the changes, think more creatively and decide more effectively in order to become successful at schools and workplaces. The most current educational paradigms and practices position the learner as the main and active part of the teaching and learning processes. In this sense, being an active learner requires one's deploying the affective features besides the cognitive ones. Even these affective features have been underlined as more crucial indicators of the students' success than the cognitive ones (Organisation for Economic Co-operation and Development [OECD], 2016). Hence, the researchers in the field of education have also focused on learners' affective features in their studies at all educational levels, from preschool to higher education.

The value given to the tasks in the learning process by students studying in higher education may differ. Among the reasons for this situation, students' affective characteristics such as attitudes, values, interests, academic self-esteem and self-efficacy, and their engagement in school work have attracted the attention of researchers in both education and psychology (Anderson & Bourke, 2013). That is why it is crucial to understand what contributes to academic engagement. According to Junco and Clem (2015), student participation mainly influences learning outcomes. To this end, Tam (2014) asserts that engagement is a desirable experience in educational practice and a widely explored construct in education research, as the most emphasized area in the design of curricula is learning outcomes rather than content. Furthermore, engagement can help us understand whether differences in academic achievement are due to the fact that some students are often more engaged than others. Over the past decade, researchers have studied these traits to better understand and significantly improve individuals' enthusiasm and energy, namely engagement, in learning environments. In this study, we extended this literature by exploring whether burnout and personality traits play a role in improving student engagement.

### **Engagement**

As a positive psychological construct for indicating commitment, engagement is about individuals' mental states while working or studying. The concept is defined as a "...positive, fulfilling, and work-related state of mind that is characterized by vigor, dedication, and absorption" (Schaufeli & Bakker, 2004, p. 295). The first dimension, vigor, is portrayed by an eagerness to put exertion into work, significant levels of mental durability while working, and constancy in terms of work exercises. Dedication, on the other hand, is related to such positive feelings as excitement, pride, and challenge towards work. Finally, absorption means being motivated and deeply involved in work. Furthermore, it is asserted that energy and involvement are two essential components of engagement (Maslach & Leiter, 2008).

Initially, engagement was thought to be a part of individuals who worked with other people, but today the concept also involves school activities and school life. Therefore, engagement, as a predictor of such qualities as school performance and academic success, involves both cognitive and affective motivation regarding school-related tasks for an extended period of time (Bakker et al., 2015; Casuso-Holgado et al.,

2013; Fuller et al., 2011; Pascarella & Terenzini, 2005; Strauser et al., 2012; Wefald & Downey, 2009). The concept is also regarded as a shield term for the problems related to behavior (Li et al., 2011), academic failure (Willingham et al., 2002) and dropout (Archambault et al., 2009).

A student can feel a sense of engagement by focusing on the learning activity behaviorally, cognitively, and emotionally (Poitras et al., 2013). Students' motivation related to school tasks is also determined by engagement (Roebken, 2007; Stoeber et al., 2011). To this end, by carrying out studies related to engagement, we can also predict the extent to which students will be successful in their future careers (Salmela-Aro et al., 2009). All in all, school engagement refers to students' efforts and investments towards academic goals, to the determination to acquire knowledge and to the will to master the school tasks (Newmann et al., 1992). Because of this, in educational settings, engagement is a popular concept and a topic of interest studied in relation to other psychological constructs. In order to understand engagement better, burnout has been investigated extensively, and all dimensions of engagement were found negatively correlated with the builds of burnout (Salmela-Aro et al., 2009; Schaufeli, Martinez, et al., 2002).

### **Burnout**

While recent research highlights a dynamic relationship between engagement and burnout (Leon et al., 2015), these two concepts have been often investigated within a continuum where the negative experience of burnout and the positive experience of engagement are positioned at two ends (Leiter et al., 2015). The term 'burnout', first introduced by Herbert J. Freudenberger (1975) to express the negative state of workers in health services with heavy workloads, is described as "physical, emotional, or mental exhaustion accompanied by decreased motivation, lowered performance, and negative attitudes toward oneself and others" (APA, n.d.). In fact, this definition includes the three dimensions of burnout, which are underlined in the International Classification of Diseases prepared by the World Health Organization [WHO]. These dimensions are (1) feelings of Exhaustion, (2) increased mental distance from one's job or Cynicism about it, and (3) a sense of ineffectiveness (WHO, n.d.). The same dimensions (i.e., Exhaustion, Cynicism and Reduced Efficacy) also form the three-factor structures of the Maslach Burnout Inventory (MBI), which researchers have frequently used to investigate burnout (Schaufeli, Martinez, et al., 2002). In particular, Exhaustion can be considered "the core symptom" of burnout, and Cynicism or depersonalization refers to psychological distancing while reduced Efficacy implies decreasing personal or professional accomplishment (Leiter et al., 2015).

Burnout generally refers to an apparent mismatch between the mental or physical requirements of the job and the characteristics of the person who does the job (Maslach & Leiter, 2008; Rahmati, 2015). Traditionally, the term has been used or studied within the domain of human services such as health care, social work and education. However, it is experienced by people in various types of occupational groups nowadays, including students as well (Schaufeli, Martinez, et al., 2002). Schaufeli Martinez, et al. (2002) adapted the general definition of burnout for students and described it as "feeling exhausted because of study demands, having a cynical and detached attitude toward one's study, and feeling incompetent as a student" (p. 465).



Student burnout emerges due to school-related stress, course load or other psychological factors in students' lives, which includes activities such as studying long hours, sitting for exams, submitting assignments and dealing with deadlines as well as pressure on school achievement and lack of time for rest and fun (Aypay, 2012; Jacobs & Dodd, 2003; Law, 2007; Yang, 2004). While there are a number of studies in the area of work-related burnout, mainly focusing on burnout among people working in the education and health sectors (Rahmati, 2015; Schaufeli, Martinez, et al., 2002), a limited number of studies have been conducted on the subject of students' burnout and its relationship with other factors such as personality and academic performance (Cazan, 2015; Pala, 2012). For example, Rahmati (2015) investigated academic burnout in university students with a high-low level of self-efficacy in the context of an Iranian university and presented that there was a negative and significant relationship between high self-efficacy and academic burnout. Cazan (2015) examined the relationships among engagement, burnout and academic performance among university students in a Romanian university and pointed out a need to further explore the relationship between burnout and academic performance. Pala (2012) and Gündüz et al. (2012) also aimed to find out the burnout level among undergraduate students in Turkey and stated that the burnout levels might vary depending on department, grade, and course load. Morgan and De Bruin (2010), on the other hand, studied the relationship between burnout and personality traits among South African university students underlying that "students who are emotionally stable, outgoing and hardworking and who maintain good interpersonal relations display lower levels of burnout" (p. 188). They also emphasized that future research in this area should include engagement while exploring the relationship between personality traits and burnout.

### **Personality Traits**

Personality has been widely investigated as a factor that has a determinative effect on engagement and burnout (Ariani, 2017; Morgan & De Bruin, 2010). In personality research, the Five-Factor Model of personality, consisting of five comprehensive areas, neuroticism, extraversion, agreeableness, Conscientiousness, and openness to experience, has been a universal standard since its onset. The first domain, neuroticism, focuses on the negative aspect of personality and is about an inclination towards feeling distressed (McCrae & John, 1992). It is also identified as being emotionally unstable, fearful and irritable (Costa & McCrae, 1980). The studies investigating neuroticism, engagement and burnout revealed that neuroticism is both related to engagement (Langelaan et al., 2006) and burnout (Bakker et al., 2006; Cano-García et al., 2005; Tanculescu, 2019). Furthermore, lower levels of neuroticism signal less burnout or vice versa (Alarcon et al., 2009; Hochwälder, 2006). The second domain extraversion implies a positive outlook and manifests itself with a tendency to be active, self-confident, dominant, enthusiastic (Costa & McCrae, 1980). Some studies demonstrated that extraversion is positively related to engagement because positive emotions contribute to engagement (Langelaan et al., 2006) and are negatively related to burnout (Bakker et al., 2006).

Conscientiousness, the third domain, is represented by such characteristics as responsibility and perseverance (Costa & McCrae, 1992). In addition, Conscientiousness suggests the impulse to complete a task successfully by being

systematic, meticulous, adept, proficient, and reliable (De Raad, 2000). Students with the conscientiousness trait focus on a specific set of goals and work hard to accomplish those (Chowdhury, 2006). Such students tend to be organized, meticulous, disciplined, hardworking, reliable, methodical and purposeful. Accordingly, it is expected that the construct of Conscientiousness is positively associated with engagement (Inceoglu & Warr, 2011; Sulea et al., 2012). Thanks to their qualities, individuals who are more conscientious feel more ready to face problems and have better defense mechanisms against boredom and burnout (Alarcon et al., 2009; Hochwalder, 2006). However, Bakker et al. (2006) found no significant relationship between Conscientiousness and burnout as a result of their research.

The fourth dimension, agreeableness, is portrayed by the tendency to deal with interpersonal relationships (Matthews et al., 2003). According to Costa and McCrae (1992), agreeableness refers to the extent to which an individual cooperates and sympathizes with others. There are not many studies examining the relationship between agreeableness and engagement, and the results of the research did not reveal significant relationships (Kim et al., 2009). Nevertheless, agreeableness can foster supportive relationships with peers, foster personal development and help overcome difficulties (Bakker et al., 2002). On the other hand, there was a negative correlation between agreeableness and burnout (Alarcon et al., 2009).

Lastly, openness to experience, which is explained by an inclination towards being creative, curious, intelligent, and open to new ideas, also reflects the positive side of personality (Costa & McCrae, 1992). Students with such characteristics can actively deal with problems and tailor their work to their own values and preferences. Openness to experience is positively associated with personal success (Wiese et al., 2003) and negatively associated with depersonalization (Bakker et al., 2006), the two dimensions of burnout.

Considering the similar studies analyzing the variables included in this study (e.g., Ariani, 2017; Celik & Oral, 2013), it can be deduced that academic engagement, burnout and students' personality traits are interwoven and affect each other in educational settings. Also in the related literature, the relationship between burnout and engagement has been emphasized. It can be claimed that when one's burnout level is high, his/her academic engagement in school might decrease. The research on burnout is also associated with engagement because of the positive psychology trend. This is a part of the more general emerging trend toward focusing on the strengths of humanity and optimal functioning rather than the weaknesses of the individuals (Seligman & Csikszentmihalyi, 2000).

Personality traits are also considered important in students' engagement and burnout levels. For instance, as mentioned before, extraversion, as a dimension of personality, has been positively correlated with engagement because positive emotions contribute to engagement (Langelaan et al., 2006) and are negatively related to burnout (Bakker et al., 2006). It is clear that personality traits have close associations with all of the variables of this study. For the stated reasons, within the scope of this research, the relationships among these variables were investigated in depth. When the related literature is analyzed, engagement and its relation with burnout have been widely studied; however, there are few studies on the relationship between these constructs and personality. It is expected that the individuals' study habits and engagement levels are

also affected by their personality traits. Especially in Turkey, although a few researchers investigated the relationship between burnout and engagement (e.g., Akbaşlı et al., 2019; Bilge et al., 2014), to the best of our knowledge, there are no studies examining these concepts (i.e., burnout and engagement) with personality traits and students' academic achievement together.

### **Present Study**

The primary purpose of this study is to expand the research carried out on school engagement, burnout, personality and academic achievement by conducting an exploratory study to examine the relationships among these variables. To investigate these relationships, we formulated the following hypotheses:

*H1:* There is a significant relationship among the students' Utrecht Work Engagement Scale-Students Form (UWES-SF) Scores, personality traits, burnout scores and their grade point average (GPAs).

*H2:* School engagement is negatively associated with exhaustion and cynicism dimensions and positively associated with the efficacy dimension of the burnout scale.

*H3:* Personality traits, burnout and academic achievement predict students' school engagement levels.

In this study, GPA was used as an indicator of students' academic achievement, and other psychological constructs were investigated via measurement tools, which are described in detail in the following section.

### **Method**

As mentioned before, this study's main goal is to explore the relationships among school engagement, burnout, and academic achievement levels of undergraduate students. To this end, the study was tailored as descriptive research and adopted a correlational design in order to describe existing relationships between two or more variables without any manipulation and intervention to the variables (Fraenkel & Wallen, 2003).

### **Participants**

The data were collected from a total of 307 volunteer undergraduate students (105 males and 202 females) using a non-probabilistic convenience sampling procedure in the spring term of the 2019-2020 academic year. The sample consisted of students in the second (41%) and third (56%) of their studies in the faculty of education at a state university in Turkey. The participants' ages ranged from 18 to 21 years.

Only two respondents were excluded from the data set because their personal information or scale forms were mostly incomplete. Moreover, in order to investigate univariate and multivariate normality assumptions, outliers were analyzed via calculating Z scores and Mahalanobis scores. As a result, four respondents were also removed due to the violation of these assumptions.

### **Data Collection Tools**

The data were collected through personal information form, Maslach Burnout Inventory-Student Survey (MBI-SS), Utrecht Work Engagement Scale-Students Form

(UWES-SF) and The Quick Big Five Personality Test (QBFPT). The researchers developed a personal information form to collect details of the participants such as their gender, age, school year and grade point average (GPA). GPA was used as an indicator of academic achievement in this study.

### ***Maslach Burnout Inventory-Student Survey (MBI-SS)***

A Turkish version of MBI-SS was used to assess burnout. The original inventory is developed by Schaufeli, Salanova, et al. (2002) and consists of 13 items and 3 subscales. The subscales include Exhaustion (5 items), Cynicism (4 items) and Efficacy (4 items). The items are scored on a 5-point Likert scale from 1-Never to 5-Always. High scores in Cynicism and Exhaustion and low scores in Efficacy show high levels of burnout in scoring. For each participant, three different burnout scores are calculated. There are a few adaptations of this inventory to the Turkish language (Balkis et al., 2011; Capri et al., 2011). Upon considering the available adaptations of the inventory, we found several inconsistencies among the adapted versions. The items did not reflect the Turkish meaning, and also several vague expressions were detected among the adapted inventories. Hence, a new adaptation study for the MBI-SS was administered by the researchers.

For the new adaptation study, firstly, two different English language teaching experts translated the inventory into Turkish. After the first translation of the items, the back translation method was applied, and the Turkish form of the inventory was again translated into Turkish by two different experts in the Turkish language teaching program. The preliminary analyses were conducted with the data gathered from 128 undergraduate students. Although there are several criteria that should be considered for the sample size and the applicability of CFA in the related literature, none of those rules provides an exact size of sample based on the number of items. For this reason, Tabachnick and Fidell (2001) proposed that the sample size should be arranged in accordance with the item loadings, which means that if the item loadings are high, the sample size can be smaller than the expected level.

In order to investigate the structural validity of the scale scores, Confirmatory Factor Analysis (CFA) was applied, and Maximum Likelihood Estimation (MLE) was used considering the normality of the items. Following the CFA, the item loadings were initially analyzed and ranged from .66 to .85, which indicated a high level of explained variance. Later, items' t values were checked and all of them were significant. The p-value of the proposed model was significant, as well. Thus, the model-data fit indexes were analyzed and the results were interpreted based on Kline's (2011) recommended values. For the fit indexes such as GFI, AGFI, NFI and NNFI; values higher than .90 are accepted as a good fit. Root Mean Square Error of Approximation (RMSEA) was used as misfit indices, with RMSEA <.06 considered very good and <.010 acceptable (Schermmelleh-Engel et al., 2003). Hu and Bentler (1999) suggested an RMSEA of less than .06 as a cut-off criterion. Nearly the same values are valid for SRMR, which shows the misfit, too. A rule of thumb is that the SRMR should be less than .05 for a good fit (Hu & Bentler, 1995), whereas values smaller than .10 may be interpreted as acceptable. The estimated fit indexes from the CFA are presented in Table 1 and interpreted below based on the provided cut-off values.

Table 1  
*Model Adaptation Index Based on MBI-SS CFA Results*

Scale	Analysis	$\chi^2$	<i>sd</i>	$\chi^2/sd$	GFI	AGFI	RMSEA	NFI	NNFI	CFI	SRMR
MBI-SS	3-Factor	239.15	87	2.74	.87	.82	.090	.92	.94	.95	.040
	3-Factor (Modified)	193.06	86	2.24	.89	.85	.076	.93	.95	.96	.038

Based on the model-data fit values, it was found that the original three-factor structure of the scale was preserved. When the findings of the unmodified analysis were examined, it was observed that every index pointed to acceptable and good results. The  $\chi^2/sd$  value was found below 3, which showed a perfect fit, also GFI, NFI, NNFI, CFI and SRMR values indicated a good to mediocre fit. A rule of thumb, AGFI and GFI for these indexes is that .90 indicates a good fit relative to the baseline model, while values greater than .85 may be considered an acceptable fit. Then it may be said that these indexes indicate acceptable levels of fit. However, the RMSEA value seemed to have a poor fit with a value of slightly over .08. In the modified model, the value decreased below .08, indicating an acceptable fit. When the proposed modifications were analyzed, one modification that would make a contribution to model-data fit was determined, which was associated with the error variant in items 11 and 14. These items were in the same subscale and had very similar expressions. Hence, the suggested modification was made and after the modification, an increase in every good-fit index was observed. Furthermore, a decrease in  $\chi^2$  and RMSEA showed that the modification improved the model-data fit quality. These results demonstrated that the scale, composed of 13 items and three factors with a sufficiently high level of structure validity, assesses the Turkish students' burnout levels in a valid and reliable way.

#### ***Utrecht Work Engagement Scale-Students Form (UWES-SF)***

UWES-SF, on the other hand, assesses the level of positive work-related fulfillment and absorption. Although it was developed to determine work satisfaction, it was adapted for students by Schaufeli, Martinez, et al. (2002). It has two forms; a long form consisting of 17 items and a short form including nine items. In this study, the short form of the scale was preferred. The scale includes three subscales, Vigor (3 items), Dedication (3 items) and Absorption (3 items). The items are scored as 0-Never and 6-Always. At the scoring phase, both total scores and subscale scores are calculated. Higher scores obtained from the scale mean that students' engagement levels are high.

The original form of the scale was adapted to Turkish by Eryılmaz and Doğan (2012). In the adaptation process, a back-translation method was utilized and the Turkish form of the scale was administered through online and face-to-face methods. The psychometric properties of the adapted scale were investigated with CFA, the test-retest method and inter-consistency of the scale were analyzed. The adapted form of the scale was found valid and reliable in the assessment of individuals' work engagement.

#### ***The Quick Big Five Personality Test (QBFPT)***

QBFPT aims to assess the personality traits of individuals based on the Big Five Personality Theory with five factors. These are extraversion (E), openness to experience

(O), neuroticism (N), agreeableness (A) and Conscientiousness (C). The original scale was developed by Vermulst and Gerris (2005) and adapted to Turkish by Morsunbul (2014). The scale is composed of 5 factors and 30 yes-no items. The factor structure of QBFPT was confirmed in the adaptation study. Besides, item analysis showed that test items worked well to measure personality traits. Lastly, the reliability of the test scores was investigated by the test-retest method and Cronbach alpha coefficients. The results showed that the Turkish version of the test was capable of producing similar results at different times and that the items had internal consistency ( $r=.88$ ).

### **Analysis of Data**

The data were analyzed in line with the hypotheses of the research. In the preliminary analyses, item analyses, as well as reliability and validity tests, were carried out on each subscale. After examining the subscale scores, the analyses that may reveal the relationships among the variables were applied. Then, descriptive statistics, zero-order correlations, regression analyses were performed. Before conducting the regression analysis, the assumptions (normality, linearity, extreme values and multicollinearity) were tested.

For the data analyses, Lisrel 8.71 and SPSS 22.0 were used. At the adaptation phase of the MBI-SS, Lisrel 8.71 (Jöreskog & Sörbom, 2004) was used in order to perform CFA. Pearson moment correlations were calculated to reveal the relationships among the variables. Finally, stepwise regression analysis was applied to create the regression equation of the students' engagement levels.

### **Ethical Procedures**

This study was carried out with the approval of the Kastamonu University Ethics Committee (2020-3/12). Before starting the survey, the participants were informed through a consent form which involved the confidentiality of given responses, the objectives and aim of the study and so on. The researchers guaranteed anonymity and data confidentiality.

## **Results**

### **Preliminary Analysis**

Item analyses were performed, and discriminations and popularities of the items were calculated. These analyses were performed based on the scales and subscales. Firstly, the results of the UWES-SF items were analyzed and showed that the item means ranged from 1.69 to 3.25, indicating that most of the participants preferred low values for the items. Then, corrected item-total correlations, the discrimination power of the items, were calculated and it was found that item discrimination indexes ranged from .58 to .75. As for the item discrimination index, values higher than .40 are accepted as highly discriminative items (Crocker & Algina, 1986). Based on this cut-off value, we can conclude that these items are highly discriminative. The internal consistency of the scale scores was investigated with Cronbach's alpha coefficient, which was calculated as .89. Lastly, the items' contribution to the internal consistency was investigated and it was found that all of the items improved the total scale reliability.

The second measure used in the study was the MBI-SS. The validity and reliability of the scores of the inventory were analyzed at the sub-scale level. Item discriminations indexes, item means and reliability coefficients were estimated and it was found that all of the items have high discriminative power ( $r_{jx}=.49; .74$ ). In addition, Cronbach's Alpha coefficients of three subscales were (Exhaustion,  $r=.87$ , Cynicism,  $r=.87$  and Efficacy,  $r=.79$ ) higher than .70, meaning that the subscale scores are highly reliable. Moreover, each item contributed to the total reliability of the scale. Based on these findings, it can be concluded that the scores of MBI-SS are valid and reliable.

The last measurement tool used in this study was the QBFPT. Item discrimination indexes ranged from .50 to .81, which indicates high discrimination power. Item means were found between 3.59 and 5.33, revealing that most participants were prone to selecting mid-points for the items. For reliability, Cronbach's alpha coefficients were estimated for each subscale and the coefficients ranged between .78 and .88, which indicates medium-high internal consistency. It was also determined that all of the items contributed to the reliability of the subscale scores. Lastly, the descriptive statistics of the scale scores were calculated and these values were presented in Table 2.

Table 2

*Descriptive Statistics of the Scale Scores*

Scale/ Inventory	Sub-scales	<i>n</i> of items/ cases	Min.	Max.	Mean	<i>SD</i>	Skew- ness	Kurtosis
QBFPT	Agreeableness	5	20.00	42.00	35.44	4.097	-.65	.60
	Extraversion	5	7.00	42.00	26.12	7.70	-.06	-.63
	Conscientious- ness	5	9.00	42.00	30.50	7.07	-.53	-.18
	Neuroticism	5	6.00	41.00	25.03	6.55	.08	-.03
	Openness to experience	5	14.00	42.00	32.84	4.48	-.23	.23
UWES-S	Engagement	9	9.00	44.00	23.71	7.00	.23	-.40
	Exhaustion	4	7.00	35.00	21.48	6.57	.17	-.46
MBI-SS	Cynicism	5	4.00	28.00	15.73	5.88	.05	-.55
	Efficacy	6	12.00	42.00	29.37	5.75	-.12	-.07
GPA	-	279	2.00	4.00	2.96	.31	-.06	.27

When the results were investigated, it was concluded that the participant group was heterogeneous according to the research variables based on the minimum and maximum scores. The standard deviation values, which are relatively high, also confirmed the results. Mean values showed that most of the students tended to choose the average values. Skewness and Kurtosis values ranged between -1 and 1, indicating that the scores are distributed normally (Tabachnick & Fidell, 2001).

### The Results of Correlation and Regression Analyses

Firstly, in order to test the first hypothesis of the study, the relationships among the variables were investigated and Pearson product-moment correlations were computed to examine the intercorrelations. The computed correlation coefficients were presented in Table 3.

Table 3

#### *The Pearson Product-Moment Correlations among the Research Variables*

Pearson Correlation	UWES-S	Agree.	Extra.	Cons.	Neu.	Open.	Exhaustion	Cynicism	Efficacy	GPA
UWES-S	1.00									
Agree.	.29**	1.00								
Extraversion	.12*	.31**	1.00							
Cons.	.34**	.25**	.02	1.00						
Neuroticism	.14**	.19**	.49**	.14*	1.00					
Open.	.23**	.47**	.34**	.07	.19**	1.00				
Exhaustion	-.60**	-.27**	-.13**	-.25**	-.35**	-.14**	1.00			
Cynicism	-.62**	-.24**	-.07	-.25**	-.23**	-.09	.74**	1.00		
Efficacy	.62**	.46**	.22**	.34**	.24**	.38**	-.48**	-.55**	1.00	
GPA	.22**	.19**	-.01	.25**	-.05	-.03	-.09	-.16*	.32**	1.00

In Table 3, the correlation coefficients between the research variables were presented and the values showed that nearly all variables were correlated with each other significantly. This finding proved the study's first hypothesis, which was "H1=There is a significant relationship among the students' UWES-S scores, personality traits, burnout scores and GPAs." The relationships among the dimensions of Burnout inventory ( $r=.74$ ;  $.55$ ;  $.48$ ,  $p<.001$ ) and UWES-S were the strongest. The strongest positive correlation, considered as a large effect size based on Sink and Stroh's guideline (2006), was observed between Efficacy and UWES-S ( $r=.62$ ), meaning that students with a relatively high efficacy subscale score will likely have a high engagement score and vice versa. The other two dimensions of MBI-SS were also correlated with UWES-S scores but negatively ( $r=-.62$ ;  $-.60$ ). Results further indicated that only Conscientiousness had a positive medium level of correlation with UWES-S from the assessed personality traits. Lastly, the GPA was found positively correlated with UWES-S; however, this relationship was found below the medium level. These findings verified the second hypothesis of the study that was "H2: School engagement is negatively associated with exhaustion and cynicism dimensions and positively associated with the efficacy dimension of the burnout scale."

Stepwise multiple regression was conducted to investigate how well the subscale scores of Burnout and Personality inventories and students' GPAs would predict the students' engagement scores. Before conducting the regression analysis, normality, linearity, extreme values and multicollinearity assumptions were tested. Normality was checked at univariate and multivariate levels. For the univariate level, skewness and



kurtosis values were calculated and they ranged between  $-.85$  and  $.77$ , which indicates that the values have a normal distribution (Tabachnick & Fidell, 2001). In order to analyze the extreme values, Z scores and Mahalanobis distances were calculated. For Z scores, 3 and -3 were accepted as boundary values (Field, 2013) and it was found that there were no cases including extreme values. In addition, Mahalanobis distances showed that there was not any case including an extreme value. The linearity of the variables was investigated in terms of scatter plots and it was found that all graphs had a form of an ellipse. Thus, it was concluded that this assumption was met for all the research variables. Lastly, the variance inflation factors (VIFs) and tolerance values (TVs) were computed to measure multicollinearity. All the VIFs of the predictor variables in the regression models were less than 3.0, which indicates that the multicollinearity of the variables does not affect the regression estimates. Also, all of the TVs of the predictors were calculated higher than .10, which shows there is no multicollinearity among the predictors (Tabachnick & Fidell, 2001). All of the predictors were included in the model for the regression analyses, and five different models were produced. The regression and Beta coefficients of the predictors according to the proposed models are presented in Table 4 below.

Table 4

*The Results of Stepwise Multiple Regression Analysis*

				Standardized			Collinearity	
	R	R <sup>2</sup>	Adjusted R <sup>2</sup>	Beta	T	Sig.	Tolerance	VIF
1 (Constant)					1.08	.28		
Efficacy	.62	.39	.38	.62	13.09	.00	1.00	1.00
2 (Constant)					6.98	.00		
Efficacy				.43	8.87	.00	.77	1.31
<b>Exhaustion</b>	.71	.50	.50	-.39	-7.95	.00	.77	1.31
3 (Constant)					7.92	.00		
Efficacy				.38	7.40	.00	.69	1.46
Exhaustion				-.25	-3.94	.00	.45	2.22
<b>Cynicism</b>	.72	.53	.52	-.23	-3.56	.00	.41	2.44
4 (Constant)					6.53	.00		
Efficacy				.34	6.65	.00	.65	1.55
Exhaustion				-.24	-3.82	.00	.45	2.23
<b>Cynicism</b>				-.23	-3.53	.00	.41	2.44
<b>Conscientiousness</b>	.73	.54	.53	.11	2.43	.02	.87	1.15
5 (Constant)					7.06	.00		
Efficacy				.36	6.92	.00	.64	1.56
Exhaustion				-.28	-4.39	.00	.42	2.39
<b>Cynicism</b>				-.22	-3.37	.01	.41	2.45
<b>Conscientiousness</b>				.11	2.56	.01	.87	1.15
<b>Neuroticism</b>	.74	.55	.54	-.11	-2.56	.01	.87	1.16

Dependent Variable (Constant): UWES-S

In Table 4, the produced regression models and related statistics were presented. The first model was composed of the constant value and Efficacy scores of students. Efficacy was found as the strongest predictor in the regression model. Its Beta coefficient was the highest; thus, it was included in the model first. In the second model, Exhaustion was added to the model and this variable increased the total adjusted R2 from .38 to .50. In the next step, Cynicism was entered into the model and the total adjusted R2 reached .52. Standardized coefficients of Exhaustion and Cynicism were found negative, which indicates that if the students' UWES-S scores increase, the subscale scores of Efficacy and Exhaustion will decrease. In the fourth model, Conscientiousness was included in the model and the explained variance increased to .53. In the last step, students' emotional stability scores were included in the model and it became the last predictor variable of the model. Its beta coefficient was found to be the same as the precedent predictor, Conscientiousness. As a result of regression analysis, the final model consisted of five variables explaining .54 of students' engagement scores. Also, the beta weights presented in all models were found significant, and while two of the predictors had a positive influence, three of them had a negative influence on the UWES-S scores of the students. These results indicate that the students' engagement could be predicted by their Efficacy, Exhaustion, Cynicism, Conscientiousness and emotional stability scores.

Students' GPAs, the sub-scale scores of openness to experience, agreeableness and extraversion were not included in any model due to the low Beta coefficients. These results showed that the third hypothesis of the study, "H3=Personality traits, burnout and academic achievement predict students' school engagement level.", was confirmed partially. As a result of regression analysis, the composed regression model can be stated as:

$$yI=21.38+0.36*Efficacy+-0.28*Exhaustion+-0.22*Cynicism+0.11*Conscientiousness+-0.11*Neuroticism$$

## Discussion

The primary purpose of this study is to extend the research carried out in the area of school engagement, burnout and personality by conducting descriptive research to investigate the correlation and prediction relationships among these variables. The results indicated that the highest mean score obtained by the students for personality traits was agreeableness while the lowest was neuroticism, which was also supported by some other studies (Burke & Witt, 2004; Côté & Moskowitz, 1998; Jensen & Patel, 2011; Saling et al., 2019; Templer, 2012). On the other hand, levels of engagement and all dimensions of burnout were moderate among the participants, as also reported by Akbaşlı et al. (2019).

The first hypothesis of the study was that there is a significant relationship among the students' engagement scores, personality traits, burnout scores and GPAs. The results revealed that engagement scores had significant relationships with all the research variables. Although some studies underlined the associations and implied that engagement improves academic achievement (Bilge et al., 2014; Crossan et al., 2003; King, 2015; Zhu, 2010), the results of this study highlighted that there was a positive but low relationship between GPA and engagement. Some other researchers also reached similar results, and even in some studies, researchers did not observe a significant correlation between these variables. For instance, Appleton et al. (2006)

reported that the relationship between engagement and GPA was weak. Chen et al. (2013) and Shernoff (2010) stated that no significant correlation between student engagement and GPA. This could be because students with higher grades acquire the abilities required to comprehend the content faster; therefore, they spare less time to study. On the contrary, as also expressed by Lei et al. (2018), students with low grades could have problems in mastering the skills that compose the base for learning the content, so even if they engage more, they cannot get high grades.

As for the relationship between engagement and personality traits, we found a significant correlation between engagement and all dimensions of QBFPT. Upon examining the coefficients, we found that the correlations were positive but low for all dimensions except for Conscientiousness. Kim et al. (2009) and Douglas et al. (2016) also supported the finding by stating that of all the personality inventory dimensions, only Conscientiousness was significantly correlated with engagement. Based on the findings, we might posit that the students with a high conscientiousness personality trait, identified by organized, principled, responsible, forward-thinking, persistent and goal-oriented characteristics, tend to lead their energy to school-related tasks, exams and activities and, as a result, feel a strong sense of engagement.

For the second hypothesis, we tested whether the students' engagement levels were negatively associated with exhaustion and cynicism dimensions and positively associated with the efficacy dimension of the burnout scale. As stated in the hypothesis, the direction of Pearson coefficients showed that UWES-S and Exhaustion and Cynicism were negatively correlated while there was a positive and high relationship between Efficacy. This finding is also in line with the results of other studies reporting that the students with a high level of engagement have a lower level of Exhaustion and Cynicism and a higher level of Efficacy (Fiorilli et al., 2017; Hakanen et al., 2006; Maricuțoiu et al., 2017; Prins et al., 2010; Salmela-Aro & Read, 2017; Salmela-Aro et al., 2011; Schaufeli, Salanova, et al., 2002; van Beek et al., 2013; Virtanen et al., 2018; Zhang et al., 2007). Therefore, we can say that students who have relatively weak school engagement tend to exhibit the features of burnout.

As for the last hypothesis, the prediction of students' school engagement level by personality traits, burnout and academic achievement was tested. The results of regression analysis pointed out that the scores of two dimensions of personality inventory (Conscientiousness and neuroticism) and all dimensions of burnout (Efficacy, Exhaustion and Cynicism) predicted engagement significantly. Kim et al. (2009) also reported that Conscientiousness and neuroticism were primary predictors of engagement. To this end, we can conclude that students with high Conscientiousness, characterized by being proficient, efficient, organized and determined, tend to complete the tasks on time, drive their energy to work, and feel a strong sense of competence resulting in a high level of engagement in schoolwork. Based on the regression model, we can also assert that students who show signs of burnout feel less engaged and might have problems focusing on learning activities behaviorally, cognitively, and emotionally. On the one hand, it can be claimed that students with high Efficacy, the ability to perform a school task to a satisfactory or expected level, are expected to have a higher engagement level. On the other hand, students who feel emotionally exhausted and psychologically distant are assumed to have a lower level of engagement, as also explained by Maricuțoiu et al. (2017). Llorens-Gumbau and Salanova-Soria (2014) and

Salmela-Aro and Upadyaya (2014) have also reported similar findings, who found that all dimensions of burnout predicted engagement.

GPA and three other dimensions of personality inventory (agreeableness, extraversion and openness to experience); however, did not significantly predict students' engagement. Shernoff and Schmidt (2008) could not also establish a prediction relationship between engagement and GPA. Hence, the finding is relatively surprising, as there is no prediction relationship between engagement and extraversion. It was initially suggested that the influence of extraversion on engagement would be positive due to the high energy level that extroverts often have. The result of the present study also indicates that agreeableness, extraversion and openness to experience could have a limited impact on improving school engagement. The finding is in line with previous results revealing that engagement and all dimensions of QBFPT do not have a strong predictive relationship (Kim et al., 2009). Some other studies, on the other hand, revealed different dimensions of QBFPT could be a predictor of engagement. For example, Douglas et al. (2016) stated that openness is one of the significant predictors of engagement.

### **Conclusion, Limitations, and Implications**

The present study showed that Conscientiousness and neuroticism as personality traits and burnout levels of students are effective factors in predicting the level of school engagement. In order to enhance students' attention, curiosity, interest, and motivation, we can modify the educational environments to minimize the factors causing burnout such as pressure on school achievement, excessive amount of homework, and lack of time for rest. Moreover, developing learning tasks and realistic targets that build on students' own strengths, interests and needs is invaluable in the improvement of school engagement. These adjustments in the educational settings will also lead to a decrease in students' state of emotional, physical burnout and mental distance from schoolwork.

The findings of the study and the discussion presented are limited to the following issues. First, the preference of convenient sampling to collect data may limit the generalizability of the findings. Therefore, it can be suggested that future studies include a more representative sample of university students. The second limitation of the study is the use of self-report measures whose limitations are well documented in the research and social science literature. Especially when evaluating positive behavior, the results of self-report measures should be carefully interpreted. Despite these, this study has crucial practical implications for the researchers, as well. This study has gone some way towards enhancing our understanding of the relationships between school engagement and both personality traits and burnout. Additional studies carried out with a more representative sample of university students and with the support of qualitative data would help us explore these interrelationships among these constructs thoroughly.

### **Statement of Responsibility**

The study was conducted and reported with equal collaboration of the researchers. The researchers had equal roles in the tasks for conceptualization, resources, data collection and analysis, reporting, drafting, reviewing and editing.

**Conflicts of Interest**

There is no conflict of interest to disclose.

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## To What Extent Are Preparatory School Students Ready for Online Learning?

### Hazırlık Okulu Öğrencileri Çevrimiçi Öğrenmeye Ne Kadar Hazır?

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**ABSTRACT:** The aim of this study is to investigate the opinions of students enrolled at the School of Foreign Languages concerning their readiness for online learning. Sequential mixed method design was used in this descriptive study. The researcher administered the Online Learning Readiness Scale (OLRS) and conducted interview to collect data. As for data analysis, the data obtained from the quantitative part of the questionnaire were analyzed using descriptive statistics. For the qualitative part of the research, inductive content analysis was applied to analyze the beliefs of prep school students to ascertain their levels of online learning readiness. The results revealed that prep school students had a moderate level of readiness for online learning. They indicated enhanced computer/internet and online communication self-efficacy and motivation, whereas they often failed to direct and control their own online learning. A final suggestion was that researchers and practitioners should seek to understand better why students generally cannot be successful at directing and controlling their own online learning.

**Keywords:** Prep class, online learning, online learning readiness, learner control, self-directed learning.

**ÖZ:** Bu araştırmanın amacı, Yabancı Diller Yüksekokulu'na kayıt yaptıran öğrencilerin çevrimiçi öğrenmeye hazır bulunuşluklarına ilişkin görüşlerini incelemektir. Tanımlayıcı nitelikteki bu çalışmada sıralı karma yöntem deseni kullanılmıştır. Veri toplamak için araştırmacı, Çevrimiçi Öğrenmeye Hazırlık Ölçeği (OLRS) ve görüşme soruları uygulamıştır. Veri analizinde ise anketin nicel kısmından elde edilen veriler betimsel istatistikler kullanılarak analiz edilmiştir. Araştırmanın nitel kısmında, hazırlık okulu öğrencilerinin çevrimiçi öğrenmeye hazır bulunuşluk düzeylerini belirlemeye yönelik inançlarını analiz etmek için tümevarımsal içerik analizi uygulanmıştır. Sonuçlar, hazırlık okulu öğrencilerinin çevrimiçi öğrenmeye orta düzeyde hazır bulunuşluk düzeyine sahip olduklarını ortaya koymuştur. Araştırma sonuçları öğrencilerin gelişmiş bilgisayar/internet ve çevrimiçi iletişim öz-yeterliliğe ve motivasyona sahip olduklarını belirtirken, genellikle kendi çevrimiçi öğrenmelerini yönlendirmede ve kontrol etmede başarısız olduklarını da göstermiştir. Son bir öneri ise, araştırmacıların ve uygulayıcıların, öğrencilerin kendi çevrimiçi öğrenmelerini yönetmede ve kontrol etmede genellikle neden başarılı olamadıklarını daha iyi anlamaya çalışması gerekiyor.

**Anahtar kelimeler:** Hazırlık sınıfı, çevrimiçi öğrenme, çevrimiçi öğrenmeye hazırlık, öğrenen kontrolü, öz-yönlü öğrenme.

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Online learning has already become popular globally in every field of education as a result of the ubiquity of information and communication technologies regardless of Covid-19 pandemic. Moreover, online learning, which is defined as a more student-centered, innovative, and flexible teaching-learning process (Dhawan, 2020), has become an indispensable part of mainstream education as the preferred teaching and learning method immediately after the outbreak of Covid-19 pandemic, which has upended our lives (Chung, Subramaniam, & Dass, 2020). Online learning, which is considered a panacea, is being used by a large number of higher education institutions in various countries in order to meet the learning needs of a growing and increasingly multicultural student population by providing a wide range of opportunities (Allen & Seaman, 2013; Dhawan, 2020; Rumble & Latchem, 2004).

The forced shift from face-to-face education to online education due to the covid-19 pandemic has generated some challenges in higher education (Rapanta et al., 2020). One important area of inquiry into these challenges is to ascertain the online learning readiness of higher education students, which is a crucial factor in reaping the full benefits of online learning (Bowles, 2004; Chung, Noor, & Mathew, 2020; Hukle, 2009; İlhan & Çetin, 2013; Smith, 2005; Wang et al., 2009; Yeh et al., 2019; Yu, 2018). Online readiness is defined as “being mentally and physically ready for certain online learning experience and actions” (Borotis & Poulymenakou, 2004). As emphasized by So and Swatman (2006), examining the online learning readiness of learners early in the training process is essential for an effective online learning process since students faced urgent transition from the traditional way of English language learning to the digital modes of teaching and learning practices which paved the way for online language learning. Thus, it is important to reveal to what extent students at prep schools have online learning readiness in order to achieve successful and effective results in the online learning, which is now exponentially used in higher education in Turkey.

## **Literature Review**

### ***Theoretical Framework***

In recent years, there has been a conceptual paradigm shift in terms of online learning in higher education. The concept of online learning readiness was first brought forward by Warner et al. (1998), who reflected three different aspects of online learning readiness: (1) a form of delivery preferred by students opposed to face-to-face education (2) students' ability to use Internet and computers for learning, and (3) ability to participate in independent learning. To date, the concept of online learning readiness has been discussed from various aspects in the literature by several researchers (Evans, 2000; Hung et al., 2010; McVay, 2000, 2001; Smith, 2005; Smith et al., 2003). There exist different measurement tools which have been identified, validated and used for assessing the readiness for online learning (McVay, 2000, 2001; Smith, 2005) among which this study employs online learning readiness scale developed by Hung et al. (2010) as it is a hypothetical model that best explains preparatory school students' readiness for online learning. Moreover, the assessment of online learner readiness needed to address a comprehensive set of dimensions that vary widely, such as technical computer skills, internet navigation skills, and learner control over the sequence and selection of resources, which were all missing from the previous instruments. Hence,

despite the fact that similar scales exist in the literature, the five composite dimensions of OLRs are depicted below thoroughly to gauge learners' readiness for online learning.

### ***Computer & Internet Self-Efficacy***

Computer self-efficacy (Compeau & Higgins, 1995) and internet self-efficacy (Eastin & LaRose, 2000) as two distinct domains merged to form a single domain; that is, computer and internet self-efficacy, a concept suggested by Hung et al. (2010). This concept encompasses skills, attitudes, competencies and knowledge students need to employ to utilize technologies to meet educational demands and expectations in higher education (Mirete et al., 2020). An extensive body of research shows that students with higher levels of computer and internet self-efficacy tend to show high performance on some internet-related tasks for educational purposes, such as uploading or downloading, saving files, ripping, burning, chatting, and applying higher-level skills such as online system management and troubleshooting problems in online learning (Eastin & LaRose, 2000; Mirete et al., 2020; Pellas, 2014; Tsai et al., 2011). Therefore, it can be hypothesized that there is a strong positive and direct relationship between the increased computer and internet self-efficacy and students' high level of satisfaction and engagement (Aldhahi et al., 2021; She et al., 2021; Thurasamy, 2021; Wolverson et al., 2020).

### ***Self-Directed Learning***

Self-directed learning is defined as “autonomy and control by the individual who monitors, directs, and regulates actions toward goals of information acquisition, expanding expertise and self-improvement” (Paris & Paris, 2001, p. 89). To reiterate it, self-regulated learners are “metacognitively, motivationally, and behaviorally active participants in their own learning process” (Zimmerman & Schunk, 2001, 2011). A growing body of research has demonstrated that successful online self-directed learners can make their own informed decisions to fulfill their own needs at their own pace depending on their existing knowledge and learning objectives (Alotaibi et al., 2017; Bonk & Lee, 2017; Ergen & Kanadli, 2017; Geng et al., 2019; Hung et al., 2010; Song & Bonk, 2016; Yang et al., 2020). In their study, Hung et al. (2010) proposed five items to gauge learners' self-directed learning as follows: the ability to make a study plan for their own needs, seeking help for any challenge(s) they are faced with, good time management, holding their own learning outcomes and learning performance with high expectations.

### ***Learner Control***

Hung et al. (2010) delineate the concept of learner control as the ability of learners to sustain learning without being interrupted by other online activities and reviewing the content of online materials considering their learning needs. By adopting an individualized approach, learners are able to decide on the amount of the content, the order, and the speed of learning with full flexibility (Mayer, 2003; Means et al., 2009; Shyu & Brown, 1992). Learner control is found to be directly beneficial to online learning through a wide array of research. A large number of studies undertaken shows that if online learners are empowered to assess their own learning, they become agents of their own learning (Blaschke, 2018; Jung et al., 2019; Lange, 2018; Taipjutorus et al., 2012; Väljataga & Laanpere, 2010; Wang & Beasley, 2002).

### ***Motivation for Learning***

Motivation is defined as “the process whereby goal-directed activity is instigated and sustained” (Schunk et al., 2008, p. 4). A number of researchers have investigated the role of motivation on the willingness of students to learn online. For example, Ryan and Deci (2000) found out that learners with intrinsic motivation had high amount of freedom to decide their own learning direction in an online environment. Similarly, Saadé et al. (2007) identified that the success or failure of online learning is highly dependent on the intrinsic and extrinsic motivation of the learners. The dimension of “motivation for learning” will greatly facilitate the online learning, retention, and retrieval of information so that learners can fulfill their desires and efforts (Artino, 2008; Bekele, 2010; Buzdar et al., 2016; Chen et al., 2017; Firat, & Bozkurt, 2020; Genc et al., 2016; Horzum et al., 2015; Wei & Chou, 2020; Zhu et al., 2020).

### ***Online Communication Self-Efficacy***

Building opportunities for interaction and communication between students and their instructors in Web-based learning is important (Barker, 2002; Bodomo, 2010; Chung, Noor, & Mathew, 2020; Hosseini & Branch, 2015; McVay, 2000; Sun & Hsu, 2012). In essence, the theory of self-efficacy in online communication focused on explaining the adaptability of learners to the online world through asking, reacting, commenting, and debating (Hung et al., 2010). However, in their study, Chung, Noor, and Mathew (2020) pointed out that university students do not feel confident in posing critical thinking questions in online discussions, which indicates that they are not equipped with a high level of online communication self-efficacy. This has directly impacted their preparation for online learning. In a nutshell, Hung et al. (2010) concluded that communication self-efficacy in online learning is a significant aspect in eliminating the barriers to online communication.

Although there has been a plethora of research regarding the assessment of undergraduate students’ online learning readiness levels at different departments at various universities in Turkey, there is a dearth of research regarding the issue in a prep school context in Turkey. For example, Kalkan (2020) conducted a study to identify to what extent students from other departments such as Sport Sciences, History, Literature, and English Language and Literature were ready for e-learning. “The Scale of E-Learning Readiness” instrument adapted and developed by Yurdugül and Demir (2017) was used in this study. The results showed that there was a significant difference among learners in terms of “Computer Self-Efficacy”, “Online Communication Self-Efficacy”, and “Learner Control”. According to the findings, students in the English Language and Literature department have greater degrees of readiness for e-learning than students in other departments because they use e-learning modalities more frequently than students in other departments. In the same vein, Demir and Eren (2021) carried out a study to examine the online learning readiness of students at a public and private universities. “University Students E-Learning Readiness Scale” developed by Demir (2015) was employed in the study. The participants consisted of first-year associate degree students (n=1392) enrolled in English I course during the fall semester of the 2020-2021 academic year. Based on the findings of this study, it was determined that students’ readiness for online learning was excellent. The findings also demonstrated that students had remarkably high levels of readiness in the “Internet self-efficacy,” “online



communication self-efficacy,” “computer self-efficacy,” “self-directed learning,” and “learner control” sub-dimensions, and low levels of readiness in the “motivation for e-learning” sub-dimension.

Furthermore, in their descriptive study, Cobanoglu and Cobanoglu (2021) aimed to scrutinize readiness levels of students from various departments for online learning based on a variety of factors. The researchers applied the adapted Turkish version of Online Learning Readiness Scale (OLRS), which was originally developed by Hung et al. (2010) in their study. The findings obtained from quantitative data indicated that student teachers’ readiness for online learning was satisfactory. There were, however, significant differences among student teachers in terms of their departments, access to the Internet, perceived information and competency of communication technology use. If preparatory schools in Turkey intend to design a sound English preparatory program in such a challenging time and onwards, online learning readiness levels of prep school students must be considered to provide better quality education. The target population of this research study is especially prep school students because they are at the very beginning of their university life. It will be vital to get promising results from online learning to improve teaching and learning English during the preparatory education. To elaborate, as online learning seems to be the dominant learning paradigm, students need to be prepared for a virtual learning environment at universities. Adapting to technology-assisted language learning in the early stages of their academic careers will help them become more effective language learners. In this sense, this research study aims to explore the degree to which preparatory school students are ready for the forced shift to online learning. The results of the study will shed more insights into the online learning process spurred by the outbreak of Covid-19 pandemic. They will assist stakeholders (i.e., policymakers, administrators, curriculum designers, instructors) with establishing more innovative, inclusive, sustainable, and accessible teaching and learning methods and strategies.

## Method

### Research Design

Believing that researchers need to be free of mental and practical limitations placed by the “forced choice dichotomy between post-positivism and constructivism” (Creswell & Plano Clark, 2007, p. 27), the study holds pragmatic worldview. In addition, a sequential explanatory mixed methods study was used in the study in which quantitative data is collected in a first instance followed by qualitative data collection (Creswell, 2013) to investigate the preparatory school students’ online learning readiness by forming the following overarching research questions.

RQ1. What is the online learning readiness of preparatory school students?

- 1.1. What are the espoused beliefs of preparatory school students about their computer- internet self -efficacy?
- 1.2. What are the espoused beliefs of preparatory school students about their self-directed learning?
- 1.3. What are the espoused beliefs of preparatory school students about controlling their own learning in an online context?

1.4. What are the espoused beliefs of preparatory school students about their motivation for online learning in an online context?

1.5. What are the espoused beliefs of preparatory school students about their online communication self-efficacy?

RQ2. Do preparatory school students' beliefs about online learning process differ significantly in terms of their gender, previous online learning experience, internet connection and program type (compulsory or optional)?

### **Setting and Participants**

During 2020-2021 Academic Fall Semester, 217 preparatory school students 121 of whom were female (55.8%) and 96 of whom were male (44.2%) enrolled at a state university School of Foreign Languages involved in the study.

### **Research Instrument and Procedures**

The study was conducted after getting approval from the ethical committee of the university. The "Online Learning Readiness Scale" developed by Hung et al. (2010) was considered in the study due to its multidimensional structure and relevance of the factors identified for preparatory school students. However, the scale adapted and translated into Turkish by Yurdugül and Sirakaya (2013), was used as a quantitative data collection tool in the study as participants were at A1-A2 level. The 5-point Likert type OLRs ranging from 5 (Strongly agree) to 1(Strongly disagree) was given to the participants via Google Docs during one month period in November 2020. Participation in the study was voluntary. The scale with 18 items comprised of five different dimensions, namely, computer/internet self-efficacy (3 items), self-directed learning (5 items), motivation for learning (4 items), learner control (3 items), and online communication self-efficacy (3 items).

Furthermore, an online focus group interview with 35 students via Zoom was utilized as a qualitative data collection technique to delve into the findings obtained from the quantitative phase of the study besides the applicability of the data collection technique (Gibbs, 2012) due to the COVID-19 pandemic. The researcher hosted, as a moderator, 5 group meetings with 5-7 interviewees via Zoom, which has a 40-minute time limit. The interviews for each participant lasted approximately 10 minutes. The total time recorded was reported as 225 minutes. Their participation was truly on a voluntary basis, and their answers were kept anonymous. The interviews were in participants' native language. Watching and listening to the recorded meetings, the researcher translated the interviews into English and transcribed them as texts. The interviews and their transcriptions took nearly three weeks to be completed. The following interview questions were asked to explore how preparatory school students were ready for the forced shift to online learning.

1. Do you think you are competent at using computer software and Internet? How and in what ways?
2. Do you think that you are successful in planning, controlling and monitoring your own learning? How and in what ways?
3. How do you control your own learning during online learning process?
4. To what extent are you motivated for online learning?

5. Can you interact easily with your instructor and classmates on online platform? Why? Why not?

### **Reliability and Validity**

The composite reliability of the OLRs revealed a Cronbach's alpha score of  $\alpha=.75$ , which indicated an acceptable reliability for the survey to be used in the study (Büyüköztürk, 2002). Additionally, Cronbach Alpha reliability coefficients calculated for the sub-dimensions are .72 for computer/internet self-efficacy, .78 for self-directed learning; .67 for learner control, .70 for motivation for learning, and .82 for online communication self-efficacy.

In order to ensure the validity of the study, the interview questions, which were framed in accordance with the OLRs items, were checked by an expert with PHD in ELT, and the final form of the questions was reached under the direction of the expert's opinions and suggestions. To minimize or avoid the threats to the study, the researcher followed the steps recommended by Polit and Beck (2010), such as standardizing the conditions under which the research study will be carried out; obtaining as much information as possible about the participants; deciding when and where the study will be conducted, and choosing an appropriate research design.

### **Data Analysis**

The data gathered by conducting OLRs were analyzed using SPSS 23. In order to find answers to the first research question, descriptive statistics such as frequency and mean values of the items were calculated and presented to reveal the participants' views about online learning readiness. In addition, the Mann-Whitney U statistical test, which is an alternative to parametric tests like the t-test due to the lack of conditions of normality (Nachar, 2008), was used to reveal whether statistical differences appeared in their views based on gender, having a previous online learning experience and their type of internet connection and program. In addition, the inductive content analysis technique was used to analyze the data that emerged from the focus group interviews to support the findings of the quantitative data.

### **Ethical Procedures**

I declare that the research was conducted in accordance with the ethical standards of the institutional research committee. Before the research started, the researcher applied the ethics committee for ethical approval. The study was approved with the Meeting Date and Number 02.10.2020/07 by the Social and Human Sciences Ethics Committee of Bursa Uludag University. Informed consent was obtained from all individual participants included in the study. The author received no financial support for the authorship, research, and publication of this article.

### **Results**

The overall result of the study indicated a moderate level of readiness for online learning at a tertiary level. Considering that the lowest point that could be gotten from the OLRs is 18 and the maximum point is 90, students' overall score on their online learning readiness levels is found to be 62.58, which is between "Neutral" ( $M=54$ ) and "I agree" ( $M=72$ ) being mostly closer to "I agree".

Preparatory school students' readiness for online learning was analysed with respect to their computer-internet self efficacy, self-directed learning, controlling their own learning, motivation for online learning and online communication self-efficacy. Table 1 displays the descriptive results of the participants' beliefs about computer-internet self-efficacy.

Table 1

*The Descriptive Statistics of Participants' Beliefs on their Computer-Internet Self-Efficacy*

Items	N	Strongly agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	X
Computer- internet self efficacy							3.51
3. I feel confident in using the Internet (Google, Yahoo) to find or gather information for online learning.	217	21.2	52.5	18.9	5.1	1.8	3.84
2. I feel confident in my knowledge and skills of how to manage software for online learning.	217	7.8	41.0	34.1	14.7	2.3	3.37
1. I feel confident in performing the basic functions of Microsoft Office programs (MS Word, MS Excel, and MS PowerPoint).	217	10.6	35.0	34.6	14.7	5.1	3.31

Based on the results in Table 1, 73.7% of students agreed that they felt confident in using the Internet to find or gather information. On the other hand, nearly half of the participants (48.8%) felt confident in their knowledge and skills of how to manage software for online learning, whereas 34.1% were hesitant. Similarly, 45.6% of them agreed and 34.6% of the participants were hesitant that they felt confident in performing basic functions of Microsoft Office programs. With regard to their hesitance about not feeling confident in their knowledge and skills of how to manage software for online learning, female interviewees ( $N=10$ ) expressed their opinions about the issue as seen in the extracts below:

ST3: "Online learning in pandemic is a new experience for me. As I haven't had experience attending classes online via mobile phone before, I am not good at utilizing some online applications such as Kahoot, Quizzes etc.; therefore, I fall behind the class in joining and demonstrating high performance during the quizzes and activities."

ST10: "I get stressed when we are doing quizzes on Quizlet. I think our male friends are more advantageous than us. I believe they are more adapted to a competitive environment because they are already familiar with computer games".

As for the hesitance about not feeling confident in performing basic functions of Microsoft Office programs, the following extracts reveal how female students ( $N=8$ ) consider this issue.

ST16: "I believe that I do not feel comfortable using Google Docs in the Google classroom. As some of my friends have done homework and projects with Microsoft Word and PowerPoint before, they are more familiar with these practices..."

ST9: "Doing homework online through Google Docs makes me nervous. Preparing homework online is not appropriate for me. I'm trying to get used to doing homework online".

Table 2 presents the descriptive results of the participants' beliefs about self-directed learning.

Table 2

*The Descriptive Statistics of Participants' Beliefs on Their Self-Directed Learning*

Items	N	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	X
Self-directed learning							3.13
5. I seek assistance when facing learning problems.	217	14.7	41.5	22.1	14.3	7.4	3.41
4. I carry out my own study plan.	217	10.6	32.3	31.8	15.7	9.7	3.18
8. I have higher expectations for my learning performance.	217	16.6	27.2	26.3	16.6	13.4	3.17
7. I set up my learning goals.	217	7.4	37.8	27.2	15.2	12.0	3.12
6. I manage time well.	217	6.9	24.0	26.7	24.4	18.0	2.77

As can be seen from table 2, among the five dimensions of OLRS, participants rated lowest on self-directed learning ( $M=3.13$ ). 56.2% of prep school students agreed that they sought assistance when facing learning problems. Moreover, nearly half of the participants agreed that they carried out their own study plan (42.9%), had higher expectations for their learning performance (43.8%), and set up their learning goals (45.2%). However, a considerable number of participants were also hesitant about managing their own learning and disagreed with the aforementioned statements. With regard to time management, although 30.9% of the participants agreed that they could manage time well, 42.4% of them disagreed with this statement.

A considerable number of the interviewees ( $N=12$ ) mentioned about failing to prepare a self-study plan by themselves, as displayed by the comments below:

ST19: "I always tell myself "make a plan" but then I change my mind. Unfortunately, I am studying in unplanned way. I leave homework to the last minute and sometimes I forget to do it".

ST15: "I am making the plan of the week, but I cannot put it into practice. There is always an obstacle to me. We are a crowded family. I share my room with my sister. She prevents me from being organized".

As indicated below, some of the interviewees ( $N=7$ ) explained why they had doubts about having higher expectations for their learning performance.

ST6: "I had high expectations at first to learn English, but as the duration of staying at home increased because of Covid-19 pandemic, the stress level increased and my expectations from life started to run out".

ST25: “I started with high expectations at the beginning of the semester. However, as the assignments increased and I could not cope with them during the semester, my expectations started to disappear”.

Moreover, five of the interviewees mentioned their uncertainty in setting up learning goals for themselves:

ST29: “I am studying optional prep school. I didn’t set a goal for myself from the very beginning. I’m trying to enjoy it”.

ST35: “I cannot determine my learning goals on my own. Someone should help me in this regard. Maybe you can help us.

Additionally, the interviewees ( $N=8$ ) reported having difficulty in time management in online tasks, as indicated in the following extracts:

ST31: “Since we cannot keep up with the speed of the instructors and the intensity of the subjects, we do not have the chance to revise subjects. As Zoom has a 40-minute limitation, we, students and instructors, always race against time”.

ST21: “We are overloaded with too many tasks each week and this makes our time management difficult.”

Table 3 shows the descriptive results of the participants’ beliefs about controlling their own learning.

Table 3

*The Descriptive Statistics of Participants’ Beliefs on Controlling Their Own Learning*

Items	<i>N</i>	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	<i>X</i>
Learner control (in an online context)							3.28
11. I repeated the online instructional materials on the basis of my needs.	217	17.1	49.8	18.4	10.6	4.1	3.64
9. I can direct my own learning progress.	217	12.00	36.9	29.5	13.8	7.8	3.31
10. I am not distracted by other online activities when learning online (instant messages, Internet surfing).	217	9.2	30.0	18.4	26.7	15.7	2.90

Table 3 indicates that 66.9% of the participants agreed that they repeated the online instructional materials based on their needs. Nevertheless, although nearly half of the students agreed (48.9%) that they could direct their own learning progress, a notable number of students were hesitant about the issue (29.5%). Another significant finding is that 39.2% of the participants claimed that they were not distracted by other online activities, whereas 42.4% stated that they were distracted by other online activities during online learning.

As for directing learning progress, seven students specified that they were unsure about how to direct their own learning progress online as follows:

ST10: “We are not in control of our learning process. We learn what is imposed on us. We do not have a chance to choose or sort. We are not the decision-makers”.

ST13: “There is a coursebook and curriculum to follow. The topics to be covered week by week are determined in advance. So I do the exercises in the book. I do not go out of the coursebook. I don’t know if I have to use extra resources”

With regard to the issue of distracters, 11 students opined that they were not distracted by other online activities as indicated in the following extracts:

ST26: “The functions, such as chat, break-out rooms, screen sharing, raising a hand, annotation etc., do not distract me; on the contrary, they draw my attention. Sometimes I daydream. When someone asks something or the teacher gives someone a say, it makes me awake”.

ST17: “When the teacher enters any other relevant site at that moment, it becomes catchy in terms of visuality and audibility and makes the learning more interactive”.

On the other hand, 14 students expressed that they were distracted easily by other online activities.

ST32: “Distractions during online lessons disturb me a lot. For example, if someone leaves his or her camera on and moves or does something, or if they forget to mute themselves, and there are noises coming from behind, I get distracted very quickly and I cannot easily come back to myself”.

ST1: “What bothers me the most is the messages sent to the WhatsApp groups. Someone constantly sends out irrelevant messages and makes me break away from the lesson”.

Table 4 displays the descriptive results of the participants’ beliefs about their motivation for online learning.

Table 4

*The Descriptive Statistics of Participants’ Beliefs on Their Motivation for Online Learning*

Items	N	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	X
Motivation for learning (in an online context)							3.94
12. I am open to new ideas.	217	34.6	53.9	7.4	3.2	.9	4.17
14. I improve from my mistakes.	217	18.9	62.7	15.7	1.8	.9	3.96
13. I have motivation to learn.	217	15.7	49.3	26.3	6.9	1.8	3.70
15. I like to share my ideas with others.	217	17.1	39.6	28.6	10.6	4.1	3.54

The results revealed that the most agreed dimension for online learning was about the participants’ motivation for learning ( $M=3.94$ ). In this respect, the participants mostly agreed that they were open to new ideas (88.5%), learned from their mistakes (81.6%), had motivation to learn (65%), and liked to share their ideas with others (56.7%). Their high motivation was also reported by the interviewees ( $N=25$ ), as exemplified in the following extracts:

ST4: “Online group discussions enable us to create new ideas, to think creatively and to give us a different perspective. That’s why I am open to new ideas”.

ST33: “Our teacher’s tackling with our pronunciation mistakes and the pronunciation exercises we do help us not to make the same mistakes again”.

ST24: “I find break-out rooms very useful. We can easily share our ideas there with each other”.

Table 5 shows the descriptive results of the participants’ beliefs about their online communication self-efficacy.

Table 5

*The Descriptive Statistics of Participants’ Beliefs on Their Online Communication Self-Efficacy*

Items	N	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	X
Online communication self-efficacy							3.70
17. I feel confident in expressing myself (emotions and humor) through text.	217	24.9	44.7	21.2	6.9	2.3	3.82
16. I feel confident in using online tools (email, discussion) to effectively communicate with others.	217	19.8	49.8	21.2	7.4	1.8	3.78
18. I feel confident in posting questions in online discussions.	217	15.2	40.1	29.5	10.1	5.1	3.50

It is evident in table 5 that more than half of the students felt confident in expressing themselves through text, in using online tools to communicate with others effectively (69.6%) and in posting questions (55.3%), as mentioned in the following extracts.

ST2: “I think I express myself better by writing. For this reason, I often use chat. Thus, I express my opinions comfortably”.

ST28: “Normally, I’m shy. I could not easily ask questions in face-to-face education, but I can do it easily online with the “raise hand” function or I can write it to the “chat” feature if my voice does not go to the other party. I think the features in ZOOM appeal to me”.

Preparatory school students’ beliefs about online learning process were also examined in terms of their program type, gender, previous online learning experience and internet connection type. Based on the Mann-Whitney U test results, whether the participants’ English preparatory program was compulsory ( $N=158$ ) or not ( $N=59$ ) revealed a significant difference between their beliefs about their online readiness regarding only one item which was about repeating the online learning materials based on their needs ( $U=3775.500$ ,  $p=.021$ ). To clarify, the participants without the compulsory preparatory program ( $MR=124.01$ ) repeated the online learning materials



based on their needs more than those with the compulsory preparatory program ( $MR=103.40$ ).

9 participants with optional preparatory program reported their revision of the online learning materials based on their needs as follows:

ST22: "My department is Maritime and Port Management. I do not worry that I will learn the grammar and rules of English in the best way. By the end of the year, my only goal is to be able to speak English fluently. For this reason, I repeat the "Practice" part of the online application of the coursebook in my spare time".

ST11: "My department is Econometrics. I will not have the chance to be exposed to English again in four years like my friends with compulsory program. My aim is to get the maximum benefit from the program during this period. For this purpose, I try not to miss any lesson and to repeat the subjects after the lesson. I do the extra activities in the application. I watch the video parts of the coursebook with expressions in everyday language over and over and I repeat those expressions myself".

Table 6

*The Difference between Male and Female Participants regarding Their Online Learning Process*

The items	Gender	N	Mean Ranks	U	Z	P
1. I feel confident in performing the basic functions of Microsoft Office programs (MS Word, MS Excel, and MS PowerPoint).	Male	96	118.11	4933.500	-1.994	.046
	Female	121	101.77			
2. I feel confident in my knowledge and skills of how to manage software for online learning.	Male	96	120.36	4717.500	-2.520	.012
	Female	121	99.99			
16. I feel confident in using online tools (email, discussion) to effectively communicate with others.	Male	96	118.47	4899.000	-2.135	.033
	Female	121	101.49			
17. I feel confident in expressing myself (emotions and humor) through text.	Male	96	118.05	4939.500	-2.009	.045
	Female	121	101.82			
18. I feel confident in posting questions in online discussions.	Male	96	125.64	4210.500	-3.655	.000
	Female	121	95.80			

The Mann-Whitney U test results displayed in table 6 revealed that male participants ( $MR=118.11$ ) felt more confident in performing basic functions of Microsoft Office programs than the female ones ( $MR=101.77$ ). Similarly, the males ( $MR=120.36$ ) felt more confident in their knowledge and skills of how to manage software for online learning than the females ( $MR=99.99$ ). As for communication self-efficacy, the males ( $MR=118.47$ ) felt more confident in using online tools to communicate with others than the females ( $MR=101.49$ ). In addition, the males ( $MR=118.05$ ) felt more confident in expressing themselves through texting than the females ( $MR=101.82$ ) and the males ( $MR=125.64$ ) felt more confident in posting questions in online discussions more than the females ( $MR=95.80$ ).

Males expressed a considerably higher amount of comfort in using digital tools as clarified by some interviewees below ( $N=15$ ):

ST3: “I am interested in computer technologies. I know the Microsoft Office programs like the back of my hand. I was on the project team of the school in high school. We made lots of PowerPoint presentations, prepared visual materials with graphics.”

ST19: “Last year, we were using the zoom in our lessons. I was curious about it. I learned almost all its features by watching YouTube videos. In fact, our teachers were asking for my help when something went wrong in the lesson.

ST 34: “I could not get used to online education. It looks very artificial to me. It’s not like the interaction in the classroom. For example, I cannot use chat or ask questions comfortably as I feel like I am sabotaging the lesson. I think boys are better at these issues than us and they are quite comfortable. We are afraid that we will do something wrong, and they do not have such anxiety”.

Table 7

*The Difference between the Participants with Pre-Online Learning Experiences and without Pre-Online Learning Experiences regarding Their Online Learning Process*

The items	Pre-online learning experience	N	Mean Ranks	U	Z	P
1. I feel confident in performing the basic functions of Microsoft Office programs (MS Word, MS Excel, and MS PowerPoint). (MSWord, MS Excel, MS Power Point)	Yes	90	101.43	4754.000	-2.209	.027
	No	127	119.68			
6. I manage time well.	Yes	90	116.32	4785.000	-2.098	.036
	No	127	98.67			

The results in table 7 revealed that the participants without pre-online learning experiences ( $MR=119.68$ ) felt more confident in performing basic functions of Microsoft Office programs than the experienced ones ( $MR=101.43$ ). Furthermore, the experienced ones ( $MR=116.32$ ), while learning online, managed their time better than the inexperienced ones.

With regard to feeling more confident in performing basic functions of Microsoft Office, 12 participants without pre-online learning experiences expressed their views as stated below:

ST7: “I don’t necessarily need to have an online learning experience to use Microsoft Office programs. I already knew “word, excel”. The only new thing I’ve learned is to send homework in Google classroom via Google docs. Actually, I didn’t have difficulty in learning it as I was already familiar with Microsoft Office programs”.

10 participants with pre-online learning experience mentioned about how they manage time well as indicated below:

ST24: “I am more experienced in managing time since I received online education last spring. Zoom is limited to 40 minutes and my eye was constantly on time, sometimes I reminded the teacher that there was the last 10 minutes. If I had questions, I was asking in accordance with time. This year I also pay attention to the same things. I can manage time. For example, some friends miss the deadline for some assignments or cannot complete them because they are not

able to manage time well. They either ignore the assignments or leave it to the last moment. Thank God I have never experienced such situations”

Table 8

*The Difference between the Participants with Limited and Limitless Internet-Connection regarding Their Online Learning Process*

The items	Internet-connection	N	Mean Ranks	U	Z	P
3. I feel confident in using the Internet (Google, Yahoo) to find or gather information for online learning.	Limited	37	83.97	2404.000	-2.907	.004
	Limitless	180	114.14			
15. I like to share my ideas with others.	Limited	37	87.74	2543.500	-2.373	.018
	Limitless	180	113.37			
17.I feel confident in expressing myself (emotions and humor) through text.	Limited	37	90.84	2658.000	-2.053	.040
	Limitless	180	112.73			

The Mann-Whitney U test results also indicated significant differences as for three items depending on the participants' internet-connection facilities. The results in table 8 showed that the participants with limitless internet connection ( $MR=114.14$ ) felt more confident in using the Internet to find information than the ones with limited internet-connection ( $MR=83.97$ ). Furthermore, the participants with limitless internet connection ( $MR=113.37$ ) liked to share their ideas with others while learning online more than those with limited connection ( $MR=87.74$ ). Similarly, the participants with limitless internet connection ( $MR=112.73$ ) felt more confident than those with limited internet-connection ( $MR=90.84$ ) in expressing their thoughts through text.

The following extracts might shed light on the reasons of the participants with limitless internet connection ( $N=25$ ) feeling confident as follows:

ST17: “I can easily access the website and the information source I want on the internet. I have no worries that my internet package will run out because it is unlimited”.

## Discussion

In line with Wei and Chou (2020), who suggested that online learning perceptions of college students profoundly and positively impacted their readiness for online learning, the study highlighted the importance of detecting online learning readiness level of students in higher education to improve the preparation, development, and implementation of online educational resources. As for the participants' readiness, the study revealed that prep school students at the tertiary level had a moderate level of online learning readiness, which is consistent with the findings of the studies by Chung, Subramaniam, and Dass (2020) and Çakır and Horzum (2015).

The first sub-research question, which sought to find out the beliefs of preparatory school students about their computer- internet self-efficacy, revealed generally moderate results. As also reported in the studies conducted by Chung, Noor, and Mathew (2020) and Hung et al. (2010), a large number of prep school students felt

confident in using the internet to find or gather information. Similarly, the interviewees attributed their capability of using technology to their frequent exposure to technological tools.

The second sub-research question, which was formed to reveal the participants' beliefs about their self-directed learning, indicated that prep school students displayed the lowest mean scores among the five sub-dimensions. Unfortunately, a substantial number of participants were undecided about how to prepare a satisfactory study plan, set up their learning goals and manage their time well. This finding contradicts those of Cigdem and Yildirim (2014) and Kırmızı (2015), which indicated that tertiary education students had higher level of readiness in the dimension of self-directed learning. Qualitative findings with regard to the aforementioned points corroborate the findings of Mishra et al. (2020) and Chung, Noor, and Mathew (2020), who reported that making online learning personalized is the most important skill that needs to be developed by students.

The findings of the study revealed that prep school students were also hesitant about directing their own learning progress, which is in parallel with the studies by Schunk and Usher (2012) and Taipjutorus et al. (2012) that learners should have a say on *what* to learn, *how* to learn and *to what amount* they would learn. Furthermore, one of the most striking findings of the study was that two types of learners emerged: the ones who argued that they were distracted by some other online activities easily and the others who argued that they were not distracted by them easily. The former group claimed that they were distracted by some other online activities such as going to break out rooms, screen sharing, annotation etc. easily because there were too many distracters around them like the noise coming from outside and/or the other family members, WhatsApp messages, chat notifications, classmates who unmute microphones etc. This finding is similar to the findings of Hung et al. (2010) and Chung, Noor, and Mathew (2020). On the other side, the latter group proposed that they were not so easily distracted by such digital distractions. On the contrary, they think such practices draw themselves to the lessons, as can be seen from interview extracts.

The study also aimed to investigate the participants' beliefs about their motivation for online learning, which indicated the highest mean score among the five constructs. Prep school students generally opined that they were open to new ideas, learned from their mistakes, had motivation to learn, and liked to share their ideas with others in virtual classes, as implied in the findings of the studies by Alsancak-Sırakaya and Yurdugül (2016), Çakır and Horzum (2015), Chung, Noor, and Mathew (2020), Cigdem and Ozturk (2016), Tang and Lim (2013), and Torun (2020).

The last sub-question aimed to delineate the participants' beliefs on their online communication self-efficacy. The results demonstrated that prep school students felt confident in expressing themselves through typing and using online tools to communicate with others effectively and they felt confident in posting questions online via "raising hand" and using the chatbox. This result is in line with the one reported by Dhawan (2020) and Hung et al. (2010), who found that online applications such as Zoom and Google Meet allowed learners to utilize program functions effectively during virtual classes thanks to user-friendly program features.

Based upon the second main research question, the study revealed some points in need of clarification regarding the students' habit of repeating the content of the online learning materials based on their needs. To be more precise, the participants studying at the preparatory program optionally surprisingly repeated the online learning materials based on their needs more than the ones with compulsory preparatory program. As understood by the interview results, the participants without compulsory preparatory program were having fun while learning English, and they wanted to spend the whole year with maximum benefit as they would not be heavily exposed to the language for the upcoming years in their departments. This finding is in line with the findings of Knowles and Kerkman's (2007) study, in which the overwhelming majority of students had relatively intrinsic motivation towards online learning.

Unlike the findings of the study by Chung, Subramaniam, and Dass (2020) and Hung et al. (2010), which indicated no significant difference in terms of gender variable, the results in this study showed significant differences in gender in favor of male participants. The male participants in this study asserted more confidence in performing basic functions of Microsoft Office, in their knowledge and skills of managing pieces of software for online learning, using online tools to communicate with others, expressing themselves through texting, and posting questions in online discussions compared to their female counterparts, which was also reported in the studies by Alsancak-Sırakaya and Yurdugül (2016), Çetin (2008), İpek and Acuner (2011), Tekinarslan (2008). Male participants' success in these areas might be ascribed to their special interest in Information and Communications Technology (ICT), which also explains why they sustain high academic performance during the gamified quizzes and activities.

Furthermore, more than half of the participants in this study were without pre-online learning experience and expressed their content in that they felt more confident in performing basic functions of Microsoft Office programs. Their number was more than that of the experienced ones and they stated that they were already familiar with some basic elements of Microsoft Office programs which indicated the similar results with the study by Chew (2010). Unlike the result of the study by Aliyyah et al. (2020), in which teachers applied question and answer (Q&A) and lecture method due to time limitation of ZOOM, the participants with pre-online learning experience believed that they managed their time better than the inexperienced ones while learning online due to their familiarity with the time constraint of Zoom

With regard to the type of internet connection, the participants with limitless internet connection felt more confident in using the Internet to find information, in expressing their thoughts through text and they also liked to share their ideas with others while learning online more than the ones with limited internet-connection. This finding is also supported by Chung, Subramaniam, and Dass (2020) and Aliyyah et al. (2020), who mentioned that limited broadband, which is less conducive to learning, posed a great challenge for students to participate in online classes. As understood by the interview results, the participants can easily exchange ideas and rehearse with each other for hours without worrying that their internet package will run out while doing their online speaking practice and assessment tasks.

### **Conclusion and Implications**

Along with technological infrastructure, the quality of course content and learning platforms, the level of students' online readiness appeared as one of the vital factors of online learning to obtain the better quality of learning in this online process which has become common practice for university students and lecturers.

Although students underwent an unexpected kind of EFL learning due to the severe impact of Covid-19 on education, the study indicated that learners of English at a preparatory school felt almost confident in using Web 2.0. tools, and they were motivated to communicate and learn in an online context. However, the study also signified the importance of empowering them to become independent learners by guiding them into planning their own learning properly. Thus, it is important that instructors increase prep school students' awareness about taking more responsibility for their own learning. Accordingly, self-assessment tools can be designed for every unit to enable students to regulate their own learning. In addition, instructors should encourage students to collaborate with them and with their peers whenever they are confused in and out of class by using online communication tools.

This study has several limitations that can provide a basis for future studies. The data gathered were limited to the students' beliefs in this study; thus, further studies can be conducted by examining the recordings of online virtual classes to reveal more representative results in a higher education context. Furthermore, further research can also be conducted to examine the opinions of students and lecturers from other universities to view the issue from a broad perspective by including more stakeholders.

#### **Conflicts of Interest**

There are no conflicts of interest in this study.

#### **Author Bio**

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## The Mediating Role of Job Satisfaction in the Effect of Leader-Member Exchange on Burnout: A Study on Physical Education Teachers

### Lider-Üye Etkileşiminin Tükenmişlik Üzerindeki Etkisinde İş Tatminin Aracı Rolü: Beden Eğitimi Öğretmenleri Üzerine Bir Araştırma

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**ABSTRACT:** This research was carried out to examine the mediating role of job satisfaction in the effect of physical education teachers' leader-member exchange on burnout. As data collection tools, leader-member exchange, job satisfaction and the Maslach burnout scale were used. The study group of the research consists of a total of 155 physical education teachers who work in Malatya and Hatay provinces of Turkey. The study group was selected with the convenience sampling method, one of the non-random sampling methods. A questionnaire was applied to the teachers participating in the research via electronic communication tools. Data obtained from participants were analyzed using SPSS Amos 20.0 and Process macro. In the research, descriptive statistics, correlation, confirmatory factor analysis, and bootstrap regression analysis were performed. As a result of this study, it was found that job satisfaction played a mediating role in the effect of leader-member exchange on physical education teachers' burnout levels. It can be stated that increasing physical education teachers' leader-member exchange and improving their relationships with their superiors can effectively increase job satisfaction and reduce burnout.

**Keywords:** Leader-member exchange, job satisfaction, burnout, physical education teacher.

**ÖZ:** Bu araştırma, Beden Eğitimi Öğretmenlerinin lider-üye etkileşiminin tükenmişlik üzerindeki etkisinde iş tatminin aracı rolünü incelemek amacıyla yapılmıştır. Veri toplama araçları olarak lider-üye değişimi, iş tatmini ve Maslach tükenmişlik ölçeği kullanılmıştır. Araştırmanın çalışma grubunu Türkiye'nin Malatya ve Hatay illerinde görev yapan toplam 155 Beden Eğitimi Öğretmeni oluşturmaktadır. Çalışma grubu, tesadüfi olmayan örnekleme yöntemlerinden biri olan kolayda örnekleme yöntemi ile seçilmiştir. Araştırmaya katılan öğretmenlere elektronik iletişim araçları aracılığıyla anket uygulanmıştır. Katılımcılardan elde edilen veriler SPSS Amos 20.0 ve Process makro kullanılarak analiz edilmiştir. Araştırmada tanımlayıcı istatistikler, korelasyon, doğrulayıcı faktör analizi ve bootstrap regresyon analizi yapılmıştır. Bu çalışma sonucunda lider-üye etkileşiminin Beden Eğitimi Öğretmenlerinin tükenmişlik düzeylerine etkisinde iş tatminin aracılık rolü olduğu tespit edilmiştir. Beden Eğitimi Öğretmenlerinin lider-üye etkileşimini artırmanın ve üstleriyle ilişkilerini geliştirmenin iş tatminini artırmada ve tükenmişliği azaltmada etkili olabileceği ifade edilebilir.

**Anahtar kelimeler:** Lider-üye değişimi, iş tatmini, tükenmişlik, beden eğitimi öğretmeni.

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Today, the role of human beings, psychology, and social relations are important factors in the formation and survival of the organizational structure. In organizations where modern approaches in management are treated as open systems, unlike classical and neo-classical theories, the interactions of different elements of the organization are evaluated with each other and with the environment (Öztürk & Soytürk, 2021). Moreover, job satisfaction is considered a function of the employee's exchange with the work environment (Navajas-Romero et al., 2020), in which the working conditions play an important role (D'Elia, 1979). Studies show that teachers with high burnout levels exhibit lower levels of job satisfaction (Nagar, 2012).

Therefore, the feeling of burnout causes the employees in the organization to experience negative emotions (loss of motivation, decrease in job satisfaction, physical and psychological diseases) and events (productivity decreases, workplace accidents, absenteeism increases) (Gabriel & Aguinis, 2021; Schaufeli et al., 2009). In particular, it has been determined that teachers experience a sense of burnout as a result of their long-term work due to their profession (Kara, 2020). For example, Vilorio et al. (2001) conducted a study on physical education teachers' burnout levels, and it was observed that 58.6% had high levels of burnout, 48.6% had moderate levels of burnout, and 10% had low levels of burnout. In addition, Martín Mateos (2006) stated that approximately 60% of physical education teachers working in Spain receiving continuous and long-term sick leave reports are associated with burnout. It has been claimed that 23.4% of these sick leave reports are primarily due to psychological disorders along with physical symptoms (Bartholomew et al., 2014). As can be seen in employees in almost all occupational groups who interact with people face to face due to their jobs, it can be said that burnout is a situation encountered in teachers who are in frequent contact with people such as parents, students, and the school administration (Yılmaz et al., 2020). In particular, it can be foreseen that the decrease in the performance of teachers will undoubtedly have a negative impact on education and training activities. Therefore, managers and employees need to be in constant communication and exchange in order to achieve organizational goals effectively (Alev, 2020). In achieving organizational success, along with the leadership characteristics of the managers or the leadership approach exhibited, the duration of exchange with the subordinates, as well as the quality of this exchange have a significant effect on the employees (Sökmen, 2020). The most important factor determining these factors is the relationship and exchange established between the leader and the member. With this feature, it is considered important in terms of examining the leader-member exchange model (Sürücü, 2021). Within the scope of this information, it is assumed that the results of our research will affect the physical education teachers' job satisfaction positively and the burnout level of the physical education teachers negatively. In the literature, although different components have been investigated on these variables, it has been observed that three variables are the subject together and studies investigating the mediating effect of job satisfaction on the relationship between leader-member exchange and burnout are very limited (Akkoç & Çiftçi, 2016). Considering the positive effects that these variables will create together, it can be said that the research is important when considering the contribution to the organizations and the literature. Considering that a high-quality leader-member exchange can positively affect the job satisfaction of teachers working in educational institutions and reduce their burnout levels, it is thought that this situation

may contribute to the performance of teachers and the educational institutions they are affiliated with. Therefore, the aim of this study is to examine whether job satisfaction has a mediating role in the effect of leader-member exchange on burnout of physical education teachers working in the public sector.

## **Theoretical Framework and Literature Review**

### ***Leader-member Exchange (LMX)***

Leader-member exchange theory first comes into the literature the name Vertical Dyad Linkage (VDL). VDL was developed by Dansereau et al. in 1973 (Dienesch & Liden, 1986). This model focused on the exchange between leader and members within the framework of a vertical dual approach and was renamed as “Leader-Member Exchange (LMX) Theory” in the literature (Dansereau et al., 1975). LMX theory is an approach that examines the relationship quality between the superior (leader) and subordinates (member). A distinctive feature of this theory is based on the dyadic leadership level (Bauer et al., 2006). Role and social exchange theory form the basis of LMX theory (Ariani, 2012). The theoretical structure of LMX is based on Role Theory. According to role theory, the leader tests his members with various assignments. Thus, the degree of compliance and reliability of members with business demands determines the correctness of the type of LMX (Liden & Maslyn, 1998). According to social exchange theory, LMX occurs depending on social exchange (Liden et al., 1993). According to Blau (1964), loyalty, commitment, trust, and relational contracts form the basis of social exchange theory. These concepts explain why, over time, members show loyalty to their organizations and engage in behaviors that are not formally rewarded or coerced. According to the social exchange theory, when the leader shows a positive behavior towards his employee, the employee will show behaviors that will contribute to the leader’s success against these positive behaviors (Sürücü, 2021). According to LMX; the leader divides his members into two groups as “in-group (high-quality relationship)” and “out-group (low-quality relationship)” (Bauer & Green, 1996; Graen & Uhl-Bien, 1995; Liden & Maslyn, 1998; Van Breukelen et al., 2006). In-group; refers to the high-quality relationship between the leading member, where formal relations are not involved, and is a relationship involving positive behaviors (such as mutual trust, more communication, and responsibility, more support, respect, love, tolerance, mutual influence) (Buch et al., 2014; Dienesch & Liden, 1986; Kuvaas et al., 2012; Liden & Maslyn, 1998). Out-of-group relationships, members have less access to leaders, and there is a low-quality relationship within rules and agreement (Graen & Uhl-Bien, 1995; Liden et al., 1997). Relationships in this group are associated with low support, limited interaction, and less reward from members’ leaders (Dienesch & Liden, 1986; Graen & Uhl-Bien, 1995). Thus, depending on this exchange relationship, it is clarified why a more close and high-quality subordinate-superior relationship is established between some employees and superiors, while a formal and low-quality subordinate-superior relationship is established with another group of employees (Bolat, 2011a). In LMX studies, it is generally considered as four dimensions. These dimensions are “reciprocal relationship based on interpersonal attraction (Affect), the degree to which leaders and members are loyal to each other (Loyalty), work for common purposes (Contribution), and perception of dignity (Professional respect)”. Thus, the researchers stated that the measurement tool of LMX is an approach that can be explained by more than one



dimension and component, as opposed to a one-dimensional structure. Another important consequence of the multidimensional component of LMX is that there can be a lot of variability within the types of exchanges (e.g., low-and high-quality LMXs) (Liden & Maslyn, 1998). It is stated that the establishment, development, and maintenance of positive relationships between the leader and the member in the business environment occur through high-quality exchanges (for example, respect, responsibility, admiration, appreciation, support) (Dulebohn et al., 2012; Graen & Uhl-Bien, 1995; Huang et al., 2021; Kurtessis et al., 2017). A high-quality leader-member exchange in the work environment reduces stress factors, while a low-quality leader-member exchange increases stress factors more (Montani et al., 2017). Thus, it can be said that members who have higher-quality relationships with the leader will gain more job-related benefits (motivation, job satisfaction, performance, low level of burnout, organizational commitment) than members with low quality (Kim et al., 2010).

### ***Job Satisfaction***

The concept of job satisfaction was first introduced by the American psychologist Hoppock in his book “Job Satisfaction” published in 1935. Hoppock defined job satisfaction as the psychological and physical satisfaction of employees, environmental factors, and the individual’s subjective response to the work environment (Hoppock, 1935). Locke (1970) defined job satisfaction as “*a pleasant or positive emotional state that is the result of one’s evaluation of one’s job or work experiences*”. F.W. Taylor handled the first job satisfaction studies within the framework of the scientific management approach. Taylor ignored that humans were social beings; he thought that only increasing the wages would satisfy the employees, and he laid the foundations of the incentive wage system. Elton Mayo et al., as a result of the studies known as the Hawthorne researches they carried out at Western Electric Company, revealed the necessity of considering the human being as a whole with its social aspect, and concluded that employees could not be satisfied by increasing wages alone (Bağcı, 2018). Job satisfaction is considered a function of the employee’s exchange with the work environment (Navajas-Romero et al., 2020), where working conditions play an important role (D’Elia, 1979).

### ***Burnout***

Burnout is a syndrome that occurs as a physical and psychological reaction as a result of long-term emotional exhaustion in occupational groups (teaching, nursing, etc.) that deal with people. It imposes higher costs on both the organization and individuals as a result of employees in the organization having a negative attitude towards work and leading to undesirable behavior (Kang, 2013). The concept of burnout was first discussed by Freudenberger and Maslach (Maslach et al., 2001) and was used in the 1970s to describe the situation of high workload volunteers in mental health clinics (Eckleberry-Hunt et al., 2018). Burnout syndrome was first defined by Freudenberger (1974) and explained as “*the state of exhaustion of the individual’s internal resources as a result of failure, fatigue, loss of strength and energy as a result of overload or unmet needs*”. Freudenberger (1974) considered burnout work stress and an occupational hazard. Freudenberger considered burnout only in the emotional dimension and evaluated it as the erosion of emotions and exhaustion of individuals as a result of excessive work demands. According to this approach, burnout does not appear

out of anywhere. Some symptoms appear over time, and in the course of time, with the increase in emotional wear, burnout becomes evident (Yildiz, 2015). On the other hand, Maslach considers burnout as a psychological syndrome consisting of three dimensions (emotional exhaustion, depersonalization, and a sense of decline in personal accomplishment) (Maslach & Jackson, 1981).

*Emotional exhaustion:* This is the dimension in which an individual feels tired, without energy, and devoid of emotion. This dimension appears as the internal dimension of burnout.

*Depersonalization:* This dimension is seen as the interpersonal dimension of burnout. It is expressed as strict and negative attitudes and approaches towards the people to whom the individual serves and unresponsiveness to work. The depersonalization dimension is a response to emotional exhaustion.

*The sense of decline in personal achievement:* This dimension is expressed as the individual's feeling and evaluation of himself as inadequate and unsuccessful (Maslach et al., 2001).

### **Research Hypotheses**

The quality of the relationship between leader and member affects employees' attitudes towards work (Breevaart et al., 2015). Employees with high-quality leader-member exchange are counted as in-group, receiving more support and attention from their leaders. This can lead to job satisfaction by taking extra-role behaviors from the leaders of employees (Liu et al., 2013). Thus, employees may be more likely to obtain both individual and organizational benefits. Studies have found that a high-quality leader-member exchange positively and significantly affects employees (Han & Jekel, 2011). Employees who are considered "in-group" (high-quality exchange) to take some additional responsibilities from their leaders and to communicate more effectively with their leaders increase the level of job satisfaction (Bitmiş & Ergeneli, 2012). Therefore, there are studies in the literature that show that LMX has an impact on job satisfaction (Eryılmaz et al., 2017; Malik et al., 2015; Mardanov et al., 2007; Shaikh et al., 2019). In line with this information, the following hypothesis has been developed.

*Hypothesis 1:* The LMX has a significant and positive effect on job satisfaction.

According to the LMX theory; employees in the -in-group- (high-quality exchange) will experience less burnout than those in the -out-group-. It can be said that employees in the -outgroup- (low-quality exchange) will experience more burnout as they will receive less support, attention, and resources from their leaders (Bolat, 2011b). Lee and Ji (2018), as a result of their work on clinical nurses, have determined that the exchange of leadership members has a negative and significant effect on burnout. Studies were conducted on teachers (Demir, 2019), hotel staff (Bolat, 2011a), nurses (Uğurluoğlu et al., 2013), professional football players (Yildiz, 2011b) in different sectors have found that LMX has a significant and negative effect on burnout. The following hypothesis, which is based on literature and theoretical, has been developed:

*Hypothesis 2:* The LMX has a significant and negative effect on burnout.

It is known that teachers' work satisfaction and burnout levels affect their private and professional lives, improve the productivity and performance of teachers with high levels of job satisfaction and reduce burnout (Kara, 2020). Studies in the

literature state that employees with high job satisfaction levels have low burnout levels (Safari, 2020; Song et al., 2020; Tarcan et al., 2017; Tsigilis et al., 2006). The following hypothesis, which is based on literature and theoretical, has been developed:

*Hypothesis 3:* The job satisfaction has a significant and negative effect on burnout.

Job satisfaction refers to the degree of difficulty and satisfaction with the meaning that the individual feels for their work. When employees get satisfaction from their work, it will enable them to have a better quality interaction with their leader (Ariani, 2012). In addition, it can be said that employees provide job satisfaction and reduce the level of burnout through organizational support resources received from their colleagues and leaders (Hombrados-Mendieta & Cosano-Rivas, 2013). Therefore, considering the relationship between job satisfaction and burnout, it can be mentioned that there is a mediating effect between LMX and burnout relationship. In other words, it can be said that teachers with job satisfaction will experience less burnout than those in the out-group (low-quality exchange) since they will be in the in-group (high-quality exchange according to the LMX theory. Based on these explanations, the following hypothesis was developed:

*Hypothesis 4:* The job satisfaction has a mediating effect on the relationship between LMX and burnout.

## Method

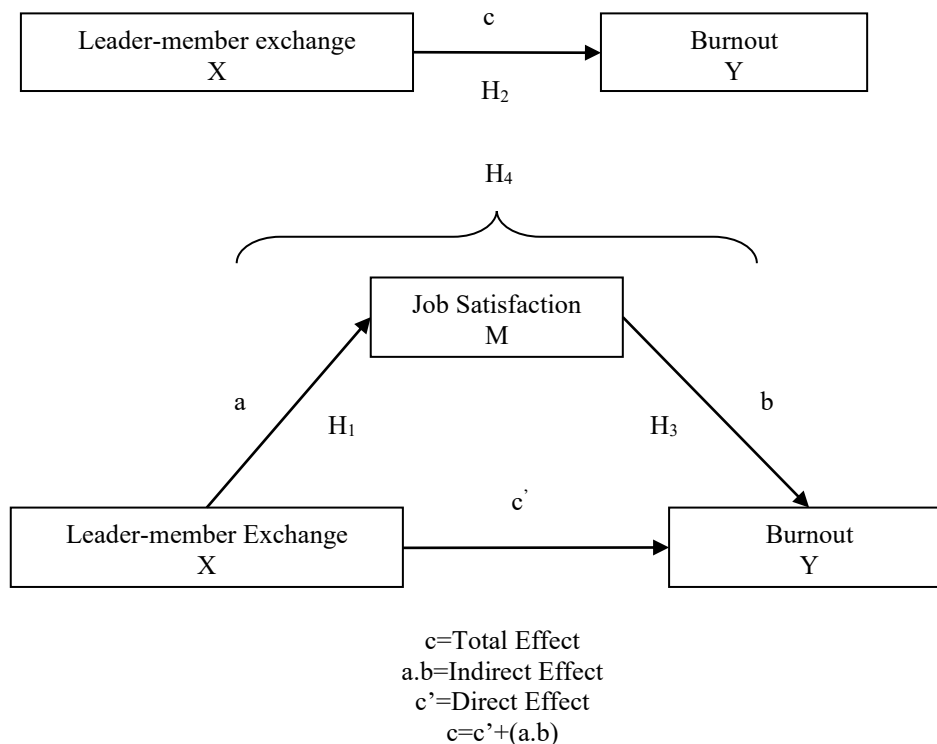
In this study, a relational screening model was used as one of the quantitative research methods. The relational screening model is a research model that aims to determine the level of variability and relationship between two or more variables (Karasar, 2011).

### Research Design

The model of this study, which was conducted to examine the mediating effect of job satisfaction on leader-member exchange and burnout, is presented in Figure 1. This model shows the effect of the independent variable on the mediating variable, the independent variable on the dependent variable, and the mediating variable on the dependent variable. In the contemporary approach, the primary focus of the mediation model is the calculation of indirect effect values and inference from the calculated values. Indirect effect; which is the product of the effect of the predictor (X) on the mediating variable (M) (path a) and the mediating variable (M) on the outcome variable (Y) (path b) (a.b). According to the contemporary approach, in the mediating effect model shown in Figure 1, if there is an indirect effect of X (a.b) as a result of the bootstrap test, the mediation model is accepted as validated (Gürbüz, 2019).

Figure 1

*A Model of Relationships among Leader-Member Exchange, Job Satisfaction, And Burnout*



### Data Analysis

In the data analysis, SPSS Amos 20 and the Process macro developed by Hayes (2018) were used. Before performing statistical analyses on the hypothesis tests, the data to be analyzed were tested using SPSS 20 for missing value, outlier, and normal distribution analysis. According to the result of the Kolmogorov-Smirnov test, the value of the leader-member exchange scale was .076 ( $p > .05$ ), the value of the job satisfaction scale was .096 ( $p > .05$ ), and the value of the burnout scale was .074 ( $p > .05$ ). These values show that all three scales exhibit a normal distribution. As a result of the normality test, it was decided to perform parametric tests. Frequency and percentage calculations were made with SPSS 20 to reveal the demographic characteristics of the participants, and correlation analysis was performed to determine the direction and strength of the relationship between the variables. Then, to verify the construct validity of the scales, confirmatory factor analysis with Amos and to test the mediating role of job satisfaction in the effect of teacher-member exchanges on burnout, regression analysis based on the bootstrap model was performed using the Process macro developed by Hayes (2018).

### Data Collection Tools

#### *Leader-Member Exchange Scale*

The scale was developed by Liden and Maslyn (1998) as LMX-MDM (Multidimensionality of Leader-Member Exchange) in order to determine the levels of leader-member exchange. It was adapted into Turkish, and its validity and reliability study was carried out by Başı et al. (2010) using the “Leader-Member Exchange” scale.

The scale evaluates the level of leader-member exchange in four dimensions (influence, commitment, contribution, professional respect) with a total of 12 questions. Examples of statements are: “I like my supervisor as a person, beyond the work relationship”, “I enjoy working with my supervisor”. Participants answered these statements by choosing one of the 5-point responses (for example, “1-I strongly disagree”, “5-I totally agree”) developed in accordance with each statement. Liden and Maslyn (1998) found the reliability values of the scale as  $\alpha=.90$  for the influence dimension,  $\alpha=.74$  for the commitment dimension,  $\alpha=.57$  for the contribution dimension and  $\alpha=.89$  for the professional respect dimension. Baş et al. (2010) found the reliability values of the scale as  $\alpha=.92$  for the influence dimension,  $\alpha=.86$  for the commitment dimension,  $\alpha=.70$  for the contribution dimension, and  $\alpha=.90$  for the professional respect dimension. In this study, the reliability values of the scale were determined as  $\alpha=.78$  for the influence dimension,  $\alpha=.70$  for the commitment dimension,  $\alpha=.87$  for the contribution dimension and  $\alpha=.88$  for the professional respect dimension. The reliability value of the leader-member exchange scale is  $\alpha=.874$  (Table 2).

### ***Job Satisfaction Scale***

This scale, which was developed by Chang and Chang (2007), was adapted into Turkish by Yildiz (2011a) and then applied in the sports sector by Yildiz (2014). The scale has ten items and two dimensions (intrinsic and extrinsic satisfaction). Reliability values of the scale are .839 for intrinsic satisfaction, .747 for extrinsic satisfaction, and .835 in total (Yildiz, 2011a). The expression “my job provides me the chance to fulfill my ability” is an example of a scale item. The statements in the scale were measured with a 5-point Likert interval (“=I totally disagree”, “5=I totally agree”). In this study, the reliability values of the job satisfaction scale were  $\alpha=.82$  for the intrinsic satisfaction dimension and  $\alpha=.75$  for the extrinsic satisfaction dimension total reliability value of job satisfaction  $\alpha=.82$  (Table 2).

### ***Burnout Scale***

To measure the level of burnout, the Maslach Burnout Scale, developed by Maslach and Jackson (1981) and adapted to Turkish by Ergin (1992), was used for validity and reliability studies. Examples of expressions are: “I feel that I am emotionally cooling down from my work”, “I feel spiritually exhausted at the end of the working day”. The scale is a 5-point Likert-type (1=Never; 5=Always) scale consisting of 22 questions in total to measure three sub-dimensions of burnout: Emotional exhaustion, depersonalization, and the sense of decline in personal achievement. Maslach and Jackson (1981) found the reliability coefficients for each subtest of Maslach Burnout Scale as  $\alpha=.89$  and .86 for emotional exhaustion,  $\alpha=.74$  and .74 for the sense of decline in personal achievement, and  $\alpha=.77$  and .72 for depersonalization. After it was adapted into Turkish by Ergin (1992), the Cronbach Alpha coefficients for these three sub-dimensions are as follows. Emotional exhaustion is  $\alpha=.83$ , depersonalization  $\alpha=.65$ , the sense of decline in personal achievement  $\alpha=.72$ . In this study, the reliability values of the scale were determined as  $\alpha=.82$  for emotional exhaustion dimension,  $\alpha=.67$  for depersonalization dimension and  $\alpha=.75$  for the sense of decline in personal achievement. The reliability value of the burnout scale was  $\alpha=.71$  (Table 2).

### Sample Size and Procedure

This study was limited to physical education teachers working in the state sector. Physical education teachers working in the private sector were not included in the study. The study group of this research consists of a total of 155 physical education teachers, 97 males and 58 females, who work in Malatya and Hatay provinces of Turkey, selected by convenience sampling method, one of the non-random sampling methods. The convenience sampling method is one of the most widely used sampling types in the social sciences (Koç Başaran, 2017). The convenience sampling method was used in the study because of time, effort, and cost difficulties. Convenience sampling method, each sampling unit is given an equal probability of being selected. In this sampling method, all units in the universe have an equal and independent chance to be selected for the sample. In other words, all participants have the same probability of being selected, and the selection of one participant does not affect the other participant. It can be said that the convenience sampling method is superior to other methods in providing representation (Büyüköztürk et al., 2018). The study was based on voluntary participation. A questionnaire was applied to the teachers participating in the research via electronic communication tools. The number of questionnaires filled in was found to be 162. However, 7 scale forms were excluded from the study due to their extreme values. The remaining 155 forms were found suitable for analysis.

### Ethical Procedures

This study received ethics approval from the Humanities Sciences Ethical Review Committee of the Social and Human Sciences Ethics Committee of İnönü University [2021/15-23].

### Results

The majority of the sample was males (62.6%) and married (67.1%). Most participants had undergraduate degrees (60.6%) and were between 36 and 45 years old (37.4%). Most of the participants' income level was between 5001 TL and 6000 TL per month. Approximately 25.8% of participants had worked for the same educational institution between 1 and 5 years (Table 1).

Table 1

#### *Demographic Characteristics of Participants*

Variables		<i>f</i>	%
Gender	Male	97	62.6
	Female	58	37.4
	Total	155	100.0
Age	25 years and under	29	18.7
	26-35	27	17.4
	36-45	58	37.4
	46-55	41	26.5
	Total	155	100.0
Marital Status	Married	104	67.1

	Single	51	32.9
	Total	155	100.0
Education	Undergraduate	94	60.6
	Postgraduate	48	31.0
	PhD	13	8.4
	Total	155	100.0
Income (TL)	4000 and less	19	12.3
	4001-5000	35	22.6
	5001-6000	68	43.9
	6001 and over	33	21.3
	Total	155	100.0
Total number of years employed (year)	1-5	40	25.8
	6-10	23	14.8
	11-15	23	14.8
	16-20	19	12.3
	21-25	33	21.3
	26 years and over	17	11.0
	Total	155	100.0

### Validity and Reliability Analysis

According to the results of confirmatory factor analysis used to confirm the construct validity of the scales,  $X^2/df$  values of the scales and the values of other indices had acceptable compatibility (Meydan & Şeşen, 2011; Mishra & Datta, 2011; Uzun et al., 2010). Moreover, Cronbach's alpha coefficients showed that the leader-member exchange and job satisfaction scales were highly reliable, while the burnout scale was quite reliable (Bursal, 2017) (Table 2).

Table 2

#### Validity and Reliability Results of the Scales

	Variables	$X^2$	df	CMIN/DF	GFI	AGFI	CFI	NFI	RMSEA	Cronbach's Alpha
				≤5	≥.85	≥.80	≥.90	≥.90	≤.10	
1	Leader-Member Exchange	124.28	48	2.58	.93	.85	.92	.90	.07	.874
2	Job Satisfaction	125.50	32	3.92	.87	.89	.91	.90	.08	.829
3	Burnout	411.32	20	2.06	.95	.92	.96	.92	.06	.719

Note. Goodness of fit value ranges is arranged according to "acceptable standards".

Note. (Meydan & Şeşen, 2011; Mishra & Datta, 2011; Uzun et al., 2010)

### Correlation Analyses

The results of the correlation analyses reveal that there are significant relationships between the dependent and independent variables within the scope of the research model (Table 3).

Table 3  
*Results of Correlation Analysis*

Scale and Sub-Dimensions	1	2	3	4	5	6	7	8	9	10	11	12
1. Leader-Member Exchange	1											
2. Affect	.734**	1										
3. Loyalty	.742**	.328**	1									
4. Contribution	.829**	.397**	.580**	1								
5. Professional Respect	.737**	.663**	.290**	.409**	1							
6. Job Satisfaction	.610**	.497**	.358**	.491**	.533**	1						
7. Intrinsic Satisfaction	.507**	.476**	.247**	.296**	.598**	.829**	1					
8. Extrinsic Satisfaction	.539**	.387**	.358**	.526**	.343**	.886**	.475**	1				
9. Burnout	-.024	-.033	.051	-.082	.007	-.259**	-.243**	-.206**	1			
10. Emotional Exhaustion	-.178*	-.224**	.002	-.122	-.231**	-.501**	-.514**	-.362**	.808**	1		
11. Depersonalization	-.152	-.205*	.001	-.091	-.205*	-.284**	-.324**	-.178*	.640**	.534**	1	
12. Personal Accomplishment	.314**	.399**	.08	.099	.475**	.484**	.554**	.302**	.067	-.468**	-.332**	1

\* Correlation is significant at the .05 level

\*\* Correlation is significant at the .01 level

The result of the correlation analysis in this study showed that there was an insignificant  $r$  ( $-.024, p > .05$ ) relationship between LMX and burnout. In addition, there was a moderately significant and positive  $r$  ( $.610, p < .01$ ) relationship between LMX and job satisfaction. However, the findings reveal the existence of a low-level negative relationship between the variables of job satisfaction and burnout,  $r$  ( $-.259, p < .01$ ).

### Bootstrap Regression Analysis

In the analysis of the mediation model, the contemporary approach, which was put forward as a result of the criticisms brought to the Baron and Kenny method (traditional approach), was taken as a reference. Especially in the contemporary approach, it is recommended to test the indirect effect with the bootstrap technique, which produces stronger and more valid results than the Sobel test. Calculating the indirect effect values and making inferences from these values in mediation analyses is the focus of the contemporary approach. The indirect effect is found by multiplying “path a” with “path b”. The path a is the effect of the independent variable (X) on the mediating variable (M), and path b is the effect of the mediating variable (M) on the outcome variable (Y) (Gürbüz, 2019). In the bootstrap method, more reliable results are obtained by correcting the bias and skewness related to the distribution. The contemporary approach decides whether there is a mediating effect or an indirect effect (a.b) by looking at the values in the 95% confidence interval (CI) obtained as a result of



the bootstrap analysis. Accordingly, if the lower and upper confidence interval values corresponding to the indirect effect (a.b) value do not include the zero (0) value, the indirect effect is considered significant and it is understood that the mediation effect occurs (Gürbüz, 2019). Analyses were made using the Process macro developed by Hayes (2018). In the analysis, 5000 resampling options were preferred with the bootstrap technique.

In line with these assumptions, a regression analysis based on the bootstrap method was conducted to test whether the leader-member exchange had a mediating role in the effect of burnout levels and job satisfaction. The bootstrap method avoids primary errors due to inaccuracies in estimating confidence intervals observed in traditional approaches (MacKinnon et al., 2004). The regression analysis results conducted in this direction are shown in Table 4.

Table 4

*The Mediating Role of Job Satisfaction in the Effect of Leader-Member Exchange on Burnout*

	Result Variables			
	M (Job Satisfaction)		Y (Burnout)	
	$\beta$	SE	$\beta$	SE
X (Leader-Member Exchange) (c path)	-	-	-.0111	.0382
$R^2$	-	-	.0006	
X (Leader-Member Exchange) (a path)	.601***	.0632	-	-
$R^2$	.3721		-	-
X (Leader-Member Exchange) (c' path)	-	-	.1014*	.0460
M (Job Satisfaction) (b path)	-	-	-.1869***	.0466
$R^2$	-	-	.0962	
	$F(1; 153)=90.6782;$		$F(2; 152)=8.0925;$	
	$p<.001$		$p<.001$	

\* $p<.05$ ; \*\*\* $p<.001$ ; SE: Standard Error, Unstandardized beta coefficients ( $\beta$ ) are reported

The hypotheses constructed were tested within the scope of the mediation test. First, in testing the hypotheses, regression analysis findings showed that the effect of the independent variable leader-member exchange (X) on the mediating variable job satisfaction (M) (path a) was included. According to Table 4, the leader-member exchange effects job satisfaction significantly and positively ( $\beta=.601$ , 95% CI [.4769, .7266],  $t=9.5225$ ,  $p=.000<.001$ ). It is understood that it is less than .001 and that the CI values do not include 0 (zero). As a consequence, LMX explains approximately 37% ( $R^2=.372$ ) of the variation in job satisfaction.

The combined effects of the mediator variable job satisfaction (M) (path b) and the leader-member exchange variable (X) (c' path) on the outcome variable burnout (Y) were tested. Accordingly, it was seen that the effect of job satisfaction, which is our mediator variable, on burnout (path b) was a statistically significant and negative effect ( $\beta=-.1869$ , 95% CI [-.2790, -.0949],  $t=-4.0114$ ,  $p=.000<.001$ ). When the LMX was included in the regression together with burnout, it was determined that the direct effect value was statistically significant and negative effect ( $\beta=-.1014$ , 95% CI [.0105, .1922],  $t=2.2046$ ,  $p=.029<.05$ ). Leader-member exchange and job satisfaction explain approximately 9.6% ( $R^2=.0962$ ) of the change in burnout. As a result of the analysis test, which did not include the mediator variable job satisfaction (M), it was determined that the effect value of the leader-member exchange (X) on burnout (Y) (path c=total effect) was not statistically significant ( $\beta=-.0111$ , 95% CI [-.0866, .0643],  $R^2=.0006$ ,  $t=-.2918$ ,  $p=.7708>.05$ ).

In the fourth stage, which was perhaps the most important and final stage of the analysis, the analysis was conducted to reveal the indirect effect of leader-member exchange on burnout through mediator variable job satisfaction, according to the confidence intervals obtained using the Bootstrap regression model. The results are shown in Table 5.

Table 5

*The Indirect Effect of Job Satisfaction on the Leader-Member Exchange - Burnout Relationship*

Mediating Variable	Indirect Bootstrap Effect (a.b)	BootLLCI	BootULCI
Job Satisfaction	-.1125	-.1784	-.0543

According to Table 5, the indirect effect (a.b) of the leader-member exchange on burnout was significant; therefore, it was determined that job satisfaction mediated the relationship between leader-member exchange and burnout ( $\beta=-.1125$ , 95% BCA CI [-.1784, -.0543]). The indirect effect value (-.1125) can be interpreted such that those with a high perception of leader-member exchange among the employees have a lower burnout level of -.1125 units than other employees.

The degree of the fully standardized effect size of the leader-member exchange on burnout is given in Table 6.

Table 6

*The Fully Standardized Effect Size of Mediation ( $K^2$ )*

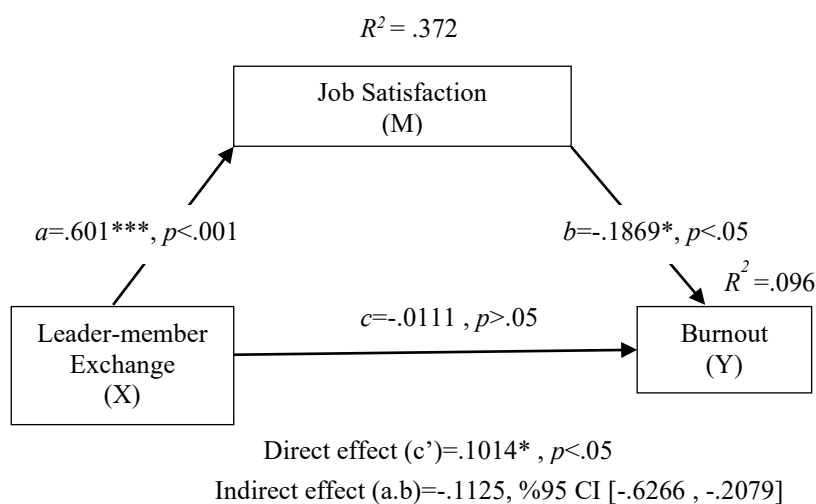
Mediating Variable	$K^2$	BootLLCI	BootULCI
Job Satisfaction	-.2381	-.3703	-.1181

According to Table 6, the confidence intervals in the effect size were significant since they did not include 0 (zero). The fully standardized effect size value was -.2381. Therefore, if the  $K^2$  value is close to .01, it is interpreted as a low effect, if the  $K^2$  value

is close to .09, it is considered as a medium effect, and if the  $K^2$  value is close to .25, it is interpreted as a high effect (Gürbüz, 2019). According to these values, the mediation effect in the model we tested was close to the high value. In line with these results, the four hypotheses of the study were confirmed. The representation of the analysis results on the research model is presented in Figure 2.

Figure 2

## Display of Analysis Results on Model



In this study, a regression analysis based on the bootstrap method was conducted to test the effect of the leader-member exchange on physical education teachers' burnout, and whether job satisfaction played a mediating role in this effect.

As a consequence of this research, it was determined that the leader-member exchange was a positive and significant effect on job satisfaction. In addition, as a result of the correlation analysis, it was determined that there was a moderately significant and positive relationship between leader-member exchange and job satisfaction at  $r (.610)$ . According to this result, physical education teachers with high job satisfaction levels have better relationships with their superiors. In other words, physical education teachers are in the in-group. Conversely, it can be said that teachers with low job satisfaction are in the out-group. Therefore, according to the social exchange theory, it can be said that employees with a high perception of organizational support have higher job satisfaction. This result is in line with the findings of previous studies. Gökalp et al. (2015) found that the leader-member exchange between the school principal and the teacher significantly predicted teachers' job satisfaction. Shaikh et al. (2019) found that leader-member exchange had a positive and significant effect on job satisfaction in a study they conducted on bank employees. Duyan and Yildiz (2018) determined that leader-member exchange affects job performance positively in their research on faculty members working in faculties of sports sciences. Moreover, other studies in the literature concluded that the leader-member exchange of the employees positively affects job satisfaction (Aslan, 2019; Eşitti & Kasap, 2020; Pan et al., 2021). Therefore, it is possible to say that physical education teachers' job satisfaction levels can increase positively by increasing the quality of the LMX.

According to the correlation analysis test between job satisfaction and burnout, a negative and weak relationship was determined between both variables,  $r (-.259)$ . In other words, as physical education teachers' job satisfaction levels increase, their burnout levels (physical and mental fatigue, restlessness, unhappiness, stress levels, etc.) will decrease. There are other studies in the literature that support our analysis results. Vousiopoulos et al. (2019) a negative relationship was found between job satisfaction and burnout, and it was further revealed that physical education teachers experienced higher job satisfaction and lower burnout than primary school teachers. Papisotiriou et al. (2019) found that physical education teachers exhibited low burnout and high job satisfaction in a study investigating physical education teachers' job satisfaction and professional burnout. Teachers who are satisfied with their jobs can be more effective and successful in fulfilling their roles because they are happier and more willing to work (Nagar, 2012). The positive exchange between school administrators and teachers allows teachers to express themselves more decently and also supports them to take a more participatory attitude within the school (Akman, 2021). Therefore, improving teachers' job satisfaction can also have positive effects on students' social and emotional development (Capone & Petrillo, 2020).

According to the Bootstrap analysis result, it was determined that the indirect effect of leader-member exchange on burnout was significant, and therefore job satisfaction mediated the relationship between leader-member exchange and burnout ( $\beta = -.1125$ , 95% BCA CI [-.1789, -.0556]). As a result of the bootstrap analysis, corrected bias and accelerated confidence interval values (BCA CI) did not include 0 (zero). The fully standardized effect size ( $K^2$ ) of the mediator effect was approximately -.2381, and it could be said that this value was an effect size close to a high value. Therefore, the hypotheses of the research were supported in light of these results. This result was also consistent with the findings of the study conducted by Akkoç and Çiftçi (2016). As a result of the research, it was found that job satisfaction played a mediating role in the effect of leader-member exchange on the burnout levels of employees. It was determined that the leader-member exchange was statistically significant effects on employees' job satisfaction and burnout levels, and when the education sector employees' perceptions of leader-member exchange increased, job satisfaction levels increased, and burnout levels decreased. Considering that the participants are physical education teachers, their constant physical activity with the students and the richness of their social lives may cause them not to experience burnout (Colakoglu & Yılmaz, 2014).

In line with these results, it can be said that increasing physical education teachers' leader-member exchange and improving their relationships with their superiors can be effective in increasing job satisfaction and reducing burnout. The development of bilateral relations established with the leaders (i.e., school administrators) of physical education teachers greatly affects their perceptions and attitudes towards both their organizations and their jobs. Providing high-quality communication between the leader (i.e., school administrators) and the member (i.e., teacher) will benefit both the employees and the organization. This encourages the quality of leader-member exchange to ensure the job satisfaction-performance of the employees and the formation of a general motivation process in the organization (Breevaart et al., 2015). Furthermore, it has been determined that school administrators

have a negative effect on the emotional exhaustion or burnout of teachers who have social support (Gonzales et al., 2020). Administrators can reduce the long-term and intense stress of the teachers by helping teachers in the educational activities of the school. This way, teachers can be prevented from having negative attitudes such as helplessness. In addition, this may be effective in preventing negative emotions such as occupational fatigue and reluctance to work. Reducing even one of the experienced negative emotions can help reduce other negative emotions. For such reasons, it is believed that establishing high-quality exchanges between school administrators and teachers is beneficial (Demir, 2019). As a final note, it should be reminded that the existing data in this study were collected only from physical education teachers, and therefore, it is not possible to make generalizations regarding the results. This result obtained from the study is important in terms of filling the gap in the literature. Considering the limited number of studies in the literature that deal with the variables of leader-member exchange, job satisfaction, and burnout together, and the positive outcomes of this study on physical education teachers, it can encourage school administrators to exhibit transformational leadership behavior towards their employees to increase both individual and organizational performance. Thus, it is thought that the quality of the relationship between leaders and subordinates can be improved more, the professional stress and burnout of their employees can be reduced, motivation, job satisfaction, and performance can be increased. A positive climate and an effective communication environment can be created or improved by periodically organizing leisure time activities (sports, nature walks, cultural etc.) with their employees in educational organizations. This study is limited to physical education teachers working in the state sector. Therefore, the results of this study cannot be generalized to all educational institutions due to both the sample size and the variety of teacher branches in educational institutions. Further research is needed to determine whether the results in this study are supported and similar with different samples. Researchers can examine the relationship between leader-member exchange, job satisfaction, and burnout in other educational institutions or different sectors by using similar methods in future research.

### **Conflicts of Interest**

There are no conflicts of interest in this study.

### **Author Bio**

Mehdi Duyan completed his bachelor's degree in sports management at the school of physical education and sports in 2006, his master's degree in physical education and sports at Mugla Sitki Kocman University in 2014, and his doctorate in physical education and sports at Mugla Sitki Kocman University in 2019. Between 2009 and 2016, he worked as a civil servant in the Agri, Hatay and Mugla provincial agencies of the General Directorate of Sports. Between 2016 and 2020, he worked as a lecturer at Bitlis Eren University school of physical education and sports. Since 2020, he has been working as Asst. Prof. Dr. in the department of physical education and sports teaching for Handicapped at Inonu University Faculty of Sports Sciences.

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## Challenges of Providing Learners with Scaffolding during Synchronous Online EFL Teaching

### Senkron Çevrimiçi İngilizce Öğretiminde Öğrencilere Öğrenme Desteği Sağlamanın Zorlukları

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**ABSTRACT:** This study employed Walsh's (2006) concept of classroom interactional competence to investigate the classroom interaction during synchronous online English language teaching. The data of this study is comprised of 8 40-minute video recordings of an EFL class at a state university's English preparatory program. The data belongs to the same group of learners who were taught by the same EFL instructor. The classes were held via ZOOM, a free video-conferencing program. The analysis focused on scaffolding moves of the teacher- specifically reformulation, extension, and modeling moves- for two reasons. First, the data was abundant in terms of teacher talk samples falling into this category. Second, several scaffolding attempts of the teacher were observed to fail due to technology-related problems. There was evidence in the data that the lack of body language harmed the dialogic nature of teacher-learner interaction and reformulation, and extension moves could not bring about extended learner turns. Regarding the unsuccessful modeling, it was observed that the teacher's failure to use annotation tools hindered the learners' noticing of teacher modeling. As a result, these findings have implications for foreign language teachers' adaptation to online teaching and also for the optimization of video-conferencing tools to be developed for educational use.

**Keywords:** Classroom interactional competence, scaffolding, teacher talk, online education, English as a foreign language.

**ÖZ:** Bu çalışma eşzamanlı çevrimiçi İngilizce öğretimi sırasında gerçekleşen sınıf içi etkileşimi Walsh'ın (2006) sınıf içi etkileşimsel yeti çerçevesi etrafında incelemeyi amaçlamaktadır. Bu çalışmanın verisi bir devlet üniversitesi tarafından sunulan İngilizce hazırlık programı bünyesinde verilen bir yabancı dil olarak İngilizce dersi sınıfına ait, her biri 40 dakikalık 8 video kaydından oluşmaktadır. Veri seti aynı öğrenci grubu ve öğretmenin bulunduğu ders kayıtlarından elde edilmiştir. Ders kayıtları, kullanımı ücretsiz bir video-konferans programı olan ZOOM üzerinden yapılmıştır. Veri analizi öğretmenin öğrenme desteği sağlama girişimleri üzerinde yoğunlaşmıştır ki bu girişimler yeniden formüle etme, uzatma ve modelleme biçimlerinde ortaya çıkmıştır. Analizin bu girişimler üzerinde yapılmasının ilk sebebi veri setinde bu kategoriye giren öğretmen konuşması örneklerinin çok sayıda var olmasıdır. İkinci sebep ise, öğretmenin öğrenme desteği sağlama girişimlerinden bazılarının teknoloji nedenli problemlerden dolayı başarısız olduğunun gözlenmesidir. Vücut dili kullanılmamasının öğretmen-öğrenci arasındaki diyalogu olumsuz etkilediği ve yeniden formüle etme ve uzatma girişimlerinin bu yüzden istenen seviyede öğrenci üretimini getiremediği durumlar gözlenmiştir. Başarısız modelleme girişimlerinin ise öğretmenin not alma araçlarını etkin kullanamamasından kaynaklandığı gözlemlenmiştir. Sonuç olarak, çalışmanın bulguları yabancı dil öğretmenlerinin çevrimiçi öğretim sürecine adaptasyonu ve video-konferans araçlarını eğitimsel amaçlarla etkin şekilde kullanmalarına yönelik çıkarımlar sunmaktadır.

**Anahtar kelimeler:** Sınıf içi etkileşimsel yeti, öğrenme desteği sağlama, öğretmen konuşması, çevrimiçi eğitim, yabancı dil olarak İngilizce.

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We are witnessing a shift in our perspectives of teachers' responsibilities in education which is no longer just about teaching content but is mainly about managing the classroom and shaping learner contributions (SLC) to enable learners to make most of the learning experience. In line with this shift, teachers' classroom management has been in the spotlight and referred to as Classroom Interactional Competence (CIC), which briefly describes how classroom discourse (CD) can be used to promote learning if orchestrated properly by language instructors (Walsh, 2006). The teaching endeavor has a highly dynamic structure and it rarely follows one size fits all approach. In order to equip teachers and teacher trainees with a flexible mindset, the orientation of CIC studies has been to describe how CIC emerges in different contexts rather than prescribing them a fixed repertoire (Can Daşkın, 2015). Parallel to this understanding, it is better to treat each language class as a natural habitat deserving to be analysed around its context-specific variables. The employment of conversation analysis (CA) as a research tool supports this approach as CA values how members in a given society use language to form a mutual understanding, 'how participants understand and respond to one another in their turns at talk' (Seedhouse, 2005, p. 166). These turns are influenced by the roles of members and other institutional and context-specific norms. In line with the ethnomethodological nature of CA, which requires researchers to evaluate the data in an agnostic fashion without relying on the premises of any teaching methodology (Seedhouse, 2005), the aim of this study is to describe how an English as a Foreign Language teacher's CIC is influenced by synchronous online language teaching (SOLT), without any attempt to judge or evaluate the effectiveness of her pedagogic style.

Teacher talk is a pivotal component of classroom interaction and teachers' task is not limited to merely ask questions to elicit answers from learners (Huth, 2011), as mostly depicted in the initiation-response-feedback (IRF) circle (Sinclair & Coulthard, 1975, as cited in Jacknick, 2011). It is undeniable that teachers represent a higher status in the class and they are the ones who control the flow of interaction in the class. Yet, they should be competent enough to maintain this control mechanism to create more opportunities for learners to be active participants in the classroom interaction (Walsh, 2011). Language teachers need to notice how much difference their classroom talk creates as 'class-based L2 learning is often enhanced when teachers have a detailed understanding of the relationship between teacher talk, interaction and learning opportunity' (Walsh, 2006, p.16). As such, it is evident that teacher talk is not arbitrary and optimum features of teachers' talk manifesting desired levels of CIC can be listed as follows:

- 'Uses language which is mode and learner convergent and handles mode switching,
- Facilitates interactional space,
- Shapes learner contributions (SLC) by scaffolding, paraphrasing, reiterating, and so on,
- Makes use of effective eliciting strategies' (Walsh, 2006, p. 131).

Teachers' language fosters the learning process in line with the extent it meets these criteria (Walsh, 2006). Among the listed features of ideal teacher talk, this study focuses on scaffolding as a specific realization of teachers' SLC because as in the study

of Can Daşkın (2015), the data has been found to include abundant samples of teacher talk illustrating the teacher's scaffolding efforts during the recorded synchronous online classes. In order to detect SLC in language classrooms, we have focused on instances where the teacher attempted to 'expand, clarify, or summarise a student contribution' (Walsh & Li, 2013, p. 262). Even if these attempts are not noticed by learners immediately, they are counted as valuable instances where an enhanced learning opportunity is provided for them (Walsh & Li, 2013, p. 263). Though there have been other studies conducted to investigate the language teacher's talk in tertiary education context (Can Daşkın, 2015; Yatağanbaba, 2020) along with other educational levels in Turkey (İnceçay, 2010; Korkut & Ertaş, 2016; Sert, 2017), they all focused on interaction taking place in face-to-face environments. The novelty of this research is bi-dimensional. First, it is the only study focusing on EFL education taking place in SOLT at the tertiary level. Second, it focuses solely on teacher's scaffolding among other CIC components, specifically on situations where scaffolding efforts of the EFL teacher failed due to the SOLT-related features while other studies had a more inclusive approach, which also created the need for digging deeper into specific CIC components.

Online education keeps its upsurge as the technological advances continue and starts to be a component of formal education, especially in these unprecedented times when many institutions are obliged to switch to online teaching platforms due to Covid-19 even without completing preliminary preparations that would normally take years for a smooth transition to digital revolution (Adedoyin & Soykan, 2020; Spoel et al., 2020; Strielkowski, 2020). Despite the fact that the appearance of distance education concept dates back to the 1720s, online education, that is computer and internet-based distance education, is a relatively new field emerging in the 1980s (Bozkurt, 2019). Not only because it has a relatively new history but also because most of the education was delivered in face-to-face system prior to the outbreak of Covid-19, it still presents itself as a new field deserving to be searched more in relation to its benefits and drawbacks. Regarding the advantages, online education is promoted for several reasons: enabling geographically distant learners to gather via technology, enhancing participants' computer literacy, and providing enriched dialogue opportunities between teachers and learners despite the lack of physical proximity (Moore, 1991; Palvia et al., 2018). On the other hand, it is sure to bring some challenges along. Palvia et al. (2018) mention the general negative perception on the quality of online education, participants' inability to master the required technological competence, and students' feeling of isolation from peers and instructors among prevalent concerns. Among the disadvantages of online education, Ni and Aust (2008) highlight 'transactional distance' as the ultimate challenge that needs to be addressed for quality online education.

Transactional distance briefly refers to 'a psychological space of potential misunderstandings between the behaviors of instructors and those of learners' (Moore & Kaersey, 1993, as cited in Ni & Aust, 2008). Moore (1993) argues that transactional distance is not static, and it manifests itself in different degrees depending on the structural and dialogic features of the online education under scrutiny, which suggests that it is possible to close this gap with careful planning. To close such a gap, above all, teachers are required to depart from their conventionalized teaching habits to respond to varying levels of misunderstandings likely to arise between instructors and learners in online teaching environments and they need to improve the dialogic nature of their

interactions. As such, understanding how interaction is framed in SOLT settings is important in evaluating to what extent language learning objectives are met and what context-specific hurdles await language teachers. Keeping in mind that language teachers are responsible for building and leading classroom interaction in such a way to maximize students' learning (Walsh, 2002), we find CIC in SOLT environments as a highly significant aspect to be explored. To the best knowledge of the researcher, there is no other study exploring pedagogic interaction with a direct focus on L2 teacher's CIC occurring in SOLT.

Regarding how scaffolding takes place in language classrooms, Can Daşkın (2015) conducted a comprehensive research by focusing on all teacher moves of shaping learner contributions in line with Walsh's (2006) framework. She analysed 4-hour teacher talk from the same EFL classroom. She highlighted the changing nature of SLC attempts by discussing how much benefit students get from SLC is highly changeable depending on classroom modes and there is no way for arguing an ideal way of SLC. Cancino (2017) also employed Walsh's (2006) framework and researched EFL teachers' scaffolding moves by narrowing his focus on classroom context mode which aims to elicit learners' feelings and ideas on a given topic. He mentioned that when EFL teachers aim to encourage learner fluency, they should opt mainly for reformulation rather than modeling and extension so as not to interfere with learners' willingness to express themselves. One recent study focusing on scaffolding, though via employing a different framework than that of Walsh (2006), was carried out by Li and Zhang (2020), who investigated scaffolding moves of language teachers in a CLIL setting in a Chinese university. The scope of the research was restricted to reading classes. The researchers listed a comprehensive set of teacher acts, from marking critical features in a reading text to schema building, as scaffolding moves. The results showed that scaffolding moves of the teachers proved to be highly conducive to learning as they simplified the content and paved the way for learners' use of that content in more cognitively challenging tasks. Still, there is no research on how CIC, specifically scaffolding, takes place in synchronous online language classrooms and this is a gap that deserves to be addressed for several reasons.

Partially due to the compulsory transition to digital education with Covid-19 and mostly as an extension of the fact that digitalization of higher education has been growing as a popular option in educational settings (Kopp et al., 2019), the Turkish Higher Education Board has enacted a recent regulation on 27.05.2020 and online education has been a formal and encouraging mode of delivery in HEIs in Turkey. However, particularly teachers, who are considered to be 'digital immigrants' who need to work hard to harvest pedagogical benefits of technology (Kopp et al., 2019), have been challenged by this transition to online teaching. Along with digital literacy, such as online-compatible lesson preparation (Adedoyin & Soykan, 2020), maintaining a positive attitude towards online teaching (Spoel et al., 2020) and classroom management, including the use of appropriate pitch (Mahmood, 2021), have been difficult skills to master for teachers on online contexts. Among all of these issues that require detailed attention, this paper specifically focuses on teacher talk as the primary means of classroom management and specifically explores scaffolding moves of an EFL instructor in SOLT. The study should be particularly useful in that, to the best knowledge of the researcher, it is preliminary as it focuses on scaffolding taking place



in a formal structured classroom interaction via SOLT. Regarding the obligatory transition to online teaching and learning platforms, the findings should have also implications about the nature of teacher education which needs to adapt itself to the new form of educational delivery.

### **Early Work on the Analysis of Teacher Talk in Online Education**

Parallel to the technological developments and the spread of distance education, online language learning environments have been investigated under different research frames. The majority of the data supporting the existing research is seen to be mainly textual, along with few exceptions analyzing face-to-face online education.

Compton (2009) investigates language teacher qualities required to deliver effective online language teaching by highlighting that language teachers need more than digital literacy to achieve this task. The researcher has proposed three main categories covering the skills a language teacher needs to be competent in online teaching. These three categories are digital literacy skills, online teaching pedagogical skills and online teaching evaluation skills. Though Compton has reached this set of skills thorough literature review and all of them sound plausible, the discussion framed in his study revolves around asynchronous computer-assisted language learning while we do not know what influence language teachers' talk create in SOLT.

One other study was conducted by Guichon (2009) who explored the set of skills that language teachers need during SOLT. The researcher has identified target competencies through reflections of a group of language teacher trainees in relation to their own online teaching. The emerging set of competencies was comprised of three main categories: socio-affective regulation, pedagogical regulation, and multimedia regulation. Gouichon's study is more related to our research as the pedagogical regulation requires language teachers to question to what degree they fulfill learning objectives and how effective the teacher feedback is in favoring language learning through SOLT. Our study will contribute to this area of research in that data coming from real teacher talk in SOLT is analyzed.

Murphy et al. (2011) provide an overview of the features of effective distance language teachers with a comparative focus as they have collected the data both from distance language instructors and distance language learners. What is meant from the distance education here is inferred to be a learning environment where students are assigned tasks to complete by themselves and later get feedback from their instructors in tutorials that may take place face-to-face or via telephone. The researchers have reported that both groups of participants have emphasized how important it is for language teachers to know their subject field and support learners in language skills and how crucial it is for language teachers to provide affective encouragement for their learners. Though useful to understand teacher-learner interactions in asynchronous settings, this study does not provide us with insights into the flow of spontaneous learner-teacher interaction in SOLT.

Many recent studies in relation to the content of online education being offered in compulsory post-pandemic crisis have been conducted. The ones related to decision-makers either focused on online teaching policies and preparations of educational institutions (Adedoyin & Soykan, 2020; Darling-Hammond & Hyler, 2020) or on teachers' perceptions and attitudes towards online teaching (Cutri et al., 2020; Darling-

Hammond & Hyler, 2020; Quezada et al., 2020). Mahmood (2021) is the only one to mention the elements in relation to teachers' talk. Accordingly, teachers should speak slowly and gently, encourage student involvement by asking questions and integrate critical thinking tasks into the classes. Though these suggestions reflect general principles, they do not provide us with concrete implications about the nature of SOLT conducted via video conferencing.

The only study that has been conducted in relation to the discourse of language teachers during SOLT in a formal setting belongs to Hampel and Stickler (2012). In their study, the researchers describe how interaction occurs among participants, including teachers and learners, taking a five-week German course via video conferencing. Due to the software structure, which did not allow more than one speaker to speak at any given time, the researchers report observing teacher-dominant spoken data while learners were seen to convey their messages via a written chat tool. They have also mentioned the teacher's active use of text chat for several purposes: responding to students, modeling written language, and summarizing spoken interaction. They draw the conclusion that many of the features associated with face-to-face interaction can be carried out if the affordances of the software to be used for video-conferencing allows. Their study points at text chatting's functioning as a tool to compensate for the lack of features specific to face-to-face spoken interaction, such as the use of body language or back-channeling.

Still, as for the aforementioned studies, the study of Hampel and Stickler (2012) falls short of addressing the gap this study aims to fill. First of all, it does not specifically provide insights about the features of teacher's talk attempting to shape learner contributions during SOLT. Secondly, the program they employed was not developed enough to allow multiple speakers synchronously. As such, there is still a dearth of studies to comprehend what language teachers go through during their synchronous online teaching experience. This study will build on existing literature by providing the most recent evidence on the thanks to the employment of a highly improved video-conferencing tool, which is ZOOM, for data collection.

### **Method**

In order to observe how CIC manifests in SOLT, 8 hours of synchronous online EFL classes offered in the English language preparatory program of a state university were transcribed in detail. The same EFL instructor taught the classes to the same group of students for two consecutive days. According to in-house placement test results, the participants, who were all intermediate level, were verbally informed about the study before the first class by the researcher who joined the session and left immediately after informing the learners. These learners were all enrolled in the same university's English preparatory program. Though gender is not a variable in the study, there were five girls and three boys in the group whose mean age was 20. Since the medium of instruction was fully English in this university, it is proper to assume that these learners had a high level of instrumental motivation during the data collection as they first needed to prove their language proficiency in order to study their majors. It was emphasized that all personal information was going to be kept confidential. Moreover, the ethics committee approval was taken from the university, with which also the instructor was affiliated.

The classes were recorded automatically via the video-conferencing application being used to hold the sessions. The application used was ZOOM, a video-conferencing tool that allowed 40-minute group recordings consecutively. It was reported to be chosen by the teacher because it was free for the users who signed in the system and the administration of the preparatory program chose it as the platform to be used. Though the application is available for general user profile, it is known to be widely used in educational contexts. The program allows users to join the meetings through their preferred modality, via audio or/and video options, by logging into the application without installing it into their personal computers. Users may mute themselves or/and turn their cameras off at their convenience.

In this study, CIC has been taken for framing teacher talk as a field of inquiry and CA methodology was employed to evaluate CIC emerging in a series of SOLT that was conducted during the Covid-19 outbreak. The study's primary aim is to investigate how teacher talk is shaped during the SOLT setting. CA has been found useful as a methodology of analysis in that it values each conversation with attention to context-specific properties and enables us to systematically analyze the interaction under scrutiny. As such, this study adopts a qualitative research design and it functions as a case study in that the CIC of one EFL teacher was analyzed by focusing on scaffolding moves. This study aims to answer the following research question:

- How are EFL teachers' scaffolding moves affected by SOLT?

### **Data Analysis**

Since this study has no comparative design similar to Can Daşkın (2015) and Sert and Walsh (2013), video-recordings of one EFL instructor who addressed the same group of students ( $N=8$ ) throughout the classes was used as the data. Prior to the study, the instructor was informed and her approval was taken for the analysis of 8 hours. Since the school policy was to videotape the classes and share them on a platform where all enrolled learners could reach them, in case they would like to revisit course content, the instructor herself recorded the classes and shared them with the researcher too, after each class.

The analysis in this study focused on three recurring forms of scaffolding as a kind of SLC, namely reformulation, modeling, and extension. In total, three sets of extracts have been used in the study in order to analyze each type of scaffolding. An emic perspective to the analysis was undertaken to understand how the interaction was shaped by the participants in the data set. As Seedhouse (2005, p. 166) argues, emic perspectives do not impose a static framework for a conversation to happen and rather tries to uncover the participants' way of seeing things and how they 'develop a shared understanding of the progress of the interaction'.

Still, it may prove useful to delineate the borders of scaffolding in order to validate how they were identified in the data set. Scaffolding is a term basically referring to any learning process where a novice is assisted to achieve a goal beyond his initial capacity and this process is attached more importance than the outcome as the novice gets most from the process rather than the achieved goal (Wood et al., 1976). This assisted learning process has been widely associated with Vygotskian Sociocultural Approach and has been valued in relation to second language acquisition (Antón, 1999). Though scaffolding may manifest itself in different forms, this study complies with

Walsh's CIC concept, according to which, scaffolding attempts of a language teacher who tries to shape learners' contributions may happen in the form of either reformulation, modelling, or extension.

### **Ethics Committee Approval**

Ethics Committee Approval for this study was obtained from the Social Sciences and Humanities Research and Publication Ethical Committee Board of Social Sciences University of Ankara (No: 7926, Date: 22.10.2020).

### **Findings**

As teacher-scaffolding was tracked by focusing on the instances of reformulation, modelling and extension in the data set, the findings will be presented in line with these categories. Though there were successful scaffolding moves in the data set, the SOLT context was not detected to be a facilitative factor in those instances. However, SOLT was observed to interfere with the teacher's success of several scaffolding attempts, as will be discussed below.

### **Reformulation**

Reformulation by a teacher is achieved 'where a learner's contribution is reworked using language which is more appropriate' (Walsh, 2006), as the following extract from the data set exemplifies:

Student 1: He is in the second picture is bored.

Teacher: He is bored, yeah, he is bored. He is looking bored.

Reformulation is valued on the basis that it promotes noticing of an error by learners (Thornbury, 1997) and facilitates language learning process by directing learners' attention to what is missing in their deviant language productions (Nassaji, 2007). Extract 1 illustrates how the teacher attempted to reformulate learner utterances in a specific instance taking place in classroom context mode.

#### **Extract 1**

##### *Reformulation in Classroom Context Mode*

- 1 T: ok <now we have a text here a sample text but before reading this sample
- 2 text I want you to focus on your ideas< before writing an essay what do you
- 3 do?
- 4 (.86)
- 5 do you take notes you prepare an outline? do you do brainstorming? or do you
- 6 start and write the essay?
- 7 (3.15)
- 8 L1: I am preparing
- 9 (1.27)
- 10 T: hı hı you → you get prepared for the essay you do brainstorming =
- 11 = L2: plan to write ↓
- 12 (0.79)

13 T: you hi hi → you plan what you will write ok.

14 L2: organizing ideas

15 (0.86)

16 T: hi hi → how in paragraphs you will write and what you will write

17 paragraphs ok↑ very good so↑ if you'll write an advantage and disadvantage

18 paragraph you brainstorm and you write the advantages and disadvantages

19 right↑? then then what else do you wrITE? what else do you BRAINstorm?

\* → has been inserted prior to reformulation of the teacher.

In Extract 1, the teacher is setting the scene for a writing assignment given in the coursebook where learners are going to first read a text and then write their own advantages/disadvantages essay as a reaction to that text. Before assigning the task, she tries to elicit basic steps of writing an advantage/disadvantage essay from her students. As this is a phase where the teacher attempts to establish a context for the next writing activity, it is considered to be materials mode (Walsh, 2006). Reformulation in this extract happens in three ways. First, the teacher structurally modifies a linguistically correct form to capture the intended meaning by adding a little elaboration. From line 1 to 6, the teacher is seen to elicit what the students take into notice while writing an advantage and disadvantage essay. Between these lines, she tries to facilitate the learners' thinking process by reminding some alternative strategies. The first reformulation move of the teacher appears in Line 10 after L1 responds 'I am preparing' in line 8. Though her answer seems grammatically accurate, the teacher takes it as grammatically problematic and in Line 10, she reformulates it as 'you get prepared' because what the student says apparently falls short of representing what she exactly means. Moreover, the teacher is seen to extend the learner's utterance by anticipating how the learner gets prepared for writing tasks and the teacher juxtaposes her own elaboration just after the reformulated part: *you do brainstorming*. This instance is thought to be a failed effort of scaffolding as there is no extension by L1, even no attempt to repeat the teacher's correction, which is accepted as proof of students' noticing (Sert, 2017).

In the second case of reformulation, the teacher makes a move solely as a linguistic correction of a non-target form. In line 11, L2 expresses his strategy in an incomplete phrase 'plan to write' and the teacher reformulates his saying in line 13 as 'you plan what you will write'. Again, similar to the first case of reformulation, there is no learner extension here. Moreover, in his next move in line 14, L2 gives another incomplete response "organizing ideas" and the teacher takes it as in need of improvement both in form and meaning as it is evident from her reformulation in line 16. She reformulates it in a completely different wording and she not only improves the linguistic features of the student's utterance but also carries the student's idea into a higher level by explaining what the word 'organizing' means in an essay writing task. This third case involving the teacher's further contribution explicitly appears to be a scaffolding move in the response stage of IRF sequence where the teacher not only reformulates what students say but also elaborates by adding more thought into it in line with the aim of task at hand (Cullen, 2002).

As another form of scaffolding, modeling is also a prominent feature of teacher talk in foreign language classrooms. While using modeling in the language classroom, a teacher's focus is mainly 'to provide an example for learners' on a linguistic unit (Walsh, 2006, p. 44). Walsh (2006) identifies the following turns as a case of modeling, made especially in obtrusive way in order not to interfere with the student's fluency, in the following sample:

'Learner: the good news is he bought the new car

Teacher: =he bought a new car=' (p. 21)

In the following extract, the teacher offers modeling in a situation that starts as skills and systems mode, which later transforms into the materials mode as she elicits correct answers from the learners for a form-focused exercise about relative clauses.

## Extract 2

### *Modelling in Skills and Systems Mode*

- 1 T: YES, what means the things which which thing what hi hi yes good so
- 2 relative clauses and relative pronouns and you can go to page a hundred and
- 3 five and you can find some relative clauses and pronouns
- 4 (0.75)
- 5 but here let's see what you know let's do these exercises together here we have
- 6 six sentences and these sentences have some mistakes of course related to the
- 7 relative clauses relative pronouns ok let's find the mistakes and correct them
- 8 so first one is instead of which we should use what how about the second one?
- 9 find it and tell me
- 10 (2.5)
- 11 L1: what=
- 12 = L2: which =
- 13 =L3: where =
- 14 =L4: less =
- 15 =L5: whose =
- 16 (1.07)
- 17 L6: which=
- 18 = T: which instead of what↑?
- 19 (1.24)
- 20 L1: which who which
- 21 (1.89)
- 22 T: YESS hi hi → >instead of who, we should use which<
- 23 L: [or that] }
- 24 L: [or that] yeah }
- 25 T: good how about third one?
- 26 (4.60)

27 L L: /who/ /who/

28 (2.03)

29 T: who was who → instead of bla bla we should use bla bla

30 (1.70)

31 L L: /which/ /that/

32 (2.70)

33 T: ok → instead OF

34 (0.80)

35 L: that =

36 = T: whERE

37 (2.01)

38 L: that

39 T: we should use that yes which or that good very good yes FOur

\* → has been inserted prior to modeling of the teacher.

In Extract 2, the teacher sets the scene for an exercise in which the learners are supposed to find and correct the mistakes about the use of relative pronouns. Since the teacher's actions, such as eliciting, modeling, and evaluating, will be based on the language presented in this exercise, it can be considered as the materials mode (Walsh, 2006). The teacher describes what the learners are supposed to do and she immediately starts the activity without allocating any time for the learners to find the correct answers by themselves. In line 9, the teacher asks the learners to tell her the answer for the second item of the activity and after having waited for two and a half minutes, she gets several different responses, out of which only two answers are correct. In Line 22, the teacher attempts to consolidate the learners' noticing of the correct answer and she repeats the answer by inserting it in a phrase 'instead of who, we should use which'. This is her first attempt at modeling. In line 25, the teacher seeks the answer for the third item. She gets the correct answer from two different students who speak simultaneously. In line 29, the teacher seems unsatisfied with the answers and by her question 'who was who' and she implies that the response of the students is not in the form she expects. The teacher further provides a model phrase: *instead of bla bla, we should use bla bla*. However, in line 31, we see that two different students again speak simultaneously and give the answer without even attempting to use the phrase the teacher has just modeled. In line 33, the teacher tries to remind the model phrase by asking 'instead of?' and she still gets another one-word response in the next line. In her very next turn, the teacher herself also responds with a one-word utterance. Similar to the previous reformulation case, the modeling attempt by the teacher seems to fall short of scaffolding learners to utilize the linguistic support provided for them to produce not only structurally accurate but also longer turns.

As it manifests itself in the data, the third form of scaffolding is extension, which basically refers to a teacher's shaping a learner's production to be more comprehensible to other learners (Walsh, 2006).

## Extract 3

*Extension in Materials Mode*

- 1 T: ok how about the third paragraph?  
 2 (1.62.)  
 3 another trick > what is the other trick<?  
 4 (7.50)  
 5 thESE↑ other tricks like whAT↑?  
 6 [like placing] }  
 7 L1: [yeah they are placing] }  
 8 popular items, placing in aisles=  
 9 = T: yea → placing items alone a section so that people have to walk all along  
 10 the aisle looking for them the ideas is to boost dwell time what does it  
 11 mean?  
 12 (2.81)  
 13 L2: waiting  
 14 (1.49)  
 15 T: hı hı → the length of time people spend in a store yes what else?  
 16 (1.89)  
 17 in the other paragraph here? is there a trick here?  
 18 (9.13)  
 19 L1: they joyed or (( )) ((**inaudible**))  
 20 (2.70)  
 21 T: hı hı↓ =  
 22 = L2: so the people feel hunger maybe?  
 23 T: yesss because of instore bakery  
 24 (1)  
 25 → when you smell bakery you get hungry and you want to buy something more  
 \* → has been inserted prior to extension of the teacher.

Extract 3 illustrates three consecutive extension attempts made by the teacher. This part of the class is again in materials mode as the class is studying a reading text. This is a skimming activity in which the learners are expected to identify several selling tricks described in the target reading text. As the teacher checks the answers, three consecutive extension moves are observable.

In line 3, the teacher asks a display question ‘what is the other trick’ to see if the students have comprehended the text. In line 6, when the teacher herself is about to give the answer after having waited for 7.5 seconds, her speech latches with that of another student and the teacher passes her turn to that student. The student partially gives the answer and in the next turn in line 9, the teacher completes the missing part of the argument. Here, she makes the answer comprehensible to other students by extending the argument. In lines 10 and 11, she asks another display question for a vocabulary



item and another student gives a one-word answer in line 13. Again, the teacher extends the learner's answer herself and provides a full definition for the target word in line 15. In line 17, the teacher asks another question, but a quite long waiting time, -9.13 seconds- elapses before any student attempts to answer. In line 19, a student answers but his answer gets less and less audible as the voice fades. Here, it is unclear whether it is because of a connection problem or the student's uncertainty about the answer. The teacher waits for another 2.7 seconds for the student to take the opportunity to speak again, but the student keeps silent. The final attempt of the teacher to get learner extension is seen in line 21. In line 21, when L1 does not continue, the teacher shows her acceptance of the student's two-word utterance by saying 'hı hı', which also indicates that she is expecting to hear from that student. Girgin and Brandt (2020), who investigated teachers' uses of 'Mm hm' as a form of minimal response token, reported that when this utterance was produced with a falling intonation after a pause (see Line 21), it indicated that the teacher expected more talk from the student. In this extract, the teacher's attempt to get more from that student fails because another student, L2 starts a follow-up turn in Line 22 before L1 could not get the chance to elaborate her speech. For L2's contribution in line 22, the teacher is not asking for elaboration from the student, but she is presenting a detailed explanation herself in her turn.

### Discussion and Conclusion

It is clear that SLC is an essential feature of teacher talk in foreign language classes taking place in online synchronous environments as much as it is in face-to-face education. Our study provides evidence.

In terms of the general turn-takings happening in SOLT, the Initiation-Response-Feedback interaction pattern was salient and all the scaffolding moves were observed in the feedback move, which is similar to the observation of Can Daşkın (2015) who tracked CIC in face-to-face education. Feedback move corresponds to the post-expansion phase as described by Sacks et al. (1974; as cited in Jacknick, 2011). Post-expansion in IRF sequence means that the teacher as initiator of a turn adds another turn to interaction upon students' response so that teachers may act on the contribution of students. This observation suggests that IRF sequence, frequently observed in conventional education, is also prevalent in SOLT. It is language teachers who determine the flow of the communication. Though this may be interpreted as a sign of teacher-dominant class structure as expressed by Hampel and Stickler (2012) in their study, it is not a threat to the quality of teaching taking place in SOLT. On the contrary, it may be accepted as a sign of how similar online-lessons can be to face-to-face lessons as teacher's leading position is a prevalent feature for this latter context (Walsh, 2006). Moreover, abundance of teacher talk does not necessarily point at teacher's lecturing but at teachers' efforts to lead students to express themselves more. Similar to Putri's (2015) study, which reports that teachers' talk was mainly comprised of moves such as questions that promoted more learner contribution or appraisals that created a positive environment, our study shows that teacher talk keeps its facilitative role in online second language learning.

One other prevalent challenge arising with SOLT is the scarcity of non-verbal messages of participants, which is abundant in physical language learning settings. Regulations on personal data protection in Turkey empowers students not to open their

cameras during the lessons unless they are volunteer to do so. This creates a challenge for a language instructor in having eye contact with students in the class as students are there but hide themselves via off-cameras or mute options. Learners who participate without their cameras and probably see unmuting themselves as a burden threaten the ‘dialogic nature of teacher-learner interaction’ (Moore, 1991, p. 5), which is an essential element impacting the success of distance education. Similar to what Zhang (2013) reports for virtual SLA environments, this study has found that the absence of eye contact between participants, specifically between the teacher and the students, degraded the potential success of the teacher’s scaffolding efforts, for all three types, extension, modeling, and reformulation. This finding of our study is in line with other studies that confirm the importance of facial expressions in allowing teachers to manage interactional organization through their gazes and gestures in face-to-face settings. Reddington (2018) observes how the teacher in her study utilizes her own gazes to embody an active listenership and to convey the students several meanings, i.e., to bind a student’s contribution to the comment of a previous student, to indicate the closing-down of a student’s turn, and to signal to the whole class that there are further items to be discussed. Girgin and Brandt (2020) also report how the teacher in their study employs gazes successfully to elicit extended learner turns by indicating that a further response was being expected from the student on the spot. Moreover, teachers’ body language, along with facial expressions, is known to be an important tool contributing to the impact of teacher talk (Murphy et al., 2011; Sert, 2015, 2017). Paralinguistic features are essential for teachers to build rapport with learners (Peachey, 2017) and improved SOLT education should enable these features as much as possible. To compensate for this lack, software programmers may consider improving the function of cameras to be used in educational settings so that teachers may act in a wider physical space and use their body language in front of the screen as well. Sert and Walsh (2013) report that the teacher could understand if the student was eager to continue her turn by paying attention to her gaze as a clear sign of her willingness. But in the given online class, the students’ cameras are turned off. It is difficult for the teacher to even identify a student when s/he produces only two words, aside from checking the student gazes. Moreover, the teacher’s perseverance to ask for clarification in this study seems impeded by the low quality of the learners’ internet connection. Unintelligibility resulting from poor connection quality negatively influences teachers’ determination for eliciting extended learner turns.

The modeling attempt of the teacher probably failed because learners may not have noticed her modeling as the teacher did not provide the written version of the target linguistic formula. This assumption regarding the failed modeling attempt is based on Walsh’s (2002) observation, according to which the discourse moves of the foreign language teachers may not always create the desired facilitative influence on learners’ contributions. In this study, the restricted learner involvement has a lot to do mainly with the online teaching environment. If the teacher in this study had used text chatting or a word file for writing down the expression, the students would have noticed her modeling. As Zhang (2013) suggests, systematic optimization is needed for the application to be used for synchronous language teaching in order for teacher talk to achieve the desired goals. An ideal video-conferencing tool should provide users with a practical e-white-board option for teachers or students to write down language samples

without relying on a chatbox. An interactive whiteboard that allows both students and teacher to work on it simultaneously plays a highly supportive and facilitative function in teachers' classroom management (Peachey, 2017).

Regarding reformulations in this study, it is impossible to infer if the students, involving those whose utterances were reformulated, could notice the corrections made. This is because the teacher did not ask for further comments from the students she corrected and did not check if they noticed her reformulation. It is impossible to precisely understand why the teacher did not ask further questions as there are undoubtedly different parameters driving teachers' in-action decisions in the class. Still, depending on our observations, we predict that the video-conferencing tool, Zoom, should be one of the main factors influencing the teacher's insistence level on seeking to what extent the students notice her reformulation moves. In ZOOM, when there are multiple participants whose images expand the borders of the screen, the view of a person speaking at a specific moment does not automatically appear at the top of the screen, which makes it difficult to identify who is speaking.

Additionally, in SOLT, where it appears to be a hassle for some students to turn their cameras on or unmute themselves, the teacher experiences difficulty in maintaining a dialogic interaction with her students. In conclusion, the nature of synchronous online classes seems to require extra effort from teachers to see if their reformulation has been comprehended or not and to encourage extended learner turns. Finally, the teacher's reformulations in this study were mainly in the form of embedded recasts, where the teacher reformulated the erroneous student output 'without highlighting the error or prompting the learner to respond to feedback' (Nassaji, 2007, p. 527). However, it was seen that some of the teacher's reformulations brought along no student repair, which is similar to Nassaji's study (2007). Nassaji reported that embedded recasts without prompts mostly resulted in no student repair. This suggests that L2 teachers may enhance the influence of their scaffolding moves by combining them with some other CIC components, such as a direct question or teacher echo, to elicit a follow-up utterance from students during SOLT.

As for teacher extensions, the teacher's filling in the gaps may have obstructed extended learner turns in this data set, as in the study of Walsh (2002). In Extract 1, we see three consecutive instances where the teacher takes the learners' outputs and reformulates them in enriched sentence structures. This may indicate that the teacher was trying to connect with the learners by showing that she was an attentive listener and understood their messages well. Alternatively, the teacher may have found it difficult to lead learners to repair their own utterances as she could not have eye contact with them, and she may have found it more practical to provide her own extended speech. This observation is in line with the results of Moorehouse (2020), who also reports that discussions taking place via video-conferencing were marked with the abundance of students' lengthened silence and short responses.

The findings of this study suggest several courses of action to improve the quality of SOLT. First of all, it proves useful for teachers and learners to work simultaneously via video-conferencing programs as long as all participants are willing to keep their cameras on. Otherwise, the teacher is not able to control the flow of interaction via the employment of non-verbal communication tools such as gestures and eye contact.

Secondly, language teachers should be more insistent on eliciting longer responses from students. In order to do so, they need to observe the type of teacher reformulation that encourages learners to contribute more. Additionally, they should notice that it may be more tempting to fill in learner gaps, especially in SOLT, rather than insisting on getting a response from learners as it is quite challenging to make invisible students talk. As reported in Li and Zhang's (2020) study, teachers should pay attention to providing support without putting learner autonomy at stake. If teachers' scaffolding attempts turn into full responses that fill in learners' space, learners will not feel autonomous and responsible for participating in the class.

Moreover, online teaching is known to foster the sense of isolation and procrastination attitude, especially in language learners (Peachey, 2017), and it is again teachers who need to adopt pedagogical moves to increase students' motivation. They need to highlight the importance of dialogic interaction in the classroom for learning to occur (Li & Zhang, 2020). In order to make sure that dialogic inquiry of teachers gets the necessary response from learners, teachers may announce some classroom rules from the very beginning to highlight that classroom participation is a prerequisite for success.

One other issue is that even though all participants turn their cameras on, teachers will still have problems using paralinguistic features as fully as in face-to-face settings (Peachey, 2017). To compensate for this limited non-verbal messaging, teachers may try finding alternative ways of conveying their non-verbal messages via using emoticons in text chatting, as in the study of Hampel and Stickler (2012). All of these suggestions take us to the conclusion that pedagogical competences required for synchronous online teaching need to be discussed by considering the digital setting's features (Baran & Correia, 2014; Peachey, 2017). As Peachey (2017) points out, even teachers can feel the sense of isolation if they are not provided with support during online teaching. As such, transition to online teaching should not be treated as a smooth process, and we should prepare both pre-service and in-service teachers for this mode of education.

Finally, as the affordances in SOLT are different from face-to-face education, the teacher should have added another move to check whether students utilize her/his scaffolding moves by using another CIC component such as a display question. As Sert (2017) illustrates in his study, in order to assume that noticing of a linguistic input by the learner takes place, we need a learner initiative as a proof where a learner indicates an awareness on the target structure, i.e., by questioning or attempting to use it, which is lacking in the scaffolding situations analyzed in this study.

There are limitations to this study. The study relies on the same group of participants, making it less generalizable. Furthermore, the study used CA as the analysis tool, and we did not have interviews with the participants. If we could question the participants' reasons behind specific actions, we would be able to match our inferences with their explanations. Finally, CIC comprises of several other elements along with scaffolding and those elements also need to be investigated to see how they are formed in SOLT settings.

### Conflicts of Interest

There is no conflict of interest to be reported for this study.

### Author Bio

The researcher conducts research in the field of teaching English as a foreign language and her research interests mainly cover pragmatics, intercultural sensitivity, English for academic purposes and classroom discourse.

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## Appendix 1

Transcription Conventions (based on Walsh, 2006 and Can Daşkın, 2015)

>< <>	'Greater than' and 'less than' signs indicate that the talk they surround was noticeably faster, or slower than the surrounding talk.
(1.8)	Numbers enclosed in parentheses indicate a pause. The number represents the number of seconds of duration of the pause or the length of silence
(would)	When a word appears in parentheses, it indicates that the transcriber has guessed as to what was said, because it was indecipherable on the tape. If the transcriber was unable to guess what was said, nothing appears within the parentheses.
((would))	unintelligible 4 seconds: a stretch of unintelligible speech with the length given in seconds
=	Turn continues, or one turn follows another without any pause
↑↓	Up or down arrows are used to indicate that there is sharply rising or falling intonation. The arrow is placed just before the syllable in which the change in intonation occurs.
CAPS	Capital letters indicate that the speaker spoke the capitalized portion of the utterance at a higher volume than the speaker's normal volume.
<b>Bold</b>	The writer's comments (in bold type)
// //	Overlapping speech by more than one learner
[do you understand?] [I see]	} overlap between teacher and learner



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## Mediating Multilingual Immigrant Learners' L2 Writing Through Interactive Dynamic Assessment\*

### Çok Dilli Göçmen Öğrencilerin İkinci Dilde Yazma Becerilerinin İnteraktif Dinamik Değerlendirme ile Geliştirilmesi

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**ABSTRACT:** Dynamic Assessment (DA) has lately taken the floor as an alternative by embedding instruction into assessment. Grounded in the dialogic teacher-learner interaction during an in tandem work, DA asserts that diagnosing the learners' matured abilities and needs, mediating them accordingly, and then observing their maturing abilities and microgenesis are crucial. This assertion paves the way to reveal each learner's Zone of Proximal Development (ZPD). Despite some influential studies on the use of DA in language education, more studies are warranted to explore the use of DA in different contexts and with different participants. Therefore, this case study recruited two multilingual immigrants/refugees who were underachievers in L2 writing classes. They were provided individual interactive DA for ten weeks, and the dialogic interactions between the teacher and the students were analyzed. Initial results revealed that the mediational moves mainly rested on teacher-agency, but over time more learner-agency-oriented mediational moves were also adopted. Furthermore, these students started to narrow the gap between themselves and their classmates. Lastly, a semi-structured interview was conducted to illustrate the participants' perspectives towards DA in the L2 writing context, and the related data revealed recurrent themes that had bidirectional relation with DA's theoretical premises.

**Keywords:** Dynamic assessment; L2 writing; multilingual immigrants/refugees.

**ÖZ:** Dinamik değerlendirme (DD) son zamanlarda değerlendirme sürecine öğretimi dahil eden bir alternatif olarak ortaya çıkmıştır. DD sırasında öğretmenler değerlendirme sürecine aktif olarak katılmakta, öğrencilerin değişen ihtiyaçlarını tespit etmekte, kişiye özel arabulucu yöntemler kullanmakta ve gelişimlerini takip etmektedirler. Öğretmen ve öğrencinin ortak çalışma ve karşılıklı diyalog sürecine odaklanan dinamik değerlendirme, öğrencilerin var olan yetenek ve ihtiyaçlarını teşhis etmenin, ihtiyaçlara göre öğretme sürecine arabuluculuk etmenin ve ardından öğrencilerin gelişimlerini gözlemlemenin önemini vurgulamaktadır. Bu yöntem her öğrencinin Yakınsal Gelişim Bölgesini (ZPD) ortaya çıkarmaktadır. Dinamik değerlendirmenin dil eğitiminde kullanımına dair bazı çalışmaların olmasında rağmen, DD'nin farklı bağlamlarda ve farklı katılımcılarla kullanımı araştırmak gerekmektedir. Bu nedenle, bu durum çalışmasına ikinci dilde yazma becerileri dersinde başarısız olan iki çok dilli göçmen/mülteci öğrenci dahil edilmiştir. On hafta boyunca bireysel interaktif DD seanslarına katılan öğrencilerin öğretmenleri ile olan diyalogları analiz edilmiştir. Sonuçlar, başlangıçta arabuluculuk hareketlerinin çoğunlukla öğretmen odaklı olduğunu, zamanla öğrenci odaklı arabuluculuk hareketlerinin benimsendiğini ortaya koymuştur. Ayrıca bu öğrenciler DD sayesinde sınıf arkadaşları ile aralarında var olan açığı kapatmaya başlamışlardır. Son olarak, ikinci dilde yazma bağlamında katılımcıların DD'ye bakış açılarını öğrenmek için yarı yapılandırılmış bir görüşme yapılmış ve ortaya çıkan temalar DD'nin teorik önermeleri ile çift yönlü bir ilişkisi olduğunu göstermiştir.

**Anahtar kelimeler:** Dinamik değerlendirme; ikinci dilde yazma; çok dilli göçmenler/mülteciler.

\* This study is a part of doctoral thesis of the first author under the supervision of the second author at Hacettepe University.

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This case study aimed to illustrate the process of mediating multilingual immigrants/refugees' L2 writing through individual interactive Dynamic Assessment (henceforth DA) and their perspectives towards employing DA in L2 writing classes. The fusion of instruction and assessment in a single activity is the hallmark of DA, and teachers actively intervene in the assessment process and work collaboratively with students. During this in tandem work, the teachers simultaneously instruct the students through graduated (from implicit to explicit) mediational prompts and assess their reciprocity acts (Poehner, 2008). Moreover, it differs from other assessment approaches since it is iterative, process-oriented, and systemic; and it includes teachers and students as active agents and requires dialogic interaction (Poehner, 2008; Poehner & van Compernelle, 2020; Shrestha, 2020). The theoretical underlying premises of DA relies on Vygotsky's Sociocultural Theory (SCT). The SCT moots that social interaction paves the way to foster individuals' cognitive development, and this developmental process cannot be pre-defined, but it is unique to each person. Therefore, exposure to mediation through interaction with the social world, such as peers, parents, and teachers, and the individuals' regulation of the mediation over time are salient to recognize their cognitive development and Zone of Proximal Development (the distance between what a person can achieve through assistance and what a person can achieve in the future without assistance (Vygotsky, 1978)).

There are some influential studies conducted on the use of DA in different L2 settings (Alavi & Taghizadeh, 2014; Davin, 2013; Poehner & Infante, 2015; Poehner & Leontjev, 2018; Poehner & van Compernelle, 2020; Shabani, 2018; Shrestha, 2017, 2020; van Compernelle, 2016; Xian, 2020; Zhang & van Compernelle, 2016). For example, Birjandi and Ebadi (2012) explored two female university students' microgenetic development on the use of modals in L2 (English) writing tasks through individual online DA and revealed each learner's differential needs and progress and/or resistance to change in time. Ebadi and Rahimi (2019) further explored six female English as a Foreign Language learners' microgenetic development in academic writing skills and their transcendence abilities by online DA. They concluded that especially those students who needed more attention could benefit from the online synchronous DA sessions. Shrestha (2020) also illustrated the microgenetic development of advanced ESP (English for Specific Purposes) students' writing skills through online DA. Yet, there are still some gaps that need further investigation. First, the related studies mostly recruited advanced, high-intermediate, and intermediate level L2 learners, but illustrating the potential contribution of interactionist DA to beginner level and/or 'academically at-risk students' (Kozulin & Garb, 2002, p. 112) in the L2 writing context needs to be illustrated. Second, the influential studies were mostly relied on qualitative data as their focal points were the learners' microgenetic development. This study, on the other hand, aims to triangulate the data and reveal the students' transcendence abilities by analyzing the moment-to-moment analysis of the dialogic interaction between the teacher and the students and analyzing each student's writing test-scores in three different periods (pre-test, post-test, and delayed post-test). Lastly, exploration of the microgenetic growth (changes and development of the learners' abilities in doing the same or similar tasks in a period of time (Vygotsky, 1978)) of the multilingual immigrant/refugee students who are underachievers when compared to their classmates through DA and their perspectives towards adopting DA in the L2 writing classes has

not been included in the research. Driven by this gap, this case study recruited two multilingual immigrants/refugees who were underachievers and demonstrated in detail the mediational moves of DA sessions and the participants' emotions/perspectives on DA.

### **Vygotsky's Sociocultural Theory**

Len Semenovich Vygotsky (1978), the Russian clinical psychologist, asserts that humans' cognitive abilities are not fixed and pre-defined traits, rather they can be developed through social interaction and environmental factors, which frames the Sociocultural Theory (SCT) (Lidz & Gindis, 2003). Accordingly, as people interact with parents, adults, teachers, and/or more able peers, they start to think and act in new ways since mediation is embedded in this social interaction. This interaction-based process is unique to each person and triggers each person's cognitive development differently (Ganem-Gutierrez & Gilmore, 2018; Poehner, 2008; Vygotsky, 1978).

Vygotsky (1978) mainly puts forward three main stages of human cognitive development: object-regulation, other-regulation, and self-regulation. First, people may rely on objects in their environments to activate their cognition and perception, and over time, they are mediated by other people through assistance and feedback. This mediation helps people govern their cognition, and in time as the amount of assistance and feedback goes down, they start to internalize the mediational moves and control their minds (Lantolf et al., 2015).

The shift from other regulation to self-regulation is a salient phase in the SCT as it is a sign of having intentional and volunteer control over cognition and formulating higher forms of cognition (Kozulin, 1998). In line with it, Vygotsky (1978) states inter-psychological plane/ social speech and intra-psychological plane/ private speech. Accordingly, the former refers to the social phase that leads to interaction and cooperation with others, and mediation is grounded in it. On the other hand, the latter refers to the mental phase during which humans might begin to act independently. When a person moves from social speech to private speech, it may indicate self-regulation and the internalization of mediational moves provided because private speech reveals valuable information about how a person governs their mind (Garbaj, 2018; Lantolf & Thorne, 2006). For example, Garbaj (2018) conducted a study with four L1 English speakers and seven proficient L2 English speakers. The participants' private speech was recorded when handling a non-technical problem. The data analysis yielded that those L2 English speakers did not turn to their L1 but used English in their private speech during the problem-solving task. As a result, the author asserted that L2 English speakers could regulate their minds in English since they could self-regulate.

Similarly, the Zone of Proximal Development (ZPD) is the hallmark of the SCT. Vygotsky (1978) describes it as the distance between what a person can do without assistance and what his/her potential to achieve during a tandem work with adults and/or more able peers and/or during an independent problem-solving task in the future. In this regard, the diagnosis of each person's matured abilities is an initial step, which is termed the Zone of Actual Development (ZAD) (Poehner, 2008). Then, the person's needs should be diagnosed, and mediation should be aligned with these needs through dialogic reciprocal interaction. During the interaction, observing and prognosis of the person's responsiveness to the mediational moves and their social and private speech

reveal maturing abilities to the proximal next level (Poehner, 2008; Vygotsky, 1978). And the distance between matured and maturing abilities displays the person's ZPD.

People of the same or close ages may share the same ZAD, which may not yield a full and clear picture of their cognition (Poehner & Lantolf, 2005). Instead, observing their responsiveness to the mediational moves and assistance on the plane of interaction and analyzing their microgenetic development in the same or similar problem-solving tasks can shed light precisely on their cognitive growth (Poehner et al., 2015; Vygotsky, 1978) as each person has different ZPD and learning potential (Kozulin & Levi, 2018). In his writing, Vygotsky (1978) exemplified it with two children who were at the same age and whose matured abilities (ZAD) were the same, but once the children were presented problem-solving tasks beyond their ZAD, they reacted in different ways: While one child could absorb the mediational moves provided, which perpetuated self-regulation in time, another child could not achieve the same thing. This showed that the first child had a larger ZPD than the second one, even though they had the same ZAD. Therefore, he moots that the diagnosis of the people's microgenetic growth in time and their ZPD is more precious than what they have already learned.

Although Vygotsky did not propose anything directly germane to language education and assessment, Frawley and Lantolf (1985) and Aljaafreh and Lantolf (1994) were pioneers who ignited the genesis of adopting the SCT in language education. Then, Poehner (2005) conducted groundbreaking research by focusing on the theoretical premises of the SCT, such as the learner's ZPD, mediation, and microgenetic growth, in a language assessment setting. Since then, Dynamic Assessment has moved to the fore.

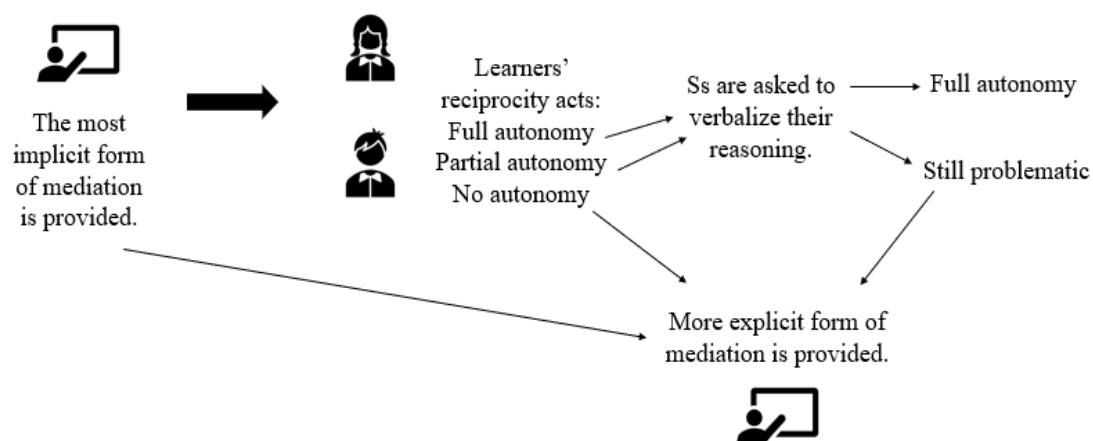
### **Dynamic Assessment**

Dynamic Assessment is a learning-centered approach and has recently appeared as an alternative to traditional assessment methods (Poehner, 2008; Poehner & Lantolf, 2005). Grounded in the theoretical premises of Vygotsky's SCT (1978), DA merges assessment and instruction in a single activity (Poehner, 2008; Poehner & Infante, 2016; Poehner & Lantolf, 2005).

DA moots that initially, the learner's matured abilities and needs should be assessed and diagnosed by the teacher, and the teacher actively intervenes in this assessment process. Then, socio-cultural theory-oriented feedback and instruction that are germane to the learner's ever-shifting needs are provided through the dialogic reciprocal interaction. This process mainly covers mediational moves based on the implicit-explicit continuum by the teacher. Simultaneously, the teacher observes and analyzes the learner's reciprocity acts towards the mediational moves provided, encourages the learner to verbalize the reasoning for their answers to see how s/he governs L2 in their mind, and tracks each learner's microgenetic development over time. Both teachers and learners are active agents in the collaborative work to reconstruct the learner's ZPD for an unmediated performance in the future (Davin, 2016; Poehner, 2008; Poehner & Infante, 2016; Poehner & Wang, 2020; Shrestha, 2020). Overall, the underlying premises of DA, such as mediation and dialogic reciprocal interaction, can unpack 'the assessment of thinking, perception of learning, and problem-solving by an active teaching process aimed at modifying cognitive functioning' (Haywood & Tzuriel, 2002, p. 41).

As the core term of DA, mediation encompasses using both physical (e.g., online tools and visual aids) and symbolic (e.g., leading questions, verbal cues, explanations, etc.) tools during an in tandem work between the teacher and the learner/s (Davin, 2016; Ganem-Gutierrez & Gilmore, 2018; Lantolf, 2000; Lantolf & Thorne, 2006; Lantolf et al., 2015; Poehner & Infante, 2016). These mediational moves are always graduated from implicit to explicit continuum. For example, as an initial step, the teacher provides the most implicit mediational move and then observes the learner's reciprocity act whether s/he shows full autonomy (e.g., self-correction), partial autonomy (e.g., asking for help, asking for cues, self-correction with hesitation) or no response. In the case of full-autonomy or partial autonomy, the learner is encouraged to verbalize the reasoning for their answer to unveil the inner cognitive mechanism, matured abilities, and maturing abilities. If the learner self-regulates, no more subsequent mediational moves are needed. However, in case of the lack of self-regulation, the subsequent mediational moves become more explicit based on the learner's needs. This dialogic reciprocal teacher-learner interaction goes on in many turns (Aljaafreh & Lantolf, 1994; Poehner, 2008; Poehner & Infante, 2019). The graduated nature of mediational moves is a landmark in DA; however, they can be either pre-defined (interventionist DA) or decided during the dialogic interaction by the mediator/teacher according to the learner's needs and reciprocity acts (interactionist DA) (Poehner, 2008). Both types of DA are driven by the need to unpack the extent of each learner's potential to achieve without mediation and assistance through the analysis of improved accuracy in revision and transfer tasks and the change in the mediational move's types and frequencies, which is connected to the learner's ZPD (Poehner & Infante, 2017; Poehner & Lantolf, 2005; Storch, 2018; Tzuriel & Shamir, 2002).

Figure 1

*The Flow of Dialogic Interaction in DA*

In brief, DA differs from conventional assessment approaches as it is a systematic and iterative process, driven by the dialogic interaction during which both teachers and learners are active agents; and it does not divide the learners as a failure and successful but proposes that everyone can succeed at a different rate and in different ways. Moreover, the microgenetic growth of the learners and the level of their shifts from other regulation to self-regulation are milestones to reveal their ZPD (Poehner, 2008; Poehner & van Compernelle, 2020; Shrestha, 2020). In this regard, these

theoretical underpinnings of DA can offer a fair assessment process not to leave the students who are tested in their L2, less proficient in L2, and/or at-risk in schooling behind (Lantolf & Poehner, 2013).

### **Dynamic Assessment in L2 Writing and with Multilingual/ Immigrants**

The growing body of research was conducted about adopting DA in an L2 writing context, such as DA's impact on learners' development in terms of L2 Spanish grammar (Davin, 2013), L2 French grammar (Poehner & van Compernelle, 2020; van Compernelle, 2016), L2 Chinese grammar (Zhang & van Compernelle, 2016), and English derivational suffixes (Poehner & Leontjev, 2018). In their studies, Poehner and Infante (2015) also focused on grammar, English-tense aspect system; however, they did not explore learner development on this specific grammar content, but they introduced a new instruction program, such as Systemic Theoretical Instruction in L2 writing. Further studies (Alavi & Taghizadeh, 2014; Xian, 2020) employed interventionist DA to unfold its effect on EFL writing; yet this paper mainly dealt with interactionist DA as it might suit well to diagnose each learner's ever-shifting needs and ZPD (Davin, 2016).

Some influential studies provided initial insights into interactionist DA in the L2 writing context. For example, Shrestha and Coffin (2012) explored online interactionist DA with the students in an academic writing class, and the researchers put forward DA, a learning-oriented assessment approach, as a better alternative for fostering the students' academic writing skills. Rahimi et al. (2015) conducted a qualitative case study to explore the mediating effect of interactionist DA on L2 writing, and the analysis of dialogic interactions revealed the diagnostic and progressive impact on advanced EFL learners' writing. Shrestha (2017, 2020) also explored the impact of DA on the transfer of genre and conceptual knowledge of business studies students in an academic writing context; and the data gathered from written assignments, interviews, and business studies tutors indicated that DA might be a powerful tool to transfer the knowledge in new assessment contexts. Shabani (2018) compared Group DA (GDA) with a control group by mixed-method research and reported that GDA contributed to L2 writing and perpetuated its improvement.

Furthermore, he emphasized core differences between GDA and individual DA formats. Poehner et al. (2018) reported process writing entailing individual, peer, and group DA context with three advanced Japanese language learners. Then Infante and Poehner (2019) merged DA and Mediated Learning Experience in a project to assist the learners with improving in English-tense aspect system in an L2 writing program. Advanced, low-intermediate, and intermediate-level English language learners were recruited into the study for six weeks. The data provided insights into their emerging differential needs and improvement over time through the mediational moves provided by the teacher; however, the dialogic teacher-learner interaction was merely based on the English tense-aspect system, which made it hard to illustrate a thorough analysis and improvement of the learners in L2 writing. Beck et al. (2020) focused on three teachers' dialogic assessments with ten students in different school settings and uncovered the teachers' differential moves according to the students' changing needs in writing. Although the researchers proposed dialogic writing assessment, whose roots relied on DA, as a better alternative to improve the students' writing skills, they failed to reveal

the participant students' progress in time. Peterson et al. (2021) carried out a study with kindergarten and grade one children. They reported the participants' emerging writing abilities and the interaction between the children and the adults during individual DA sessions. The data underpinned the pedagogical aspect of DA, and the researchers mentioned that initially, the mediational moves were mainly based on modeling by the teacher/ mediator. However, the moves were gradually changed over time into asking questions to promote writing, which was a sign of the participants' potential to learn and improve in time.

Another application of DA rests on 'transculturality', which means moving to a different cultural setting (Haywood & Tzuriel, 2002, p. 46) and 'academically at-risk students' (Kozulin & Garb, 2002, p. 112). The learners may show low cognitive performance caused by either of these reasons. In some cases, on the other hand, immigrants, especially refugees, may experience both. In that case, DA can present showcases to diagnose each learner's cognitive performance and growth by eliminating 'cultural, motivational, and situational factors' (Tzuriel & Kaufman, 1999, p. 360). In line with it, previous research recognized that DA provided valuable information about EFL learners' (including immigrant students) potential to learn beyond their current knowledge of vocabulary and the ability of L2 text comprehension (Kozulin & Garb, 2002).

Notwithstanding these influential studies, there are some gaps and suggestions that merit further research. First, these studies mostly failed to track the long-term effect of interactionist DA and to present quantitative data to triangulate results. In this regard, this study aims to fill the gap by adding the participants' writing test scores in three different periods (pre-test, post-test, and delayed post-test) to the moment-to-moment analysis of their dialogic interaction with the teacher, which is supposed to illustrate the learners' transcendence abilities. Second, despite the growing interest in merging assessment and instruction in a single activity, its praxis in various settings remains an issue (Poehner & Inbar-Lourie, 2020). For example, advanced, high-intermediate, and intermediate level L2 learners were mainly recruited for the studies. By contrast, illustrating the potential contribution of interactionist DA to beginner level and/or 'academically at-risk students' (Kozulin & Garb, 2002, p. 112) in the L2 writing context is an underestimated strand. Third, in some cases, multilingual immigrants, especially refugees, may not have sufficient and equal learning opportunities like their peers; therefore, instead of measuring their emerged knowledge through static tests, assessing their cognitive development over time through DA may provide a critical, salient, and a fair perspective. However, to our knowledge, there are almost no studies to date that have rested on multilingual immigrants/ refugees. Fourth, emotion is acknowledged as the driving force behind cognition, which mediates people's performance (Feuerstein et al., 2010; Poehner & Swain, 2016). Therefore, investigating the learners' perspectives towards an affective engagement with DA is salient but an underestimated strand. Two recent studies presented the teachers' positive perspectives towards employing learning-oriented assessment in ELT MA Classes (Leung, 2020) and towards adopting DA in high schools by Colombian teachers (Davin & Herazo, 2020). One recent study yielded three academic writing students' positive perspectives on DA. Yet further data in different settings to shed light on the learners' engagement with DA are warranted. Heeding these gaps and suggestions, the following research questions guide this study:

1. What types of mediational moves commonly lead the multilingual immigrants/refugees to improve L2 writing during DA sessions?
2. What are the participants' perspectives on using DA in an L2 writing setting?

## Method

### Participants

This study was a part of a larger project that 47 tertiary-level EFL learners were recruited, and two students in this group were multilingual refugee learners. One of them was Nancy (pseudonym), who originally came from Syria and moved to Turkey in 2013 as a refugee. She was an Arabic native speaker, and her second language was Kurdish. She could also use the Turkish language near-native-like. Nancy mentioned that because of the war in her home country, she could not attend school regularly and could not take English language courses in a formal school setting. However, she said that she worked in a tourist office in a big city where she learned English in her daily life after she had moved to Turkey. When the data were collected, she had great difficulty in writing in English. The second multilingual immigrant learner was Sandra (pseudonym), who was a Meskhetian Turk. She was a native Turkish speaker, and her second languages were Russian and Ukrainian. She moved to Turkey as a refugee in 2016, and she stated that she did not take any English language courses in a formal school setting in Ukraine before either. She also had great difficulty in writing in English and in understanding the English language when the data were collected.

At the beginning of the semester during which the data were collected, all participants in the original larger project, including Nancy and Sandra, took a pre-writing test at B1 level to pinpoint their English language level in writing. The mean score for the pre-test was calculated as 51 out of 100, and the scores of Nancy and Sandra were lower than the mean score: They got 24 and 19 out of 100, respectively, which displayed that both were behind their peers.

### Data Collection Procedure and Instruments

This case study utilized both qualitative and quantitative data, and the data were collected during eleven weeks using audio recordings of one-on-one interactive DA sessions and semi-structured interviews. Before collecting the data, ethical permission was assured. Initially, the students were informed about the aim of the study and the importance of being a volunteer. Then, the students started to take their regular courses, including the *Writing Skills* course taught five hours weekly. The course was mainly introduced and practiced five genres: description, compare/contrast, problem/solution, narration, and argumentative writing. Two weeks were allotted to each genre; and during that period, the teacher introduced a genre in the class, presented examples, and revised the related vocabularies, phrases, grammar topics given in the coursebook. Afterward, the students were assigned to write a new text related to the week's genre and topic. Also, for this study, one-on-one interactive DA was adopted; hence, the teacher announced an appointment list for each student to see them outside the class. Accordingly, the teacher (mediator) and the learner worked in tandem on the learner's written text outside the class. During these DA sessions, the dialogic interaction between the teacher and the learner was at the forefront as it could unpack the



underlying problems, ever-shifting needs, matured and maturing abilities of each learner in L2 writing through the mediational moves that were not planned before but tailored to each learner's responsiveness to the mediational move provided. Furthermore, the moment-to-moment micro-genetic analysis of DA sessions was supplemented by semi-structured interviews to reveal the participants' attitudes towards adopting one-on-one interactive DA in L2 writing courses. Lastly, the participants' scores in the pre-test (before DA sessions), post-test (after DA sessions), and delayed post-test (eight weeks after the post-test) were also used to provide further insight into their progress or regression over time.

### **Data Analysis**

How the participants were cognitively engaged with DA could be analyzed through their verbal responses to the mediational moves provided and tailored to their needs by the teacher during the dialogic reciprocal teacher-learner interaction. In this regard, DA sessions' audio recordings were transcribed in Transana (3.32), and the mediational moves by the teacher and the learners' responsiveness to them were coded. In addition, the frequencies of emergent mediational moves and the learners' responsiveness towards them were presented to track each learner's progress and/or regression over time. The learners' test scores were also provided to triangulate the data. For this study, TEEP (Test in English for educational purposes attribute writing scales) by Weir (1990) was adopted to grade the papers analytically. Accordingly, each paper's qualities in rhetorical (organization, coherence, and cohesion) and linguistic (grammar, vocabulary choice, spelling, and punctuation) dimensions were checked by two different raters. Then, the interrater reliability coefficient was calculated by using the Kappa test, and the reliability coefficient values revealed consistencies (Blerkom, 2009) between the raters (Kappa=.76,  $p<.05$  for the pre-test, Kappa=.83,  $p<.05$  for the post-test, and Kappa=.82,  $p<.05$  for the delayed post-test). Moreover, the participants' opinions and perspectives on DA could be revealed through their verbal responses to the interview questions. Therefore, the audio recordings of semi-structured interviews were transcribed, translated into English, and coded by three different lecturers. Intercoder reliability coefficient was also checked to ensure consistency between the coders, and a strong reliability coefficient value (0.83) was found (O'Connor & Joffe, 2020). In what follows, the related data will be yielded.

### **Ethical Procedures**

The researcher applied for permission to collect data, Hacettepe University Institute of Educational Sciences approved it (numbered 51944218-300/00000660158, dated 09.07.2019). Also, Erzincan University Faculty of Education approved the data collection procedure (numbered 31609083-804.01-E.45919 dated 27.09.2019).

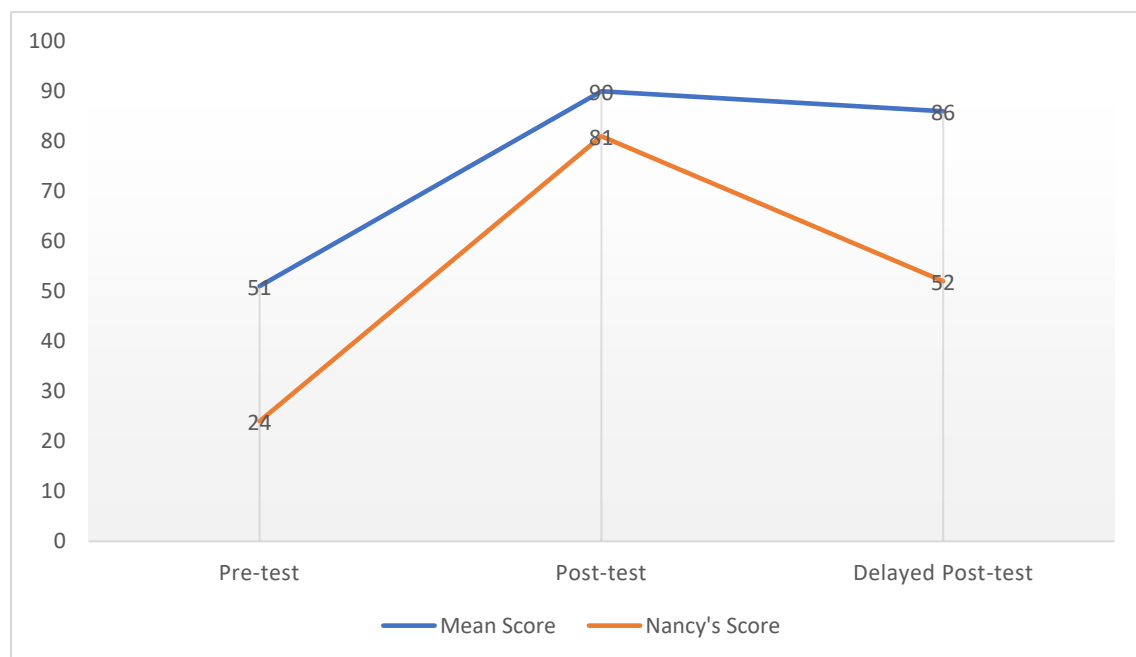
## **Results**

### **Case 1: Nancy**

Initially, to provide the general picture of Nancy's improvement in L2 writing, the following figure presented and compared her test scores with her classmates' mean scores in three writing tests. An overview of the data yielded that Nancy was behind her peers before the individual interactive DA: She got 24 out of 100, while the mean score

of the group was 51 out of 100 in the pre-test. Then, the whole group, including Nancy, was provided one-on-one interactive DA for ten weeks. When the sessions were over, the post-test was carried out. Nancy got 81 out of 100, and the group's mean score was 90 out of 100. She seemed to benefit from DA sessions, improve her L2 writing, and bridge the gap between herself and her peers. Eight weeks after the post-test, the participants took the delayed post-test, which aimed to display their transcendence abilities. During these eight weeks, the participants were not provided any instruction and DA sessions. Even though Nancy got lower (52 out of 100) than her post-test score (81 out of 100), she could transfer some knowledge and abilities as her delayed post-test score was higher than her pre-test score. However, she was still behind her classmates in terms of transcendence abilities (the delayed post-test scores: Nancy, 52; Mean Score, 86), although she could bridge the gap between herself and the classmates right after the DA sessions. What stands out in this data is that DA may step stone for the development of multilingual immigrants/refugees who are left behind their classmates and who are underachievers.

Figure 2  
*Nancy's Test Scores*



Turning now to the dialogic interaction, the moment-to-moment analysis of individual interactive DA sessions would reveal Nancy's mediational moves for and reciprocity acts. Although DA lasted for ten weeks, the first- and tenth weeks data were coded and presented in the following table to display Nancy's microgenetic growth. It is also worth mentioning that the mediational moves were based on the implicit-explicit continuum; however, when Nancy failed to provide any responsiveness to a mediational move, it was not included in the coding. And emergent mediational moves in the first week (DA 1) mainly relied on teacher-agency, explicit ones. It is clear from the table that Nancy could mostly self-correct the error/s upon a variety of mediational moves, such as explicit ones (*explanation in English and providing examples, metalinguistic*

cues, offering possible solutions, asking for alternative answers, providing for alternative answers, providing the specific location of the error, and providing the nature of errors, and more implicit ones (asking for revising and underlining the sentence with error/s).

On the other hand, the emergent mediational moves coded from the tenth week's data yielded that Nancy mostly benefitted from the most implicit form of mediational moves, *underlining the sentence with error/s*, and she could again self-correct the error/s. The results reflected that Nancy could succeed in gaining from the mediational moves as the nature of them shifted from explicit/teacher-agency-based ones to more implicit/learner-agency-based ones over time. In this regard, it might be possible to suggest employing DA in the L2 writing classes since both writing test scores and dialogic interaction analysis converged into triangulating the data to illustrate the multilingual immigrant/refugee's improvement in the L2 writing context.

Table 1

*The Mediational Moves for and Responsiveness of Nancy*

	Mediational Moves	DA 1 <i>f</i>	DA 10 <i>F</i>	Reciprocity Acts	DA 1 <i>f</i>	DA 10 <i>f</i>
Teacher-agency based/Explicit	Explanation in English and providing examples	1	2	Request for explanation in Turkish	1	1
Teacher-agency based/Explicit	Metalinguistic clues	2		Request to identify the nature of error/s	1	
Teacher-agency based/Explicit	Offering possible solutions	1		Awareness of the error but no self-correction	1	1
Teacher-agency based/Explicit	Asking for alternative answers	1		Self-correction	6	4
Teacher-agency based/Explicit	Providing the specific location of the error	1	1			
Teacher-agency based/Explicit	Providing the nature of errors	1				
Learner-agency based/Implicit	Asking for revising	1				
Learner-agency based/Implicit	Underlining the sentence with error/s	1	4			

Lastly, the semi-structured interview mainly relied on the participants' perspectives on adopting DA in L2 writing classes, such as the advantages and disadvantages of employing one-on-one interactive DA. Furthermore, they were free to share their further comments and suggestions. Nancy was satisfied with participating in the study, and the emergent themes coded from her responses mostly illustrated two themes, such as *the opportunity of individualized learning space* and *increased control/knowledge on L2 writing*. She kept mentioning that she failed to catch the classes during class hours, so she valued the individual DA sessions much since she could learn many things and track her development in L2 writing over time. She reported her perspectives by saying:

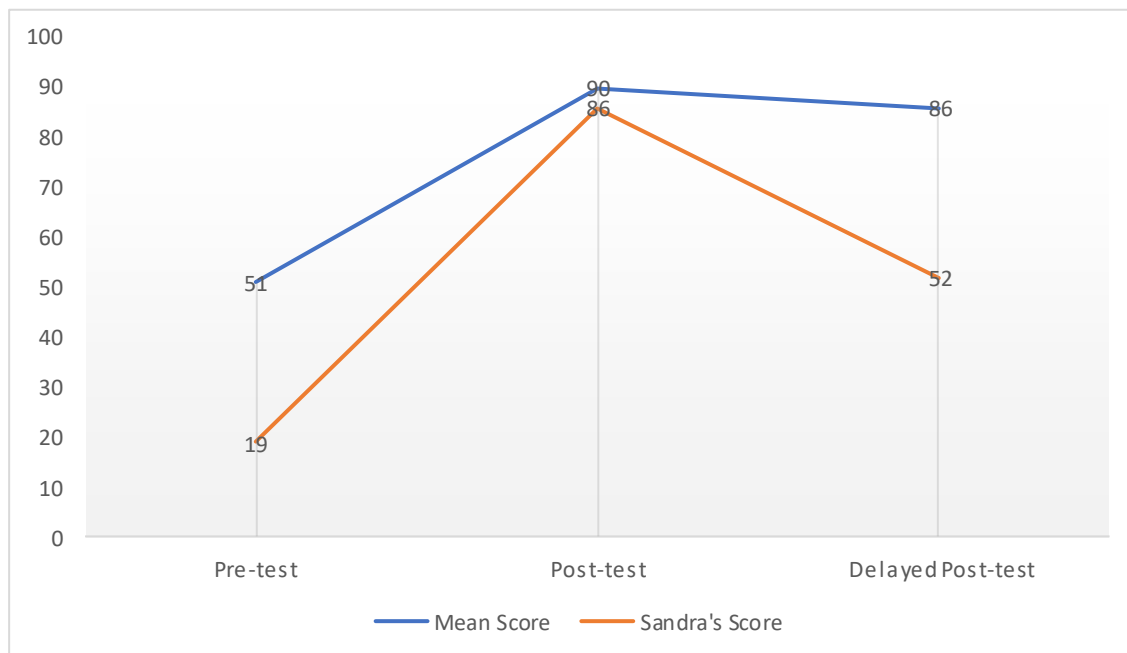
“It was the time that I could learn and improve myself. Working individually with you was very productive to see my mistakes. It was especially good for me since I did not know anything; I was bad at grammar, spelling, punctuation, and other things. Also, I could not understand everything during class hours. The sessions helped me improve not only on correct language use but also on effective writing.” (Nancy – pseudonym)

Overall, the results are encouraging since both writing test scores and dialogic interactional analysis during DA sessions overlapped and showed Nancy's improvement over time. Furthermore, she expressed her positive perspectives on DA, which was germane to the theoretical premises of DA.

### **Case 2: Sandra**

Like Nancy, Sandra experienced progression and backtracking over time according to the writing test scores. The following graph yielded both Sandra's scores and her classmates' mean scores; and accordingly, Sandra was behind her classmates before the individual interactive DA as well: She got 19 out of 100 whilst the mean score was 51 out of 100. Afterward, Sandra and her classmates were provided one-on-one interactive DA for ten weeks, and then the post-test was administered. Sandra achieved to get 86 out of 100, and the group's mean score was 90 out of 100. These scores provided insights into Sandra's progression in ten weeks through DA. She could narrow the gap between herself and her classmates like Nancy. However, when the delayed post-test was carried out eight weeks after the post-test, Sandra got lower (52 out of 100) than her post-test score but higher than her pre-test score. The related scores yield that DA might be a good alternative to trigger the progression of multilingual immigrants, especially those who are underachievers and behind their classmates, but it is somewhat surprising that their transcendence abilities can still be behind their peers.

Figure 3  
Sandra's Test Scores



To unpack the dialogic reciprocal interaction between Sandra and her teacher during the DA sessions, the following table presented emerging mediational moves for Sandra, and her reciprocity acts towards them. The related data were taken from the first- and tenth weeks DA sessions to reveal Sandra's improvement over time. Also, the mediational moves were coded only when she could provide any reciprocity acts. According to the analysis, it is clear that Sandra merely relied on teacher-agency oriented/explicit mediational moves in the first DA session, and in some cases, the teacher provided explanation in Turkish, related examples, and correct answers. Then, when she had similar errors, she could self-correct them upon offering possible solutions and providing the specific location of the error. This might indicate the microgenetic development of Sandra. In the tenth week, Sandra was mostly keen on learning-agency-oriented/implicit mediational moves. The teacher underlined the sentences with errors two times, and Sandra could find the errors and correct them. However, when she was provided with the exact location of the error, she failed to correct it. Moreover, what stood out in this data was that Sandra required more mediation in the first week than the tenth week, which could be another indicator of her microgenetic development in time.

Table 2  
*The Mediational Moves for and Responsiveness of Sandra*

	Mediational Moves	DA 1 <i>f</i>	DA 10 <i>f</i>	Reciprocity Acts	DA 1 <i>f</i>	DA 10 <i>f</i>
Teacher-agency based/Explicit	Providing correct answer	4		Asking for collaboration	1	
Teacher-agency	Explanation	1		Request for	1	

based/Explicit	in Turkish and providing examples			explanation in Turkish		
Teacher-agency based/Explicit	Offering possible solutions	1		Providing correct answers by hesitating	1	
Teacher-agency based/Explicit	Providing the specific location of error	4	1	Self-correction	4	2
Learner-agency based/Implicit	Underlining the sentence with error/s		2			

Sandra also replied to the semi-structured interview questions and expressed her further comments on the use of one-on-one DA in the L2 writing classes, and the data revealed two broad emergent themes: *Motivational aspects* and *DA as a learning tool*. First, Sandra reported that she was a shy student, so she abstained from asking questions and joining the lessons. She also felt that she was not successful like her classmates. These factors initially demotivated her to follow the lessons. The recurrent theme, *motivational aspects*, could be indicated with these words:

“I was very timid. I mean, in general, I am very timid. Also, my classmates were more successful. I could not even understand my teachers and the lessons. Therefore, I was shy to ask questions or ask for repetitions, not only in the writing skills course but also in all courses. However, when I started participating in the DA sessions, I could feel your support and guidance. You cared for us. And a few weeks later, I realized that I got excited to get ready for L2 writing lessons and DA sessions.” (Sandra – pseudonym)

In line with the *motivational aspects*, another recurrent theme was *DA as a learning tool*. As she learned many things during DA sessions, Sandra stated that she got motivated towards writing. In DA sessions, she reported her thoughts by saying, “I learned so many things, such as grammar, spelling, vocabulary use, and many more” (Sandra – pseudonym).

Taken together, DA was a promising step to assist Sandra in the L2 writing because both her writing test scores and dialogic interactional analysis recounted her needs and shift from other-regulation to self-regulation. Moreover, she mentioned that DA was prominent to improve her motivation and create a learning space for her, through which she could undergo substantial changes in time.

### Discussion and Conclusion

This study mainly grew out of the desire to enlighten the moment-to-moment dialogic interactional analysis between the teacher and the multilingual immigrant/refugee students. In line with it, the mediational moves by the teacher and the students’ reciprocity acts during the individual interactive DA sessions were coded and revealed. Accordingly, even though both students initially relied on teacher-agency-oriented mediational moves, the most explicit form amplified Sandra’s needs while Nancy was provided more implicit mediational moves. These differences confirm the

mounting evidence that moots the perfect fit of interactive DA to the learners' ever-shifting needs (Davin, 2016) since interactive DA aligns with each learner's needs in an ad hoc manner (Poehner, 2008). Also, the findings are associated with the assertion that each learner has different ZPD and learning potential (Kozulin & Levi, 2018).

Moreover, throughout the DA sessions that lasted for ten weeks, both Sandra and Nancy underwent substantial changes on the plane of interaction with the teacher: In the first week, tentative mediational moves mostly covered explicit forms; by contrast, in the tenth week, the dialogic reciprocal interaction subsumed implicit forms of mediational moves, which might display the students' viability in the L2 writing over time. This shift from other-regulation to self-regulation was experienced within ten-week, and during that interim period, the learners produced different written texts. Therefore, the shift might indicate not only the learners' different ZPD level but also their transcendence abilities. In this regard, DA is acknowledged as an alternative approach both to assess and to instruct the students in a fair and equal way since potential success in the future cannot be decided thoroughly by measuring the students' already matured skills and knowledge, especially when equal learning showcases are not supplied for all (Haywood & Tzuriel, 2002). Consistent with the literature, the findings of this study also confirm that the underachieving students, such as refugees who cannot have equal learning opportunities in schooling for some time with their peers, can deploy the mediational moves and bridge the gap between themselves and their peers. Furthermore, the salient strand of DA is transcendence, the ability to transfer emerging abilities to new contexts; hence, tracking learner development over time is important (Poehner & Lantolf, 2013). In line with it, the participants' development in this study also corroborates the findings of previous studies (Beck et al., 2020; Kozulin & Garb, 2002; Peterson et al., 2021; Rahimi et al., 2015; Shabani, 2018; Shrestha, 2017, 2020; Shrestha & Coffin, 2012).

In addition to the interactional analysis, the participants' writing test scores in three different periods indicated their improvement in L2 writing. Before DA sessions, their pre-test scores were behind the group's mean score; however, after ten-week during which they were provided individual interactive DA sessions, they could narrow the gap in the post-test. Then, no students participated in DA sessions and L2 writing classes during eight weeks. Upon this interim period, the delayed post-test was administered, and Nancy and Sandra were behind the group's mean score and their post-test scores even though their scores were higher than the pre-test scores. This finding is in line with Lantolf et al.'s assertion: Even though development in the learner ZPD is desired to shift from more explicit mediational moves to more implicit ones in time, sometimes it may regress to more explicit mediational moves and the learners may experience backtracking or regression in time (Lantolf et al., 2016).

Lastly, the findings germane to the learners' perspectives on employing DA in the L2 writing classes explicate that DA is compulsive for creating an individualized learning space and inclining motivation towards L2 writing. These results are in accord with a recent study (Shrestha, 2020) that has explored learners' perspectives on DA in an academic writing context and identified recurrent themes, such as *being more relaxed, helping the learners build their confidence in academic writing, personal interaction, graduated guidance questions helped the learners think, and a way of learning* (p. 226). Also, the findings seem to be consistent with another recent research

(Davin & Herazo, 2020) that has yielded teachers' perspectives towards using DA in EFL classes by classifying into as *changes to students*, such as *increased autonomy* and *decreased anxiety*, and *lingering challenges*, such as *class size and time* and *appropriate forms of meditation* (pp. 209-212). Taken together, the participants' perspectives towards adopting DA in L2 writing classes have bidirectional relation with DA's theoretical underlying premises.

The growing interest in embedding instruction into assessment has guided scholars to explore its praxis in situ, and DA, as an instruction-integrated assessment approach, has lately garnered increasing attention. The related DA studies have presented mounting evidence of its efficacy in the L2 writing setting. However, most of these studies have recruited advanced, high-intermediate, or intermediate students. Heeding this gap, this case study has provided deeper insights into the viability of multilingual immigrant/refugee students who are underachievers than their intermediate-level peers through one-on-one interactive DA. Furthermore, the participants seem to value the impact of DA on their L2 writing abilities. Therefore, DA can be adopted as an instruction and assessment approach for the students left behind their peers. Notwithstanding, there were merely two participants in this research, so more multilingual immigrant/refugee participants from different socio-cultural backgrounds can be included in future studies. In this regard, the feasibility of providing fair assessment settings for all students can be illustrated from different perspectives.

### **Statement of Responsibility**

Tuba Özturan; Conceptualization, Methodology, Formal Analysis, Investigation, Writing—Original Draft. Hacer Hande Uysal; Supervision, Writing – Review & Editing.

### **Conflicts of Interest**

There no conflicts of interest in this study.

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## Analysis of Strategies Used by Students in Solving Motion Problems According to the Presentation of the Problem

### Öğrencilerin Hareket Problemlerinin Çözümünde Kullandıkları Stratejilerin Problemin Sunumuna Göre İncelenmesi

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**ABSTRACT:** In this research, it was aimed to analyze the problem solving strategies used during solving problems related to constant speed and constant acceleration motion, which are often used in graphs, according to the presentation of the problem (text and graph). The research was carried out with 119 students studying in the 11th grade. In the research conducted in a case study pattern, data were collected using the problem solving strategies scale used in Physics at the high school level and open-ended questions about problems presented in two different ways. Scores from the scale were analyzed through the SPSS 25 program, and data from open-ended questions were analyzed by content analysis. According to the results obtained from the scales, it was determined that the problem-solving strategies used by students did not differ according to the presentation of the problem, but there was a difference in the stages of understanding the problem and organizing the problem according to the results obtained from open-ended questions. According to these results, it can be said that the way the problem is presented mostly affects the stage of understanding the problem. The understanding phase affects the solution process and the time required for the solution. Therefore, different techniques can be used to understand the problem according to the presentation of the problem during teaching.

**Keywords:** Physics, problem solving strategy, problem presentation, graphical representation.

**ÖZ:** Bu araştırmada grafiklerden sıklıkla faydalanılan sabit hızlı ve sabit ivmeli harekete ilişkin problemlerin çözümü sırasında kullanılan problem çözme stratejilerinin problemin sunumuna (metin ve grafik) göre incelenmesi amaçlanmıştır. Araştırma 11. sınıfta öğrenim görmekte olan 119 öğrenci ile yürütülmüştür. Bir durum çalışması deseninde yürütülen araştırmada *Lise Düzeyinde Fizikte Kullanılan Problem Çözme Stratejileri Ölçeği* ve iki farklı şekilde sunulan problemlere ilişkin açık uçlu sorularla veriler toplanmıştır. Ölçekten alınan puanlar SPSS 25 programı aracılığı ile analiz edilerek, açık uçlu sorulardan elde edilen veriler ise içerik analizine tabi tutularak bulgulara ulaşılmıştır. Ölçeklerden elde edilen bulgulara göre öğrencilerin kullandıkları problem çözme stratejilerinin problemin sunumuna göre farklılaşmadığı, ancak açık uçlu sorulardan elde edilen bulgulara göre problemi anlama ve problemi örgütleme aşamalarında farklılık olduğu belirlenmiştir. Bu sonuçlara göre problemin sunum şeklinin en çok problemi anlama aşamasını etkilediği söylenebilir. Öğrencilerin en fazla problemi anlama aşamasına yönelik stratejileri kullandıkları tespit edilmiştir. Anlama aşaması çözüm sürecini ve çözüm için gereken süreyi etkilemektedir. Bu nedenle öğretim sırasında problemin sunumuna göre problemi anlamaya yönelik farklı teknikler kullanılabilir.

**Anahtar kelimeler:** Fizik, problem çözme stratejisi, problem sunumu, grafiksel gösterim.

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Problem solving in Physics education is a research topic that is often studied and still needs new research (Gürel & Körhasan, 2018). Although students sometimes understand the subject, they cannot solve physics problems (Fraser et al., 2014; İnce, 2018). This leads researchers to study the physics problem solving process of students. The problem solving process is explained in the literature through the strategies used by expert and novice problem solvers (Álvarez et al., 2020; İnce, 2018). Problem solving is defined as a process with general steps, and what expert-novice people do on these steps is defined as problem solving strategies. But this process does not always proceed in the same way, as stated in the literature (Kim & Pegg, 2019; Steele, 2007). Different characteristics of the problem can affect the problem solving process and the problem solving strategies used.

There are studies investigating how the structure of problems affects the problem solving process. Fortus (2009) determined that experts had difficulty solving unstructured problems at the end of the study in which experts in field knowledge examined structured and unstructured (real-life) physics problem solutions. Shin et al. (2003) investigated the skills needed to solve structured and unstructured problems and concluded that they both required different skills. Kim and Pegg (2019) examined the reasoning that elementary school students use in solving two different types of problems that they call simple and complex related to physics topics, and found that higher-level reasoning is used in solving a simple problem. Tekbıyık and Akdeniz (2010) concluded that context-based problems do not make a difference in students' problem-solving achievements, but that context based problems are more comprehensible and interesting. Being more comprehensible may affect the types of information used at the problem understanding stage and problem solving strategies. As Milbourne and Wiebe (2018) stated, the path students choose in problem solving may depend on how they perceive the problem. The presentation format differentiates students' approaches to problem solving and performance (Carotenuto et al., 2021; De Cock, 2012; Hung & Wu, 2018; Ibrahim & Rebello, 2012; Kohl & Finkelstein, 2005, 2006; Maries, 2013). The form of expression of a problem is expressed as the representative format (Kohl & Finkelstein, 2005). A problem can be presented using text, graphics, symbols, images, or diagrams (Bollen et al., 2017). As Hung and Wu (2018) noted, there is no clear information about how the presentation of the problem affects the problem-solving process.

Meltzer (2005) determined students' performance in solving problems presented in different ways (verbal, symbolic, graph, diagram) through multiple-choice and explanation-required quizzes. Koedinger and Nathan (2004) found that students use different problem-solving strategies when solving problems presented in the form of verbal and symbols. De Cock (2012) determined that students use different strategies to solve problems presented in the form of verbal, graphic and picture by solving three isomorphic problems that require multiple choice and subsequent explanation. Moreno et al. (2011) determined that the use of abstract and concrete representations in problems solved during teaching related to electrical circuits affects problem solving through their research through three different groups. According to the results of these studies, it is seen that the way of presentation of the problem (text, images, graphics, tables, etc.) affects the information used in solving problems and the steps followed.

In the studies, the problem solutions of the students on paper were examined in general. However, the solution of the problems alone may not give sufficient

information about the strategies followed in the solution process. It is very difficult to understand from the solution on the paper, at which stage the student implements which strategy and for what purpose. For this reason, it is necessary to examine the data collected differently regarding the solution process of students' problems presented in different ways. In this study, different from those in the literature, it is tried to determine the strategies followed by the students in solving the problems presented in a different way, with the help of scales and open-ended questions.

It can be said that one of the presentation forms of physics problems is graphs. Handhika et al. (2019) determined that students had difficulty in solving math problems presented in graphical form. It can be said that a similar situation applies to the physics course. Students have difficulty understanding graphs in which physical quantities are presented indirectly (Erceg & Aviani, 2014). Students' lack of reading and interpreting graphs also negatively affects their success in physics (Planinic et al., 2012). Many students have difficulty in solving kinematic problems due to their inability to interpret motion graphs (Rosenquist & McDermott, 1987).

The fact that students' problem-solving strategies are insufficiently known by teachers and that teachers are unable to adapt their teaching strategies to students' thinking/learning processes is the source of many challenges (McDermott, 1993). In Erceg and Aviani's (2014) study, the fact that teachers' estimates of the answers given by students differ from the answers given also supports this situation. According to the research, teachers believe their students will give more accurate answers. The researchers noted that teaching strategies should be shaped according to the problem-solving strategies that students use. Defining the problem-solving strategies that students use offers important recommendations for planning the learning process (Arsal, 2009). As Gürel and Körhasan (2018) noted, teachers sometimes think of their students as themselves and are unaware of their readiness. For this reason, it is important to determine which strategies students use for solving the problems presented in different ways. Suggestions can be reached on how teachers can support their students in solving problems presented in different ways.

This research aimed to examine the problem solving strategies used during the solution of problems related to constant speed and constant acceleration motion, which are often used in graphs, according to the presentation of the problem (text and graph). Research questions created for this purpose are as follows:

1. What are the problem solving strategies that students use to solve problems presented in text and graphical form?
2. How do the problem solving strategies that students use to solve problems presented in text and graphical form differ?

## Method

In this research, which was conducted in mixed research method, the strategies used in the solution of constant speed motion and constant acceleration motion problems were discussed. The relationship of this situation with the presentation of the problem was tried to be determined by the scale of problem solving strategies used in Physics at the high school level (HSL-PPSSS) and open-ended questions about solving problems presented in two different ways. Mixed method design is an appropriate research method in the case of research problems that cannot be answered by only

qualitative or quantitative data (McMillan & Schumacher, 2010, p. 395). So this method provides advantages about reaching more comprehensive data (McMillan & Schumacher, 2010, p. 397). In this research method data can be collected in different way. In this research qualitative and quantitative data was collected at the same time.

### Participants

The research was conducted in a country in The Black Sea region. The determination of the participants of the study was based on volunteerism. Considering the difficulty of collecting data during the pandemic process, the data collection process has started in many schools. However, the answers of many students were not taken into consideration due to the reluctance of the students and the invalid filling of the data collection tools. 119 students who were in the 11th grade and completed learning of motion subject from two different schools constituted the participants of this research. 75 of these students study at Science High School and 44 of them study at Anatolian High School. In order to receive education in these schools, students must get a high score from the high school entrance exam. Considering this situation, it can be said that the students are generally more successful than the students receiving education in other schools.

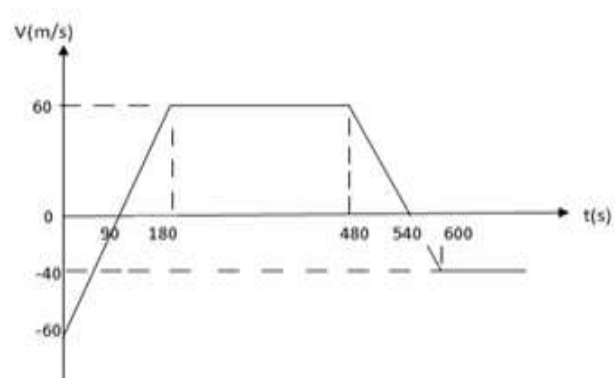
### Data Collection Tools

#### *Quantitative Data Collection Tool*

Examples of problems presented in the form of text and graphic related to constant speed and constant acceleration motion, which are the subjects of 11th grade physics course, are presented. In the examples developed by the researcher, the numerical values required to solve the problems were taken as the same by considering the effect of algorithmic information. In graphic representations, x-t (position-time), V-t (velocity-time) and a-t (acceleration-time) graphs containing movements in two different directions were used. For the tests created, opinions were received from two physics teachers and two academicians about the accuracy, clarity, and suitability of the problems for the students' level. According to suggestions from physics teachers, changes were made, such as writing "acceleration-time graph" instead of "a-t graph". They stated that they found the problems in both tests to be appropriate, accurate and understandable to the student level.

One of the pairs of problems presented in the form of graphic and text is as follows.

*The V-t (velocity-time) graph of the car passing through the starting point at the moment of  $t=0$  on a straight road is as follows on the side. According to the data in the graph, how far does the car stand at the end of the 660 secs to the starting point?*



*When driving on a straight road, someone notices that his car is going in the opposite direction as it passes by the stop with 60 m/s, and he stops by putting on the*



*brakes, slowing down properly within 90 s. He/she changes direction and accelerates properly, reaching a speed of 60 m/s within 90 s. After 300 seconds at a constant speed of 60 m/s, he realizes that he has passed the pharmacy and puts on the brake, slows down properly and stops within 60 seconds. It turns back and accelerates properly, reaching a speed of 40 m/s within 60 secs. At a constant speed of 40 m / s, he reaches the pharmacy in the 60s. According to this, how far is the distance between the pharmacy and the stop?*

At the end of the sample problems presented, three open-ended questions were included for students to explain their solution processes. In these questions, it was aimed to determine the way students follow in solving problems presented in the form of text or graphic, how presenting the problem in the form of text or graphics affects the problem solving process, and other opinions of students about the problem solving process. Before starting the research, five students' opinions were asked related to problems (in text and graphic form) and open-ended questions. Students expressed that they are clear and there is nothing incomprehensible.

### ***Qualitative Data Collection Tool***

The Likert-type high school level physics problem solving strategies scale (HSL-PPSS), adapted by Eryılmaz-Toksoy and Çalışkan (2015), was used to determine the strategies that students use to solve physics problems presented in text and graphical form. The Cronbach Alpha reliability coefficient of .885 scale consists of 25 items collected under four factors (understanding the problem, organizing the problem, gathering attention, control, and evaluation) for original of scale. For this study the Cronbach Alpha reliability coefficient is calculated .833. Students were asked to indicate the strategies they used to solve problems presented in the form of text and graphics, marking the most appropriate option for items on the scale. Options for scale items are as follows: "Always", "Often", "Sometimes", "Rarely", "Never". It is scored as from 5 to 0 between the "Always" option and the "Never" option.

### **Data Collection Process**

First of all, an ethics committee permit was obtained, indicating the ethical suitability of the research. Later, a research permit was obtained from the Ministry of Education. First, the data was tried to be collected face-to-face. Students were asked to fill out data collection tools offered in printed form in schools during exam weeks one week apart. But given the pandemic process and the number of students available, the data collection process continued online. The students were informed about the confidentiality of the data obtained from the research, and the data collection process was completed in an average of two months (March - April 2021) with the volunteer participants of the research.

Data collection was carried out in two stages. Primarily, students were asked to answer open-ended questions about the processes of solving problems presented in graphical form. Students were then asked to fill out the HSL-PPSS scale, taking into account the problems presented in graphical form. After the first stage, students were given a 10-day break so that they did not remember the questions and did not get bored. In the second stage, the same operations in the first stage were applied to solve the problems presented in the text. During the data collection process, 119 students were

reached. But when the data obtained from the scale was examined, it was found that some students did not have answers for both scales, while some scales were not filled out in a valid way. The answers of 72 students (42 Science High School students, 30 Anatolian High School students) who filled the scales validly for two types of problems were included in the analysis.

### **Data Analysis**

The responses of 72 students to the scale were analyzed through the SPSS 25 program. Data on scales completed by the same students were examined, and it was found that the data on all scales were distributed normally, but the data on their sub dimensions were not distributed normally. For this reason, the dependent t test was used in the analysis of the data for the entire scale, and the Wilcoxon marked rows test was used in the analysis of the data for its sub-dimensions.

All answers to open-ended questions were subject to content analysis. During the data analysis process, students were coded as S1, S2, S3 for given answers for in graphical and text form. The data was encoded by another researcher who is an expert in physics education and the opinion on the generated codes was taken. Incompatible code names were decided as a result of interviews. It was discussed that the obtained codes to be themed according to the dimensions contained in the HSL-PPSS scale. It was found that not all of the first level codes reached were in scale items. Therefore, in addition to the dimensions in the scale, the “solving” dimension was added. The obtained codes are presented under the titles of understanding the problem, organizing the problem, gathering attention, solving, controlling and evaluating the problem.

### **Ethical Procedures**

Application made to Recep Tayyip Erdogan University Social and Human Sciences Ethics Committee was found ethically appropriate with the decision numbered 22, at the meeting held in 02.02.2021. Data were collected by paying attention to the pandemic conditions, and no risk was created regarding the health status of the participants.

## **Results**

### **Strategies Used in Solving Problems Presented in Text and Graphical Form**

Under this title, descriptive statistics about the answers to the HSL-PPSS scale and the results obtained from the students' answers to open-ended questions about solving problems presented in graphic and text are presented.

Average and standard deviation values for strategies used by students to solve problems presented in the form of text and graphical according to the HSL-PPSS scale are presented in Table 1.

Table 1  
Descriptive Statistics for Substances on the HSL-PPSS Scale

Item no	Statements	When presented in text form		When presented in graphical form	
		$\bar{X}$	$SD$	$\bar{X}$	$SD$
1	If there is a given shape for the problem, I associate the problem sentence with the shape.	4.33	.769	4.22	.826
2	I visualize the problem in my mind.	4.28	.791	4.10	.937
3	I write down what's given and what's wanted in the problem.	3.93	.954	3.58	1.135
4	I create physics formulas that will provide the solution to the problem.	3.71	.941	3.57	1.019
5	I think about the relation between what's given in the problem.	3.96	.911	3.99	.796
6	I think about which law or laws of physics the problem is related to.	3.74	1.151	3.57	1.220
7	I identify important concepts related to the problem.	3.82	.954	3.65	1.023
8	I write the data with its units instead of the formulas.	3.33	1.256	3.40	1.195
9	I can guess the solution to the problem.	3.61	1.056	3.76	.986
10	I create a solution with more than one.	2.83	1.289	2.85	1.083
11	If there is no given shape for the problem, I visualize the problem by drawing.	3.54	1.174	3.40	1.057
12	When solving the problem, I wonder whether I'm doing right.	3.96	1.067	4.10	.995
13	I check the units of what is given in the problem, what is requested, and the result I get.	3.63	1.093	3.67	1.075
14	I rewrite the problem in my own sentences.	2.36	1.248	2.46	1.352
15	I determine the properties of the quantities in the problem (such as, scalar-vector).	2.92	1.381	3.03	1.126
16	I divide the problem into its sub-problems.	2.58	1.219	2.72	1.165
17	I wonder whether my conclusion to the problem makes sense.	4.01	1.055	4.17	.805
18	I check the mathematical operation steps that I use solving the problem.	3.85	1.122	3.93	1.012
19	I wonder whether the formulas I use in the solution make sense.	3.96	1.027	4.22	.938
20	At the end of the problem, I assess whether there is information that I need to learn in more detail on the relevant topic.	3.61	1.015	3.57	1.185
21	When I can't solve the problem, I think about the reasons.	3.85	1.002	3.71	1.067
22	At the end of the problem, I think about what information I'm using.	3.28	1.116	3.40	1.109
23	I assess whether I can fully solve the problem.	3.76	1.014	3.89	.912
24	I evaluate whether I can completely solve the problem.	3.78	1.010	3.79	1.020
25	When I can't solve the problem, I think about my lack of knowledge.	3.72	.953	3.60	1.070

According to their average value seen in Table 1, students often use the following strategies when the problem is presented in text form: 'If there is a given shape for the problem, I associate the problem sentence with the shape.' ( $\bar{X}=4.33$ ;  $SD=.769$ ), 'I visualize the problem in my mind.' ( $\bar{X}=4.28$ ;  $SD=.791$ ), 'I wonder whether my conclusion to the problem makes sense.' ( $\bar{X}=4.01$ ;  $SD=1.055$ ). And they use 'I rewrite the problem in my own sentences.' ( $\bar{X}=2.36$ ;  $SD=1.248$ ) strategy less often.

When the problem is presented in graphical form, they often use the following strategies: 'If there is a given shape for the problem, I associate the problem sentence with the shape.' ( $\bar{X}=4.22$ ;  $SD=8.26$ ), 'I wonder whether the formulas I use in the solution make sense.' ( $\bar{X}=4.22$ ,  $SD=.938$ ), 'I wonder whether my conclusion to the problem makes sense.' ( $\bar{X}=4.17$ ;  $SD=.805$ ). And they use 'I rewrite the problem in my own sentences.' ( $\bar{X}=2.46$ ;  $SD=1.352$ ) strategy less often.

Descriptive statistics on the sub-dimensions of the HSL-PPSS scale, which reflect the stages of problem solving, are presented in Table 2.

Table 2

*Descriptive Statistics on the Sub-Dimensions of the HSL-PPSS Scale*

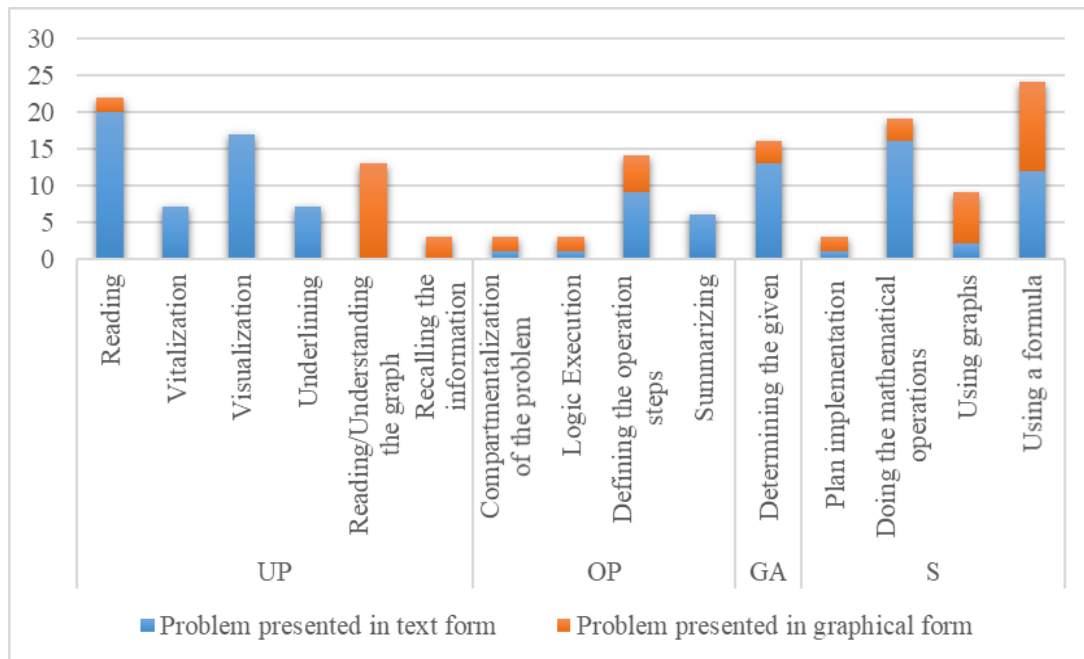
Dimensions	Text form		Graphical form	
	$\bar{X}$	$SD$	$\bar{X}$	$SD$
Understanding the problem	3.9246	.54410	3.8869	.56989
Organizing the problem	2.6736	1.00670	2.7639	.86388
Attention gathering	3.6833	.79275	3.5750	.69925
Checking and evaluating	3.7515	.74838	3.8009	.73866

According to the descriptive statistics seen in Table 2, students use respectively the following strategies below when the problem is presented in text and graphical form: understanding the problem ( $\bar{X}=3.9246$ ;  $\bar{X}=3.8869$ ), checking and evaluating ( $\bar{X}=3.7515$ ;  $\bar{X}=3.8009$ ), gathering attention ( $\bar{X}=3.6833$ ;  $\bar{X}=3.750$ ), organizing the problem ( $\bar{X}=2.6736$ ;  $\bar{X}=2.7639$ ).

Frequencies related to the strategies that students stated that they use in the stages of understanding the problem (UP), organizing the problem (OP), gathering attention (GA) and solving it (S) when solving problems presented in the form of text and graphic are presented in Figure 1.

Figure 1

Change of Strategies Used in Solving Problems Presented in the Form of Text and Graphic According to Stages



As seen in figure 1, students stated that when the problem is presented in text, they use reading (20), visualization (17), animation (7) and underlining (7) strategies for understanding the problem. A student (S34) stated that he used the reading strategy with the sentence below: *"I try to understand what I read first. I read it over and over again."* A student (S39) stated that he used the visualization strategy with the sentence below: *"I usually visualize the question. If it's easy, I visualize it in my head. If it's complicated, I draw it simple."* Another student (S28) stated that he used the revitalization strategy with the sentence below: *"I try to understand what the text says. Then I start visualizing it."* Another student (S50) stated that he used the underlining strategy with the sentence below: *"I start by highlighting things that can be overlooked."*

Students stated that they used the strategies of reading/understanding the graph (13), information recall (3), and reading (2) when the problem was presented in graphic form. A student (S15) stated that he used the graph reading/understanding strategy with the sentence below: *"First I examined the graph. I thought about the features of the graph and what I had to do."* Another student (S49) stated that he used the information recall strategy with the sentence below: *"I tried to recall the information I learned in class."* Another student (S5) stated that he used the reading strategy with the sentence below: *"I read it again and again and try to understand."*

Students stated that when the problem is presented in text form, they use the strategies of defining the operation steps for the stage of organizing the problem (9), summarizing (6), logic execution(1) and compartmentalizing the problem (1). One of the students (S22) who uses the strategy of determining the operation steps stated the sentence below: *"... then I determine the order of operation"*. One of the students (S44) who uses summarizing strategy stated the sentence below: *"I don't get too stuck in sentences that storify the event, I get the numbers or details I need to get, and I write*

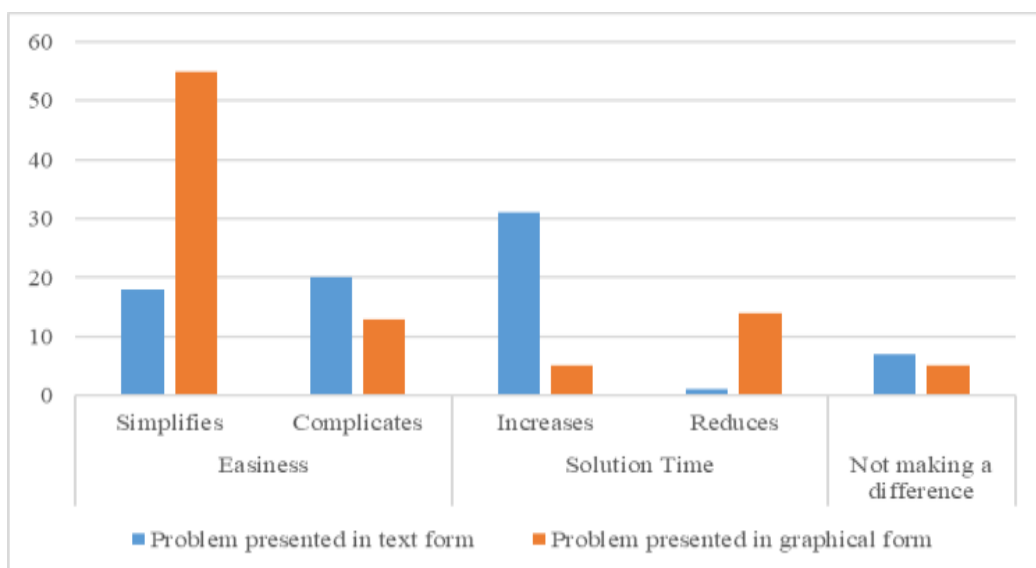
them in the corner of the paper.”. A student (S5) who uses logic execution strategy stated the sentence below: “I reason, and then I solve it.”. A student (S60) who uses the strategy of compartmentalizing the problem stated the sentence below: “I spare the text into step-by-step to-dos.”.

When the problem is presented in graphical form, students stated that they used strategies such as determining the operation steps (5), executing logic (2), and compartmentalizing the problem (2). One of the students (S15) who used the strategy of determining the steps of the operation said: “First I examined the graph. I thought about the features of the graph and what I had to do. I determined the operations.”. One of the students (S2) who used the logic execution strategy said: “I proceeded with the information in my mind, made reasoning, and interpreted the graph.”. One of the students (S8) who used the strategy of compartmentalizing the problem said: “I compartmentalized the problem.” Students stated that they used determining strategy when the problem was presented in the form of text and graphical for the gathering attention phase. When the problem was presented in the form of text 13 students, and when the problem was presented in the form of graphical, three students stated that they used this strategy. Some of the students’ statements are as follows: “I write down the information provided.” (S24 for solving problem in text form), “...then I write down the given values.” (S43 for solving problem in text form), “I read the information in the text and write down what was given.” (S47 for solving problem in graphical form).

In the data about the strategies that students use to solve problems presented in text and graphics, there is no strategy for the control and evaluation stage. According to the students, the findings on how presenting the problem in text or graphics affects the solution processes are presented in Figure 2.

Figure 2

*Effects of the Presentation Way of Problem on Solution Process*



As can be seen in figure 2, 20 students stated that presenting the problem in text form made the solution process complicated, while 18 students stated that it made it more simple. Students who think that it complicates the solution process stated that they

find it complex that the problem situation is presented in text form. And they expressed their views with the following sentences: *“It can be confusing to present it in a storified text, rather than asking the question directly. (S24)”*, *“The texts are confusing because they are longer. (S29)”*, *“It’s a little harder to analyze long texts. (S50)”*. Some of the students who think it facilitates the solution process expressed their views as follows: *“It’s actually a little easier because more information is given. (S14)”*, *“It’s good for me because the problem becomes more clear in my head. (S41)”*.

31 students stated that presenting the problem in text form increased the time needed to solve it, and 1 student stated that it reduced it. Students expressed their opinion that presenting the problem in the form of text increases the time needed to understand the problem in the following sentences: *“It makes it difficult for me to understand the question and lengthens the time. (S58)”*, *“It increases my solution process because to understand the text, I have to visualize it, at least in my head, imagine it, the fact that the problem is in the text requires me to do all these steps. (S73)”*.

The student (S61), who thinks that it reduces the time needed for the solution, said: *“Because there is more information, it becomes difficult for me to read and understand, but the solution time becomes shorter.”* 7 of the students stated in the following sentences that presenting the problem in the form of text does not make a difference in the solution process: *“It doesn’t affect much. (S59)”*, *“They’re thought to be more difficult, but it doesn’t really matter (S3)”*.

Most of the students ( $f=55$ ) stated that presenting the problem in graphical form made the solution process easier, while 13 students stated that it made the solution process difficult. Students who think that presenting the problem in graphical form facilitates the solution process stated that graphs make it easier to understand in the following sentences: *“It allows us to see more clearly and create it in our head. (S6)”*, *“It affects us to see the situation more clearly. (S30)”*, *“It is better. It is seen more clearly. It can be solved on paper. (S31)”*, *“Seeing all the data in a graph, rather than being described in text, makes it easier in the solution process. (S73)”*.

Students who think that presenting the problem in graphical form complicates the solution process stated that graphs make it easier to understand in the following sentences: *“Extra graph interpretation is added in the solution process. (S91)”*, *“I find it very difficult to solve problems in the form of graphics. (S46)”*.

Some students ( $f=14$ ) stated that presenting the problem in graphical form shortened the time required for the solution, while five students stated that it increased the time. Those who think it reduces the time said the following sentences: *“I think it works well because we can think like this, as a result of presenting a problem as a paragraph, we can reach a solution by graphing the elements in it, and giving it in graph form saves us time. (S74)”*, *“It allows us to solve it easier and faster. (S53)”*. Those who think that it increases the time stated that understanding the graph requires effort in the following sentences: *“Graph questions take longer than normal ones because reading the graph wastes time. (S18)”*, *“I take more time because I have to interpret it first. (S76)”*. 5 of the students explained in the following sentences that presenting the problem in graphical form does not make a difference in the solution process: *“It is not very different from the solution process in non-graphic questions. (S80)”*, *“It doesn’t affect the one who has a high level of chart information (S57)”*.

### Differentiation of PPSS according to the Presentation of the Problem

The result of the dependent t test to determine the differentiation state of the problem solving strategies that participants use according to the presentation of the problem is presented in Table 3.

Table 3

*Analysis Results Regarding the Differentiation State of the Problem Solving Strategies Used According to the Presentation of the Problem*

Presentation of the problem	N	$\bar{X}$	SD	t	df	p
Graphical	72	3.6139	.58685	.000	71	1.000
Text	72	3.6139	.62490			

As can be seen in Table 3, there is no significant difference between the problem solving strategies that students use to solve problems presented in the form of text and graphic ( $t(71)=.000$ ,  $p=1.000$ ).

The Wilcoxon signed-rank test results are presented in Table 4 to determine the state of differentiation of the use of strategies in the dimensions of the scales according to the presentation of the problem.

Table 4

*Results of the Analysis on the Differentiation State of Scores Taken From the Dimensions of the HSL-PPSS Scale According to the Problem Presentation*

Dimension	Sequence	N	Sequence average	Sequence sum	z	p
Understanding the problem	Negative Sequence	39	33.97	1325.00	-.270	.787
	Positive Sequence	32	38.47	1231.00		
	Equal	1				
Organizing the problem	Negative Sequence	36	32.85	1182.50	-.720	.421
	Positive Sequence	29	33.19	962.50		
	Equal	7				
Gathering Attention	Negative Sequence	36	37.44	1348.00	-.842	.400
	Positive Sequence	33	32.33	1067.00		
	Equal	3				
Checking and evaluating	Negative Sequence	37	32.88	1216.50	-.266	.790
	Positive Sequence	31	36.44	1129.50		
	Equal	4				

\* *Based on Positive Sequences*



As can be seen from Table 4, there is no significant difference among the problem solving strategies used by students in the terms of understanding the problem  $z=-.270$  ( $p>.005$ ), organizing the problem  $z=-.720$  ( $p>.005$ ), gathering attention  $z=-.842$  ( $p>.005$ ), controlling and evaluating the problem  $z=-.266$  ( $p>.005$ ).

### Discussion and Conclusion

In this research, which aims to examine the strategies that students use to solve problems presented in text and graphics, it was found that strategies aimed at understanding the problems were most often used (Table 2). Given the importance of understanding the problem in the process of solving the problem, this is an expected result. Mansyur (2015) determined through interviews what high school students and physics teachers do in the first stage of problem solving and how they successfully reach a solution. They determined that those who achieved successful solutions followed steps such as reading the problem, interpreting it, creating a diagram/visualizing it, and editing the equality/formula. They determined that they used the steps to determine what was given and what was wanted and organize the information to create the diagram. In this case, it can be said that understanding the problem covers most of the solution process.

At the stage of understanding the problem, it was found that students usually use strategies of animation, visualization, reading, underlining, reading/understanding the graph (Figure 1). These strategies correspond with the opinions of researchers who describe physics problem-solving strategies in the literature. These strategies are similar to the visualization and physical depiction of the problem in the Minnesota problem solving strategy (Heller et al., 1992), gathering information in the GOAL (gather, organize, analyze, learn) strategy (Beichner, 2002), "What's going on" in the WISE strategy (Wright & Williams, 1986); the stages of understanding the problem in the ANAPUK+KD strategy (Çalışkan, 2007).

According to the results obtained from the scale, one of the strategies that students most often use is understanding the problem (If there is a given shape for the problem, I associate the problem sentence with the shape.), and the others are related to controlling and evaluating the solution (When solving the problem, I wonder whether I'm doing right.) (Table 1). In the answers to open-ended questions, it is noteworthy that there is no expression related to checking and evaluating the solution, which is the last step of problem solving (Figure 1). This indicates that students do not consider the control and evaluation stage when explaining the process related to problem solving. Students may be taking this final stage out of the problem-solving process. In other words, they may see checking and evaluating as a process after problem solving. Or it may be an indication that they do not check their solutions, they do not evaluate the solution process. Researches in the literature have shown that students often have deficiencies in the use of control and evaluation strategies (Jua, 2018; Kelly et al., 2016). Another situation that is not mentioned in the explanations of the processes of solving students' problems is related to units. Students never made a statement about the units, but if the units are received incorrectly, the unit conversion is performed incorrectly the calculations will also be incorrect (Jua, 2018). The use of these strategies by students should be increased.

It was found that students often use the strategies of reading the problem, listing what is given, underlining, and visualizing it (Figure 1). Similarly, Çalışkan et al. (2006) determined that physics teachers candidates use “re-reading the problem” strategies while solving physics problems, Mansyur (2015) found that one of the strategies used by those who successfully solve physics problems is reading the problem. The problem reading strategy is done by each student but may not be expressed. It is important to determine what students pay attention to while reading the problem, and the factors that are effective in reading numbers. This situation can be examined in more detail in subsequent research. The findings that the visualization strategy is often used to list what is given when solving physics problems are also consistent with research in the literature (Çalışkan et al., 2006; Mansyur, 2015). Visualization is a strategy that makes drawing a diagram easier to solve by turning the problem into another form of presentation (Maries & Singh, 2018). Maries and Singh (2018) examined problem solutions in which a group of students presented diagram drawings, problem solutions that a group of students made by drawing the diagrams themselves, and problem solutions that a group of students made without interference. It was found that when solving the problems presented in the diagram, students skipped the stage of understanding the problem, made mistakes in the solution process because they moved directly to the stage of implementation, and were more unsuccessful than other groups. Arsal (2009) determined that those who used strategies for reading and understanding the problem and expressing the problem differently were more successful in solving the problem.

Findings from responses to the scale show that students generally use similar/problem-solving strategies when solving problems presented in the form of graphics and text (Table 3, 4). The results obtained from open-ended questions show that there are differences in some stages of problem solving according to the way the problem is presented. At the stage of understanding the problem, they use strategies of animation, visualization, underlining when the problem is presented in the form of text; when the problem is presented in the form of a graph, they use the strategies of reading/understanding the graph, remembering information. At the stage of organizing the problem, they use the strategy of summarizing important places in the solution of problems presented in the form of text, unlike the solution of problems presented in the form of graphs (Figure 1). This shows that, as De Cock (2012) states, students’ strategies depend on the presentation of the problem. Hung and Wu (2018) found that there were differences in the implementation and evaluation stages of the plan in their study in which they compared the solution of problems involving numbers and symbols. Different types of problems require different processes to be used in the solution (Kelly et al., 2016).

Some of the students stated that problem presentation in the form of text has effects such as facilitating and accelerating the solution process. Some students expressed the opposite. There were also different opinions that emerged regarding the presentation in the form of graphics (Figure 2). Similarly, Hung and Wu (2018) found that students had more difficulty solving problems involving symbols (such as  $m_1$ ,  $m_2$ ) in general than those containing numbers. Some students in the same study noted that symbols in symbolic problems help them remember formulas. Students stated that they are not accustomed to symbolic problems. This indicates the importance of previous

schemas in problem solving. Those who recognize the type of problem apply the solution to the problem more easily (Shin et al., 2003). Özcan (2011) also found that most physics teacher candidates use an analogy approach to previously solved problems when solving problems related to special relativity. In this study, the problems presented in text form are longer than the problems that students often encounter. This can cause students to make more effort to understand the problem and have difficulty solving it.

Students who think that the process of solving problems presented in the form of graphs is more difficult see graphs as complex and require effort to understand them. The reason for this may be the students' lack of knowledge about graphics or lack of mathematical knowledge revealed by previous research. Eryılmaz-Toksoy (2020), in her study with 11th grade students, determined that students had deficiencies in their knowledge of which information to access and how to access this information from the graph. Sezen et al. (2012) determined that physics teacher candidates had low level of graphic reading, drawing and interpreting skills. Students are inadequate in interpreting the change in height or slope in the graph, in establishing relationships between different types of graphs that describe the same situation, and decisively in interpreting the area below the chart (Erceg & Aviani, 2014). Ivanjek et al. (2016) determined that graph interpretation strategies depend on the field and subject at the end of the study in which university students investigated physics, mathematics, and the interpretation of graphs in different contexts. In a study in which Planinic et al. (2013) presented students with questions about the slope of the graph and the area below the graph in mathematics, physics, and other contexts, they determined that the easiest substances for students were those related to mathematics that did not contain a context (physics or others). Ceuppens et al. (2019) at the conclusion of the study, in which they examined the solutions of physics and mathematical problems containing the same mathematical information, they determined that students were less successful in solving physics problems and that they had no difficulty in solving negative slope problems in mathematics. However, they had difficulty in solving negative speed problems in kinematics. Students have deficiencies in associating their mathematical knowledge with the concepts of physics (Handhika et al., 2019; Turşucu et al., 2020). As Erceg and Aviani (2014) noted, students have mathematical knowledge such as slope calculation, but they are inadequate in applying it to graphs in physics. Turşucu et al. (2020) found that reminding mathematical knowledge with cues increases the ability to solve physics problems in 10th grade students. Teachers can remind general information about graphics before problem solutions.

Mansyur (2015), in his study with physics teachers and their students working in 3 different schools, found that the teacher and the teaching process influence the steps that students follow when solving problems. The teacher stated that if he draws when he starts to solve problems, he asks his students to solve them in this way as well. The student also stated that he began the solution in the same way. When teachers teach students to solve traditional problems, they expect them to be able to apply this knowledge to other problems. In fact, this distracts them from the active learning process (Erceg & Aviani, 2014). Mansyur (2015) found that although they used the same strategies, there were those who failed to achieve a successful solution. This suggests that the problem-solving strategies that students use are not sufficient to reach a successful solution alone and that the order of strategies that they use in the process is

also important. In subsequent research, the order of strategies used in solving problems presented differently can be determined. In this way, it can be revealed which stage of the problem solving process affects the way the problem is presented (understanding the problem, making plans, controlling, etc.).

### **Implications**

More detailed data can be obtained by determining the strategies used by making clinical interviews with students while solving problems. However, this could not be fulfilled due to the pandemic conditions.

### **Conflicts of Interest**

There no conflicts of interest in this study.

### **Author Bio**

She is an assistant professor at the Department of Computer Education and Instructional Technology, Recep Tayyip Erdoğan University, Turkey. She completed her undergraduate education in physics teaching and her doctoral education in physics education at Karadeniz Technical University in Turkey. Her research interests include problem based learning, physics education, problem solving, science and technology.

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## How Can School Compensate for Home Disadvantage? The Role of Schooling on Equalizing Social Distinctions

### Okul Aileden Kaynaklı Dezavantajlı Durumları Nasıl Telafi Edebilir? Eğitimin Sosyal Ayrımları Eşitlemedeki Rolü

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**ABSTRACT:** Explaining the social function of schooling through maintaining, reproducing, and increasing inequalities does not provide a clear framework for what can be done to help the disadvantaged benefit from education. In order to break this vicious circle of describing deficiencies and perpetuating, it is necessary to focus more on the recovery and compensatory function of education. This qualitative study, conducted with grounded theory, explores mechanisms within schools that can compensate for disadvantages that arise outside of school. These mechanisms were defined through the data obtained in a small city in Turkey from interviews focusing on the schooling practices of 35 educators, 19 of whom had administrative backgrounds and 16 of whom were teachers. The compensatory function of schooling operates in a gradual process of supporting the students to engage in school and become active in school. In the inclusion process, all the student's shortcomings are ignored and the student is seen as neutral. In the support phase, macro reformist and central policies are ignored, and support is rather individualized and concretized. This analysis suggested that strengthening compensatory role of schooling could help overcome barriers that students from disadvantaged backgrounds experience in educational attainment.

**Keywords:** Compensatory education, inequalities, reproduction, social function of schooling.

**ÖZ:** Okulun sosyal işlevini eşitsizlikleri sürdürmek, yeniden üretmek ya da artırmak üzerinden açıklamak, dezavantajlıların eğitimden yarar sağlamaları için neler yapılabileceği konusunda net bir çerçeve ortaya koymaktan uzaktır. Bu eksiklikleri tanımlama ve sürdürmeyle ilgili var olan döngüyü kırmak ve eğitimin iyileştirici ve telafi edici işlevine odaklanma çerçevesinde kurgulanan bu çalışma temellendirilmiş kuram ile yürütülen nitel bir araştırma olup, okul dışından kaynaklı dezavantajları telafi edebilecek okul içi mekanizmaları araştırmayı amaçlamaktadır. Bu mekanizmaları tanımlamak için 19'u yönetici ve 16'sı öğretmen olmak üzere toplam 35 eğitimcinin eğitsel pratiklerine odaklanan görüşmeler gerçekleştirilmiştir. Görüşmelerden elde edilen verilerin çözümlemesi sonucunda ulaşılan bulgular eğitimin telafi edici işlevinin öğrencilerin okula katılmasını sağlamak ve okulda etkin hale gelmelerini desteklemek şeklinde aşamalı bir süreçte gerçekleştiğini göstermiştir: Dâhil etme ve destekleme. Dâhil etme aşamasında öğrencilerin tüm eksiklikleri göz ardı edilmekte ve öğrenci nötr bir varlık olarak görülmektedir. Destekleme aşamasında ise merkezi politikalar göz ardı edilmekte, destek uygulamaları bireyselleştirilip, somutlaştırılmaktadır. Bu analiz çerçevesi, eğitimin telafi edici rolünün güçlendirilmesinin, dezavantajlı kesimlerden gelen öğrencilerin eğitsel katılım süreçlerinde deneyimledikleri engellerin üstesinden gelmelerinde işlevsel olabileceğini ortaya koymuştur.

**Anahtar kelimeler:** Telafi edici eğitim, eşitsizlik, yeniden üretim, okulun sosyal işlevi.

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This article addresses an examination of the social function of schooling in terms of compensating for the lack of resources out of school. It is a well-known subject that schools are stratified parallel to the social class structure in society. The critical actors in schools mirroring the social structure and differentiating for their audiences are the educational and cultural competences of the family (Lareau, 2003; Reay, 2010; Reynolds & Bezruczko, 1993;). The role of schools in reproducing social injustice can be explained by school processes overlapping with the daily life practices of the middle class, therefore putting these individuals at an advantage and helping them benefit more from school (Ball, 2010; Horvat et al., 2003). On the other hand, the disadvantaged masses who cannot gain the cultural and cognitive competencies required to adapt to school and participate effectively in educational processes from their out of school environment generally view the school as a hostile environment (Lee et al., 1994) while the school refers to the situation of these individuals as cultural deficiency (Hurn, 2016). For students who lack an adequately supportive home or cultural environment, their disadvantages reflect on the school as academic difficulties (Ingram, 2011; Mayo & Siraj, 2015), low cognitive skills (Gaddis, 2013; Soubelet, 2011), and low ability to interact with teachers effectively (Bourdieu & Passeron, 1977; Calarco, 2011). As advantaged students have more resources, they become more successful at school, therefore causing schools to reproduce social class injustice (Condrón & Roscigno, 2003; Downey et al., 2004). The common point behind these approaches to the social class-based elements that guide educational success and effective participation in school processes is that education is functional in families willing to invest in the schooling of their children and those who wish to and can support it.

A comprehensive literature exists about the effects of the family and non-school environment on educational achievement and the support mechanisms offered to middle class children in non-school environments (Lareau, 2003; Weis, 2010; Weis & Cipollone, 2013; Wheeler, 2018). However, a limited number of studies focus on the compensatory role of schools on non-school based disadvantages and that claim schools can bridge the differences stemming from non-school environments (see for exceptions; Downey & Condrón, 2016; Gorard, 2010; Hanselman, 2018). This leads me to an inquiry on the size of the effect schools have on people, or whether schools can transform the status quo other than reproducing, nurturing or responding to existing inequalities. If we are to accept schools as neutral in responding to inequalities (as Coleman et al., 1966 suggested), do we then assume that they do not have an equalizer or decreasing function on existing inequalities? Downey and Condrón (2016) state that the role of schools cannot be limited to neutral or exacerbatory functions that sustain these inequalities, but they also have a compensatory role that decreases them. Then this role of the school should also be considered. The main argument of approaches that explain achievement differences between schools or individuals via social class related advantages and life practices is that the non-school environment is the factor that benefits the middle class at school.

Studies on the social character of schooling have a consensus that the disadvantaged segments of the society such as the poor and working class, migrants, those from different ethnical backgrounds, and those who live in the rural experience lack of attainment and underachievement because they cannot fulfill the requirement of school (Bourdieu & Passeron, 1977; Kozol, 2005; Willis, 1981). In parallel with this

consensus, studies on social class and schooling have, on a more micro level, started to consider variables such as cultural patterns, meaning attributed to education, and cultural competencies required for the participation in the educational processes as parameters that differ in relation to social class (Ball, 2003; Bennet et al., 2012; Vincent & Ball, 2007). However, while doing this, researchers or theorists have focused on academic success, variables of educational attainment, educational investment of families, participation in extracurricular activities and outputs, and their focus have naturally been the interrelatedness or correspondence of social class and schooling (Cavanagh & Fomby, 2012; Croll, 2004; Horvat et al., 2003; Van Rossem et al., 2015; Von Otter & Stenberg, 2015). In such studies, there is a tendency to approach the individual's inability to receive sufficient economic, cognitive and academic support from the home environment in order to fulfill the requirements of the school in a structuralist and deterministic framework, and the quality of the educational life of the individual is evaluated from certain reference points. Therefore, when the topic at hand is the compensatory role of schools regarding non-school disadvantages, the focus should be inside the school, not outside. Chiu and Khoo (2005) indicate that a more egalitarian distribution of resources leads to better learning outcomes; a school system where each student is funded equally and distributed randomly reduces distribution inequality and may increase academic achievement. Gorard (2010) argues that schools may be designed to minimize social injustice and the effects of problems on themselves. Alexander (1997, as cited in Downey & Condrón, 2016) describes this compensatory role of education as "when injustice is involved, education is a part of the solution rather than one of the problem". It, therefore, seems important to reveal the mechanisms that explain how schools are an opportunity for disadvantaged students and that ruin the arguments which create the illusion that schools can only do so much for students from the low-class background. The study investigates whether it is possible to reduce the impact of social inequalities within the school context and to redefine the social function of schooling in terms of variables of the school context as an equalizer or supportive environment for students from low-class background.

### Literature Review

The initial inquiry into the compensatory role of the school was undertaken by Bernstein (1973). He stated that "school cannot compensate for society". According to Bernstein (1973), "compensatory education" emerges as intervention or enrichment, and is defined as a way of transforming culturally deprived, linguistically deprived, socially disadvantaged students. Bernstein (1973) argued that "compensatory education focuses on families and children, not on the internal organization and the educational context of the school. Thus, it implies that the family and the child are lacking and the school compensates for the lack and deficiency". He criticized "compensatory education" as it places deficiencies stemming from the non-school environment to the center and blames students' home life, rather than the deficiencies at school, for the existing situation. Bernstein (1973, p. 149) suggested that the conditions and contexts of the educational environment should be considered most seriously and systematically. This means that what needs to change or be corrected is the condescending language of the school and the school itself, not the children or their families. What renders children disadvantaged at school is the school culture based on middle class practices, which Bernstein (1973, p. 152) explains as "It is not made for him: He may not answer to it". Instead of viewing

lack of achievement as stemming from a financial and cultural deficiency of the working class, it should be seen as a result of the rule of the middle class that defines what knowledge and achievement is (Whitty, 2001). However, schools seem to believe if only they were like middle-class parents, then we could do our job (Bernstein, 1973, p. 148).

What Bernstein means with compensatory education is the use of it as aim oriented and special support programs. Compensatory education brings to mind macro, centralized, founded, curriculum development-based programs. Nixon et al. (2002) criticize compensatory education policies for treating students pathologically and for aiming to improve or replace their culture within criteria identified by experts. Dyson (2011) states that school improvement efforts should steer clear of school professionals who claim to ‘know best’. Bernstein (1973) suggested that schools appealing to all students should be the case in regular education, not “compensatory education”, and he was pessimistic about schools offering students an optimal learning environment. Even though his argument that “school cannot compensate for society” may seem pessimistic at first glance, he means that describing the family and child as deficient is a pessimistic act. He argues that when we view deficits as differences and flex the standard middle class language of the school, there may be achievement.

Bellei (2013) discusses school effectiveness in relation to compensatory education in alternative school development efforts of teachers. In his study, compensatory education initiatives, which are carried out through providing financial resources to the improvement of academic success, were evaluated within the framework of the teacher professional development program over the importance of school effectiveness and the teachers in this respect. He suggests that teachers need to transform their present practices, and strengthen teamwork and social interactions. Muijs et al. (2004) discuss the compensatory function of the school in the context of school effectiveness, suggesting that while improving schools that serve disadvantaged groups is indeed a difficult task, since they have to deal with more than one disadvantage, it is not impossible. Still, these schools have to make efforts above normal, and teachers that are employed at these schools have to work overtime, and be more consistent in their efforts than the teachers working in more advantageous areas. Lezotte and Bancroft (1985) also tackle school effectiveness in terms of supporting the education of the disadvantaged, focusing on the distribution of success within a given school. Reform studies in this direction have emphasized the importance of monitoring how the success rate of students with low socioeconomic backgrounds go up or down within the overall rising success rate. To improve compensatory education, schools need to undergo two stages of transformation. The first stage consists of the satisfaction of basic needs such as providing a decent environment and fulfillment of basic expectations, whereas the second stage consists of structural improvements focused more on the systematic and long-term processes (Teddlie et al., 2003).

Several decades after Bernstein (1973) stated “school cannot compensate for society”, Gorard (2010) suggested that schools may act as “mini communities” to alleviate the experience and effects of inequality and showed that “education can compensate for society – a bit”. According to Gorard (2010), schools could create formative and transformative impact on student lives regardless of their social or cultural origin, thus promoting mobility, even if only a bit. She added that the

integration of disadvantaged students into school may be possible if the teacher respects all pupils and encourages them to learn at their own speed, is sensitive about discrimination and peer attitudes. Understanding social class differences in home-school interactions also addresses issues regarding teacher misconceptions (Fields-Smith, 2007). Studies regarding how teachers' expectations about students contribute to their school performance suggest that teachers tend to increase certain students' successful grades because they treat some students from whom they expect good performance differently than those from whom they expect low performance, and students with lower levels of success receive less instruction because of such approach (Hurn, 2016). The research of Rosenthal and Jacobsen (1968) shows how teacher expectations influence student performance. After they applied IQ tests to students, they informed the teachers that some of the students, who in fact scored different levels, were highly gifted and they observed that the teachers acted differently towards those students and supported them more. Additionally, when the students were tested again at the end of the school year, the researchers observed that there was a significant increase in the IQ scores of these students who received their teachers' support.

Research suggests that schools are important environments for the disadvantaged and are the only accessible places to attain educational competencies. For instance, Berends (2000) states that schoolwide reforms create a difference not from one school and another, but within a school with the help of teacher support and practices that have a good impact on students. Hanselman (2018) similarly suggested that schools are the only place for the disadvantaged to acquire the skills that the advantaged may acquire outside or in the absence of a school. Therefore, schools should include the sources that offer advantages to the advantaged others outside of them. The fewer advantages students have, the more willing they are to use these sources at school and its supportive environment (Chiu & Khoo, 2005; Goldthorpe, 1996). Accordingly, teacher efficiency can be identified as another component of compensatory school order. If teachers regularly create better learning opportunities for all, disadvantages may be overcome (Balfanz & Mac Iver, 2000). Disadvantaged students are more successful in more effective schools (Teddle & Reynolds, 2003). Hanselman (2018) argued that while less effective teachers exacerbate inequalities, more effective teachers might compensate for academic disachievement. Wang and Gordon (1994) suggest that teachers' supportive teaching strategies, positive classroom environment and teaching policies can have a positive impact on students with disadvantaged backgrounds and circumstances (as cited in Arnold & Doctoroff, 2003). Teacher effectiveness is believed to be crucial in promoting especially the achievement of minority students and students with disadvantaged backgrounds (Konstantopoulos & Chung, 2011). Besides, it is very important that teachers respond to the learning needs of students, support students' progress, and help improve academic achievement for students with disadvantaged backgrounds (Ferguson, 1998).

Some previous research focuses on the organizational dimension of schools. As structural and organizational changes in schools contribute to create more caring and more supportive institutions, these efforts transform the climate and structure of school to "warmer, happier, and more peaceful places for students" (Balfanz & Mac Iver, 2000). Datnow and Stringfield (2000) suggested that schools adopt effective reform that suits a particular school's context instead of adopting reform models that would not be

suitable for the given school's culture, teachers and students. This is important for bringing equality of opportunity to education or minimizing the ineffectiveness that stems from the inequality policies of centralized and standard structure. Potter (2007) suggested that effective teaching practices, relationships with children, communicating and working in partnership with families and carers, teamwork and collaboration, and professional development are all necessary in order to improve educational attainment and achievement of students from disadvantaged social backgrounds, knowledge and understanding. Bernstein (1973, p. 149) also emphasized partnership with parents. He suggested that all families can do certain things for their children within their own competencies. If the school interacts with the family upon this principle, "then the parents can feel adequate and confident both in relation to the child and the school. This may mean that the contents of the learning in school should be drawn much more from the child's experience in his family and community". Downey and Condon (2016) identified mechanisms that can compensate for socioeconomic gaps and contribute to reducing inequality as curriculum consolidation, targeting resources toward disadvantaged children, and preventing teachers from blaming students from disadvantaged backgrounds for lack of effort. Following Frempong et al. (2012) and Hanselman (2018), who showed that schools could compensate for socioeconomic disadvantage, I studied "how" to do this. In this study, I seek to address compensation mechanisms by examining situations and how the training can be compensatory from the agents' perspective that operates the school's compensatory function.

### **Method, Design, and Procedures**

Constructivist grounded theory (Charmaz, 2014) guided this study's design and analysis process. Grounded theory was first identified by Glaser and Strauss (1967) and versions of grounded theory was identified by Strauss and Corbin (1998) as systematic model and by Charmaz (2014) as constructivist. Grounded theory aims to reveal the theory thought to exist within the data. The theory to be generated within a study designed in grounded theory grounded on the data that has been systematically collected and analyzed during the research process (Strauss & Corbin, 1998, p. 3). The purpose here is to produce analytical arguments and abstract analytical schemas from the data independently of context and time (Creswell, 2015). A general overall theme is necessary when going into the field, and mine was the compensatory function of the school. My aim was to form a theoretical model, rather than describe the existing situation. I, therefore, focused on actions and experiences.

### **Process and Participants**

Data were obtained through one-on-one interviews with participants. The semi-structured interview questions had three focal points: barriers stemming from poverty; the approach to out-of-school environments; and the dimensions zoomed on to transform the current situation and what was actually being done. In general, the questions addressed to the participants were focused on whether there is a relationship between the socio-economic status and the success of the student, and what are the ways to break this relationship; under what conditions children can be successful at school even when they do not receive any support from home; what are the things that students cannot access at home but only at school, and how school provides these for the

students. What reproduced the status quo for disadvantaged groups was their inability to achieve standardized academic achievement, and the compensatory function of schooling was expected to break this, but it was unclear how. This provided the “fresh look” mentioned by Charmaz (2014). As a characteristic of grounded theory, the analysis continues through the data collection process (Charmaz, 2014), which meant that it was possible for new areas to emerge for the researcher to detail and question. As I analyzed the data, I added new questions to the sociocultural dimension of the school about how a transformative school culture could be created. Some questions come about which tackle the topics about the success stories of students who were usually not doing satisfactory in the traditional school environment, whether schools should be standard or more flexible in terms of their curricula, and how teachers act within and apply their own educational practices under these circumstances.

The data collection period started in November 2020 and ended in March 2021 and took approximately five months to complete. The study was completed in a small city on the periphery in inner Turkey. This means that transformation in any field attracts attention in the education agenda. The participants were identified with theoretical sampling. Theoretical sampling is the process of data collection for generating theory whereby the analyst jointly collects, codes and analyzes his/her data and decides what data to collect next and where to find them, in order to develop his/her theory as it emerges (Glaser & Strauss, 1967, p. 45). Theoretical sampling is a feature specific to grounded theory. Theoretical sampling requires the researcher to have sufficient data to generate and ground the theory within the context of the research (Cohen et al., 2021, p. 223). The initial decisions for theoretical collection of data are based only on general sociological perspective and on a general subject or problem area (Glaser & Strauss, 1967, p. 45). The first stage was, therefore, to reach administrators who made significant transformation in their schools in disadvantaged regions. In order to identify these individuals, I obtained information from two different people working at the administration and supervision units in the directorate of provincial education. They had been serving in this region for many years and mostly gave me the same names without conferring with each other. I completed pilot interviews with two different names. Initially, I reached the individuals who had been mentioned and interviewed them. Theoretical sampling focuses on finding new data sources (persons or things) that can best explicitly address specific theoretically interesting facets of the emergent analysis (Clarke, 2003, p. 557). The process then continued with snowball sampling. I was shown two different directions through these. In the first one, I reached the initial participants by asking my interviewees for information about people involved in compensatory mechanisms at school, similar to themselves. In the second one, participant narratives in data analysis concerning classrooms and teaching practices directed me towards the teachers who ran these mechanisms. I interviewed a total of 35 individuals. Of these, 15 were actively working as school administrators, and 4 were recently retired administrators. Sixteen people in the group were teachers and 3 had previous school administration experience. The age range was between 39-63. There were six females and 29 males. All of the females were teachers. I mostly visited school principals face-to-face at their schools but had to meet seven teachers and four rural school administrators online as they were facing health risks. The participants told me about the characteristics of those who they directed me towards. Among these

characteristics were sheltering drug-addicted children at home, admitting homeless children disowned by their families in the school dormitory and encouraging them to develop adaptation skills, giving them pocket money, educating high school students with reading difficulties to a level which would enable them to win provincial competitions, organizing extra classes for centralized exams during holidays, and funding students' transportation and eating needs. I interviewed the participants at times that were appropriate to them. The interviews lasted between 35-80 minutes. Since the determination of the number of people to be interviewed was dependent on the saturation of the categories, data collection and data analysis were performed simultaneously (Glaser & Strauss, 1967; Strauss & Corbin, 1998). I stopped the data analysis stage when I was convinced that the data had reached saturation. I transcribed the data myself.

### **Data Analysis and Representation**

For data analysis, I followed the initial, focus and theoretical coding stages defined by Charmaz (2014). In the initial coding stage, I distinguished the systematic and non-systematic data about the school's compensatory function. In this study, my focus was on systematic coding. Unsystematic codes were usually those related to the participants' subjective experience. To list a few, parental roles, loving kids, loving their teachers... etc. Systematic codes were those that included practical actions. As for the category of "admitting the students to school" we can list the following as examples: recognizing disadvantages, looking at matters holistically, and redefining the role assigned for families and schools. I named the systematic ones within the context of schooling process components. In the focus coding stage, I categorized the related concepts I used to code the data. The categories were gathered under themes based on their inner dynamics and an analytic frame was developed. However, these themes still did not offer a holistic framework about the compensatory function of schooling. I discovered an ordered relationship within these themes and saw that the compensatory function of schooling happened in two stages. As a result, two core themes were generated, and I developed a theoretical model on the experiences of the educators in operationalizing the school as a compensatory mechanism. My analytical framework is outlined below.



Table 1  
*Themes and Categories*

Themes	Sub-Themes	Categories
Stage 1: Inclusion We exist for you	Admitting the students to school	Rejecting the predominant pattern Not blaming the family
	Ties for attaching to school	Diagnosing Flexing
	Designing a Child-Friendly Environment	Creating a fresh atmosphere Providing hygiene
Stage 2: Support What can I do for you?	Creating a sphere for social action	Structuring cultural activities Taking academic achievement far from the core
	Resource transfer	Transfer from within the school Transfer from outside the school
	Organized responsibility	Organizing school in a collective form Keeping the child in the circle
		Expanding teacher-student interaction areas

### **Ethical Considerations**

I presented the study protocol to the Ethics Committee of the Niğde Ömer Halisdemir University and obtained the approval by Decision No:10-01 dated 02.11.2020. As I requested interviews from participants, I informed them about the purpose of the study and ethical procedures. I also prepared an informed consent form asking for their approval for an audio recording. Prior to the interviews, I asked for their oral approval for the recordings once again. The narratives they obtained during the interviews but later asked for them not to be included in the study were excluded from the analyses. During the analysis process, pseudonyms were assigned and any identifying information within the texts about the school or the students they mentioned were removed.

### **Trustworthiness and Data Quality**

In order to examine trustworthiness, I deployed transferability and credibility strategies. As Guba (1981) suggests, trustworthiness of a study depends on criteria such as “prolonged engagement”, “triangulation”, “peer debriefing”, “negative case analysis” and “member-checking” to be fulfilled (as cited in Lincoln & Guba, 1985). Peer validation was applied in order to achieve trustworthiness. Therefore, some interviewees are contacted and are asked to give feedback on the research findings (Merriam, 2013). After my analysis chart was ready, I interviewed three school principals once again about the validity of this framework in order to ensure participant control. In addition, some of the participants told me at the end of the interview or contacted me later to say that they could not stop thinking about our conversation and were reconsidering their professional practices with the help of my questions. This corresponds to Charmaz’s (2014) emphasis on researcher-participant relationship characteristic. On the other hand, Strauss and Corbin (1998) suggest that grounded theory methodology research should have the factor of transferability, that is, it should be applicable to other contexts

independent of the characteristics of the study (as cited in Cohen et al., 2021). The main strategy to ensure the transferability is detailed descriptions (Lincoln & Guba, 2013). Accordingly I explained data collection and analysis process in detail, deployed thick descriptions and enhanced these descriptions with direct quotations.

There might be various limitations in field research regarding the researcher and the participants. In this study, some participants could not be interviewed in person due to global pandemic. Fortunately, distance education policies implemented in this period and assertiveness and flexibility of the participants, as well as their familiarity with the technology that allows for online meetings during the distance education process helped eliminate this limitation. Yet the online meetings held with two of the participants (Emin and Tan) got disconnected at times, some questions needed to be asked again, therefore causing these meetings to last over an hour.

### **Findings: Operationalizing the Compensatory Function of Schooling**

Two core themes emerged from the analysis process regarding the compensatory function of schooling: inclusion and support. I labeled them as stage 1, stage 2 as the data set led me to a staged classification. In order for compensatory support mechanisms to function against the disadvantages of students, they first need to be included in the school. When they are not felt welcome at school or when they do not feel they belong there, it does not look possible or functional to support them academically or materially. Therefore, three categories were identified for the *first stage: inclusion*: the student feeling fully welcome at school; establishing the bonds that tie the student to the school: the school appealing to the child; and structuring the school environment in a friendly way. The *second stage: support* describes the more practical and action dimensions of the compensation mechanism. Here, three categories emerged: creating a sphere for social action, resource transfer and organized responsibility.

#### **Stage 1: Inclusion**

The compensatory function of the school refers to overcoming barriers emerging from the disadvantages of students from lower class backgrounds. As these students fail to meet the requirements of the school, they are excluded from schooling. The study focuses on practices which do not use these exclusion processes; in other words, on inclusive forms of schooling for disadvantaged students.

#### ***Admitting the Students to School***

Recognizing the student's existence within its totality is an important step for inclusion. This emphasizes the importance of evaluating each student in their own circumstances and being fair by considering them. Equality of opportunity in education is treated as a cliché because differences in conditions outside the school cannot be neutralized by offering equal conditions inside the school. Nur (T) stated, "This child is behind already. She needs more support." Arif stressed the unfairness of evaluating unequal conditions via the same measurement and evaluation principles. During the process of purchasing resources to prepare students for centralized exams, Sedat (A) objected to the suggestion that these should only be bought for promising students by saying, "We do not know the potential of others, they may also pass the exams". Erdal

(A) also said, “We do not know what each student promises” and emphasized the importance of being fair and providing good conditions.

It is apparent that the expectation for all students to meet the requirements of the school, regardless of their circumstances outside of it, is no longer. Kaan (T) and Onur (A) stated that students should never be scolded for not bringing tracksuits, trainers, musical instruments such as the flute or painting tools, and their reasons for not doing so should be discovered in order not to alienate the children from the school. Tan (A) added that students from lower-class backgrounds are generally seen as a “hunchback”, while Mehmet (A) claimed that children who are banished to the back rows and ignored, or are labeled as non-achievers, will choose to assert their existence in unusual ways. Kaan (T) defined a child who is not welcome at school as “drowning in the ocean, struggling”. Referring to these children as “between home and school”, Esra (T) said the following about the importance of inclusion:

“These children are already scolded, complained about, otherized. In order to reinforce these, we should be doing the opposite. That is what I do. When the children realize that they too can be understood by someone, they start to behave differently.”

The participants believed that the reasons for the child to fail to adapt to school as expected by the school need to be taken seriously, and that pushing them aside and labeling them as incompetent only sustains the existing situation. It may be seen that instead of approaching students with prejudice, the view that each of them is important and has potential is adopted.

Parental involvement in schooling is considered an important criterion for educational achievement, and differences in achievement are attributed to differences in the home environment. As the family takes on the role and responsibilities of the school, both the differences and the expectations from families increase. However, there is a contrary idea here. Some participants stated that giving the family responsibilities in order to support the schooling process of the child makes the family break all ties with the school. Yavuz (A) associates this with labelling:

“We label a child as non-achiever just because they failed a subject and we tell the parents this. Do we cause the parent to move away from the school, but we also probably cause problems between the parent and the child.”

Participants who had been able to make the school compensatory viewed lacking out-of-school resources from two perspectives. The first was to present these deficiencies to students as a pedestal to rise on. These teachers told the students that when they do not have the out-of-school resources to support their education, they should resist being excluded from school and instead use the school itself as a tool to escape this deprivation. The second perspective claimed that expectations for family involvement provided justification for the school to fail to do what it is in fact supposed to do. Eren (A) criticized the responsibility transferred to the family by referring to the functions and responsibilities of the school:

“We ask families to help with homework and teach how to behave so that children arrive at schools ready to learn. Transferring our responsibilities to families is a way of denying ourselves. Why do we need teachers? Why do schools even exist?.”

Murat (A) defined the failure of educators to take responsibility and everyone deferring it to either previous stages of education or families as “passing the ball over the touchline”. Similarly, Kenan (A) explained why they never build expectations from parents at their school as follows:

“I see those kids as kittens left outside a mosque. The parents visit the school for admissions and then disappear. I’ve known parents who were looking for their 11th grade kid at grade 10. I do not hold such parents responsible as I know they may have economic problems, cultural problems, lack of education. I’ve always acted as if parents do not exist because 30% of my students come from broken families or orphanages. If we are to believe that we cannot educate children without parental support, then it would be futile to admit students from orphanages in the first place.”

### ***Ties for Attaching to School***

The educators have to know the children: their strengths and weaknesses, interests, problems and needs. Following this diagnosing process, it is important to approach them with whatever it is that they need. At this point, strategies such as guiding the work of counseling services accordingly. Knowing students’ personal information and life circumstances means knowing how to intervene. Selin (T) discussed the importance of prioritizing the individuality of the student: “Each child is different, like a fingerprint. Of course, it is lame to say individual differences exist. The right thing is to see the difference for what it is and approach the child accordingly”. Mete (T) added that not knowing about local customs and lifestyles becomes viewed as condescension by students and results in their efforts being annulled. Having plans is a strategy emphasized by participants in relation to these issues. Creating risk maps [Mete (A)], knowing the students and forming special commissions to classify their needs [Deniz (A)] and preparing a functional strategic plan that will act as a compass and not taking chances [Alper (A)] were among the strategies mentioned. Engin (A) stated that meeting their belonging needs plays an important role in making them embrace school. Kenan (A), on the other hand, emphasized the importance of attracting children to school and the possible negative consequences of not being able to do so by saying “If you do not give children a branch to hold on to at school, they will start looking for that outside”.

One of the strategies to attach the child to school has been to create a collective identity at school. Collective identity is mostly a feature of elite schooling. Through symbols and rituals, children are given a sense of belonging and a network (Khan, 2010). Murat (A) had school keychain and pins made, and used them to make students feel special and give them a sense of belonging. Other strategies in this framework included festivals, banquets, and characterizing the school in a given field.

Flexibility was an important focal point. Participants were trying to avoid feelings of incompetence and maladaptation in their students provoked by rigid and standardized rules. Flexing rules remains problematic, but the rigid rhetoric needs to be softened at the very least. Also, there are other risk-taking situations, such as breaking the determinist structure of duties. The suggestion is that when the centralized and rigid structure becomes flexible, benefits may be obtained. There was an emphasis on “Building a system in which the school gets to know and adapts to the child, not vice versa” [Kenan (A)]. The rationale behind this is not breaking children’s ties with the school, to enable them to continue to benefit from school. Emre (A) explains flexibility as follows:

“If you insist on attendance in the center of Ankara as you would do in an agricultural region, you will lose the former student. There may be standard school rules, but they should be flexible in favor of children based on the cultural structure in your area. Otherwise, you will lose the majority of the students. You will lose their families as well.”

### ***Designing a Child Friendly Environment***

Designing schools as clean, pleasant and quality places is seen as a crucial step in including students in school. My participants stated that the physical context of schools should not be condescending or uncomfortable, or they should be transformed if that is currently the case. Based on Bernstein's (1977) argument that all school acts and discourse transmit certain messages to children about who they are, I have termed signals such as high walls, iron doors, window bars, continuously hidden away sports, music, art and experiment equipment as "condescending", and giving children the message "You may harm these; therefore, we need to protect them from you". Of the school principals that I interviewed, those who prioritized improving the physical conditions of schools rationalized their efforts by repeating Bernstein's reasons. They viewed improving the physical conditions of schools, giving students access to valuable materials, creating comfortable places within schools, and making students feel that all of these are done for their sake as a way of telling them "You are valuable".

In neglected schools with poor physical conditions, a different atmosphere was attempted by improving the existing situation. This was particularly the case in boarding schools and rural schools. Murat (A) explains these children's everyday spatial environment as follows: "Children sit for 8 hours daily in wooden desks. They then go to the dorm in the evening, study in wooden desks again, and go to bed". Akif (A) was taken aback by the dark floors of his school. He thought: "It feels like a prison. How can children feel like students and focus on learning here?" and in order to cancel this "prison" feeling, he had wooden floor boards and carpets, sofa sets and TVs in the rooms. Principal at a boarding school, Sedat (A) also emphasized the role of the school atmosphere in including children in school and said "You must evoke a home like feeling in the toilets, rooms, study areas so that children will feel safe and comfortable, just like at home". Deniz (A) said the following about the inclusive function of the school atmosphere through physical improvements:

It is essential that when children enter their school, they say "Yay, this is my school". A pleasant school is important, it attracts children.

Hygiene has an important place among schools' physical problems. This problem is more visible in village schools and schools in the periphery of cities due to economic and human resource problems (Robert, 1999). Kenan (A) describes his experiences about providing hygiene at school by relying on general beliefs about schools attended by the disadvantaged:

"A delegation from the Ministry of Health came to my school for inspection and, on the way out, one of them said: Sir, this school does not smell like a Vocational High School, how do you manage this? I told them, for example, that I left toilet paper in the toilets. During the first week of school, they played ball with the rolls, they blocked the toilets, tied each other, took them to class, used them to pull tape... I didn't give up. In the second week, ball games stopped and they slowly started to use the paper in the toilets. In the third week, they started to tell on those who wasted toilet rolls. I personally witnessed in the fourth week that the students themselves stopped others who were wasting paper and told them not to do it."

The vocational high schools mentioned in this quote are schools attended by children who generally fail to achieve academically, come mostly from a lower social background, and are sent to school to learn a craft/handicraft. Another issue that should be emphasized in this narrative is the students' resistance to transformation and attempts for their own comfort. However, this resistance is broken when it is understood that the

practices are persistent and are done for the students' best interest. Emin (A) expresses how the transformation he created regarding hygiene at school increased the motivation of teachers in addition to including students in the school:

“A strong smell of urine hit me as soon as I stepped foot in the school. Even the water infrastructure was not fully functional. Under those conditions, I could not expect either myself, or the teachers or students to be productive”.

This leads to the conclusion that hygiene at school has an inclusive role not only for students but also for teachers. Improving the physical conditions is a variable that motivates both the staff and the students.

## **Stage 2: Support**

The physical presence of the student at school does not automatically mean that he can benefit from school or participate effectively in it. These students generally cannot participate effectively in school processes due to resource deprivation caused by the out-of-school environment, and therefore school can be highly demanding and challenging for them. The provision of support mechanisms at school corresponds to the praxis dimension of its compensatory function.

### ***Creating a Sphere for Social Action***

The way the participants deal with students who cause problems at school, bully others, are addicted to drugs, do not follow the rules in general, and have low academic achievement is apparent in the social action areas they construct for these students. The important point is to ignore these behaviors and create different spaces and topics via which interaction will be possible. These spaces are designed as common socio-cultural activity areas such as sports, arts, theater, poetry, and literature, considering regional characteristics and sustainability issues. Enver (A), Zafer (A) and Ali (A) created gardening areas in the school for which children are responsible. Another important point is to introduce the children to unfamiliar activities. Metin (A) constantly took the children to the swimming pool for this. It was a priority to create spaces where children could expend their energies. They channeled disinterested children who were unwelcome at school to these areas. The crucial point here was collectivity and designing spaces based on collective action, as opposed to continuing student-teacher hierarchy. “It’s very important to say come, let’s do it together. Children secretly wait to be discovered.” [Dilek (T)]. On the other hand, these areas also prevented disciplinary problems at school. Kenan (A) and Alper (A) stated that the disciplinary committee had not convened even once in 5 years. In addition, the existence of alternative action areas at school also improved attendance. In addition, Ali (T) and Engin (A) ensured that the school was open for such activities at weekends or outside school hours, and they emphasized extracurricular activity areas at school.

In order to create alternative action areas for students at school, it is first necessary to transform the established definition of achievement, that is, to de-emphasize academic achievement. Eren (A) states that when academic achievement is at the center, it means lack of achievement for other students:

“The school readily gives a feeling of lack of achievement when it should do the opposite. The fact that the child has an interest area other than academic achievement is considered problematic. The child is threatened by sentences that start with “if you don’t study”. Other areas are thus devalued.”

Emre explains this with the analogy that a good harvest can only be obtained when crops suitable for climate and land conditions are planted.

One of the objectives of national education is providing individuals with training that takes their unique areas of interest and capabilities into account. However, when this goal does not translate to the school environment properly, it is as if trying to grow wheat in the Black Sea region [which is a region in Turkey with high precipitation, and therefore does not meet the necessary climatic conditions to grow wheat]. Wheat cannot grow there, so it will definitely go wrong at some point. Or it is like trying to grow cotton in Central Anatolia, it is a waste of energy.

Kemal (A), on the other hand, expresses the importance of creating alternative achievement areas for students as follows:

“There are 500 students outside, but this room only takes 20. The 480 students outside are not there because they are bad, they’re there because this room takes 20 people. What about those left out then? We need to create other rooms and areas for them to enter. We cannot sacrifice 20 times as many students for the sake of 20 that are inside.”

There is evidence that socio-cultural activities and an experience of achievement in alternative areas translate to academic achievement. It is operationalized as an important mechanism in making the child effective at school. The point emphasized here is that the child tastes the feeling of achievement. Yasemin (T) states that this will make academic effectiveness accessible for the child: “The more we socialize our students, the better achievement will result. When we socialize the students, it will be easier for us to reach them and they will be more open to instruction .”

For example, Mete (T) integrated the very ordinary activity of book reading with performances such as theater and drama. In this way, he made it more permanent, meaningful and effective.

Mert (T) mentions the reflections of this at school by saying:

When you create an achievement culture at school and make the majority embrace it, others inevitably adapt. For example, when someone wants to sabotage school rules, he approaches other students but cannot receive support because they are busy with either the lesson or a cultural activity. When he cannot suit anyone to himself, he tries to suit himself to this structure.”

### ***Resource Transfer***

An important characteristic in the education patterns of students from a lower background is low material sources (Anyon, 2005). Poverty brings with it deprivation. However, it was obvious that the participants provided resource transfer via certain strategies. This transfer of resources had two dimensions: they both established transfer and common sharing mechanisms within the school and sought support from outside. At school, they resorted to methods such as aid funds created by teachers or assistance from existing resources. Some participants emphasized the importance of the school canteen, and it was used as a way to both understand whether the student needed financial support and to support this student. With respect to academic achievement, they operated support mechanisms by providing access to source materials or giving extra lessons. In order to improve academic skills, they created individual spaces where students could listen to online lectures.

Metin (A), who utilized local characteristics in transferring resources from his immediate surrounding and cultural context to the school, said:

“It is necessary to understand the people in the environment, their reactions, approaches, understanding, opportunities, what they can and cannot do. We need to renew the school, we need a budget. Donations are only enough for fuel needs. If I asked the villagers for money, they would not give it. They don’t have money, but they have resources that can be monetized.”

Tan stated the following about the transfer of external resources to the school:

“It is necessary to use some alternatives. You cannot ask for money if you don’t actively make an effort. I’ve never collected any money from my students. It takes some effort to transfer these resources to the school somehow. Good contacts are needed. In order to transfer resources to the school, it is first necessary to create functional areas that will bring resources.”

Deniz (A) draws attention to sustainability in the transfer of resources and emphasizes that children who feel confident about school do not drop out. He draws attention to the connection between different levels. He states that determining the economic or academic needs of each individual child may not mean much and emphasizes the importance of informing the next educational level to ensure continued support.

### ***Organized Responsibility***

It was emphasized that all stakeholders of the school and the educational process should share the responsibility in an organized manner, instead of putting the responsibility on others. The participants expressed that they saw the school as a whole and mentioned the importance of making teachers, administrators, support service staff (cleaning, catering, transport staff) and students see themselves a valuable part of this whole. Alper (A) draws attention to the importance of such partnership to avoid resistance by saying “You cannot be a school principal against the teacher”. Acting together is considered important in ensuring this partnership. The participation of all stakeholders and a culture of mutual respect were considered important in making decisions about the school as well.

Not distancing the child from responsibility is another component of organized responsibility. A significant part of the participants stressed the importance of keeping students defined as bad within the system rather than removing them from it. Emphasizing that the child should not be labeled and pushed aside, Dilek (T) explains the status quo regarding this as follows:

“Children like this are not wanted. People think this child is going to be a problem for us... and end up excluding the child. The teacher says I’m tired of this kid, do whatever is necessary. We need to tell this student what to do, we need to say let’s have a talk, we need to be solution-oriented. We have many children who are excluded in this way. The teacher usually looks at the children and says this one it will be okay, those should be sidelined.”

Arif’s (A) view is invaluable at this point. He argues that not pushing the child out of the system should be defined as an achievement.

“We can sacrifice one student out of our 1,427 with disciplinary action. But the important thing is to include the minority in school processes without sacrificing them for the majority. When we look at a student and think he disturbs the peace at school, sets a bad example for others, tries to harm the school structure, goes against the system or against my methods and rules, the number of people we have to sacrifice will increase. As a result, you may believe your school sends the highest number of students to university in the province, but you need to also consider the number of students you sent off.”



Not reducing interaction with students to the mechanical processes of class or school is also included in extended responsibility. It is believed that interacting with children only within class hours or about teaching activities will cause many important details to be overlooked. For this reason, it is considered important that the teacher interacts with the child outside of the classroom, both in and outside the school. Taner (T) noted that “It is necessary to pay attention to the child. In the hallway, at recess, outside. You can even tell something is wrong from the way the child walks. Is he cold? Is he hungry?” Interaction can also liberate the teacher from a didactic role, and mean contributing to and sharing with the child not only in regards to academic knowledge but also in other areas of life. Yavuz (A) is of the opinion that “interaction in different topics may also benefit the teacher by eliminating preconceptions about children”. This is also important to determine the subjects in which children need support.

### **Conclusion and Discussion**

The results of this study, focusing on how the school may be compensatory for the disadvantages arising from the home environment of students from lower class, showed that this could happen in two stages. The first is to find ways of giving students the message that they are the reason for the school’s existence and that the school is there for the student, thus involving the student in the school. The findings revealed that educators do this by not seeing the home environment as a continuation of the school or as a complementary school form, without burdening the home with extra responsibilities to support the school, and by supporting students in ways their job descriptions require and in line with student needs. The teachers do not dwell on parental involvement, deficiencies and other problems associated with lower class educational patterns, such as academic abilities, or resource and material support. Thus, both the family and the student are prevented from feeling inadequate in fulfilling the requirements of the school and from withdrawing or resisting. Therefore, it can be said that exclusion forms caused by lack of parental involvement can be broken when the school operates family-based educational support mechanisms within its own system. Participants stated that the nature and existential reasons of schools should be reconsidered by asking questions such as “Why does the school impose a standard language on this student and assign functions such as teaching, caring and guiding to the family? To raise individuals who meet the school’s standards and exclude or eliminate others?” Acceptance of a student at school helps overcome barriers to participation arising from exclusion. However, access and action are not the same things. The child’s participation in school does not mean that he will be active or benefit from the school. This corresponds to the second stage: Support. The questions posed to the students is: “What can I do for you?”. What is important here is individualization and concretization of support. At the center is the understanding of relativity and a criticism of centralized egalitarian approaches. It is considered important to view each school in terms of its own internal dynamics and integrity, to determine what schools and students really need, and to design an action plan for improvement in line with this, not with macro reformist policies. The fundamental characteristics of compensatory education close the educational gap between advantaged and disadvantaged children (Davezies & Garrouste, 2020) and provide additional resources to certain disadvantaged groups in order to create equal opportunities in education. These are also macro policies, but being macro does not mean they are ineffective. In Turkey, there are some important macro policies with

regards to eliminating certain deprivations of lower-class students in the school context such as free textbooks, scholarships and dormitory opportunities for students, Training Programs at Primary Schools [IYEP], which aim to support the achievements in Turkish and Mathematics class at primary schools, and Support and Training Courses [DYK] at secondary and high school levels. However, it is safe to argue that macro policies naturally fail to see the disadvantages experienced locally and singularize varied and multiple disadvantages, and therefore may not be widely effective.

Therefore, it is an important finding that the scope of these programs should be specific to the school or region. Also, what is considered a disadvantage and how best to deal with it is not as simple as it may seem at first glance (Dyson, 2011) and may pose a problem that cannot be solved in a standard way. Our findings also showed that students and the social environment need to be well understood in all their aspects. In order to improve the school, it is necessary to understand it; and in order to improve it, it is necessary to look at it individually (Goodlad, 1984). This point of view is reinforced by creating alternative areas of action for the students within the school and basing these areas on practices that overlap with the cultural context.

The findings revealed that providing resources for both inclusion and support is important. This transfer of resources usually takes place for students in the form of operationalizing government benefits as a compensation mechanism (Doyle et al., 2009; Goldhaber & Eide, 2002). It is believed that when public support for education is reduced, social class effects will increase (Hout et al., 1993, as cited in Lucas, 2001). However, compensatory education programs have been criticized for increasing social differences between schools (Davezies & Garrouste, 2020; Gamoran & Mare, 1989). Gorard (2010) suggests that raising standards in education is not really functional in closing gaps. Ball (2010) stated that policies implemented to increase or eliminate inequalities in achievement make the situation worse. The fact that compensatory programs target disadvantaged populations based on social and academic criteria is in line with Bernstein's criticism of outside intervention in schools. Our findings showed that these criticisms are justified and that the school will be functional only with individualized programs, not with centralized and standardizing programs. It was deduced that sustainable practices are needed, not policies applied on at certain education levels or with certain individuals. The findings suggest that the problem cannot be solved by simply increasing school resources as Hanushek (1997) suggested, that this must be integrated with student needs in other areas to make it more functional. A crucial point emphasized by the participants was not to focus on disadvantages or deficiencies, and to functionalize them as a step forward.

Two trends can be observed in compensatory education programs recently implemented in different countries: The first one includes the standard and central practices we criticize that aim to improve academic performance (in Portugal Ferraz et al., 2019). The other includes efforts that offer equality of opportunity over the context-based compensatory role of education rather than the dissemination of education or efforts to increase academic achievement (in Texas Stevens, 2016; in France Davezies & Garrouste, 2020; in Canada Squires, 2020). The 2023 educational vision published as a strategy document by the Ministry of National Education in Turkey (MoNE, 2018) plans for the monitoring, evaluation and support and improvement of activities for children's personal, academic and social development, within the framework of a

“School Development Model” that will enable schools to develop within their conditions and priorities. There is no systematic framework, evaluation or follow-up study for the implementation processes of this model, and no emphasis on the compensatory role of education.

My research analytic framework is the compensatory function of schooling itself, without labeling anyone as deficient or holding them responsible for being different, in a neutral way. The main emphasis here is not on whether the student is lacking or flawed according to the school’s standards, but the gap between the conditions of the school and the student. The educators who are the subjects of this study are characterized by not laying the responsibility of closing this gap on the shoulders of the student. The structuring that will take the school away from being a hostile environment needs to be general, sustainable and holistic, beyond the mere use of central or specific policies focusing on specific areas. There is a gap between equality of opportunity studies as a policy and equality of opportunity studies as an academic research subject in Turkey. Policies to ensure equality of opportunity in education are generally focused on providing access to education. Students are placed at schools at the basic education level via an address-based population registration system, and students from lower classes usually go to schools that match their social patterns. Schools revealing a pattern compatible with the student profile is named as double effect by Frempong et al. (2012). The double effect refers both to the home and school environments that are not supportive enough for academic achievement. On the other hand, tracking is done with central exams, and the main criteria for academic achievement are scores obtained from central exams based on mathematics or verbal skills. Jennings et al. (2015) criticized the representation of the inequality-reproducing function of schools in educational research. They found that inferences about this function of schools were made by looking at test scores alone. Still, in fact, the effects of school on students and inequality were due to unexplained differences. Our programs are centralized and they are not sufficiently inclusive of students’ school-related challenges, thus necessitating support within the school. Downey et al. (2004) examined in their study how inequality varied in school and non-school conditions. Students were followed up during a school term and the summer term, and schools were found to serve as a great equalizer. Entwisle and Alexander (1992) addressed the school’s equalizer function on a seasonal basis and claimed that home disadvantages are compensated during the winter, that is, during the school semester, while learning deficiencies happened among disadvantaged children during the summer. These studies and the findings of the present study all reveal that the school can be compensatory. The findings on how to ensure this suggest that the mechanisms which give middle class children an advantage outside of school (i.e., extra lessons, tutoring, shadow education, extracurricular activities, awareness and motivation situations related to the value and functions of education, etc.) should be embedded in schools, and channels that will provide access to mechanisms that cannot be embedded should be opened. This means restructuring the out-of-school resources that provide an advantage to the middle class as school-based resources.

A notable finding from the present study is the organization of responsibility for the child. Thanks to this acceptance and support mechanism that surrounds him, the child is able to benefit from school. Bernstein (1973) states that the teacher should be an

important subject in a student's life in order to ensure that the child stays at school by saying "If the culture of the teacher is to become part of the consciousness of the child, then the culture of the child must first be in the consciousness of the teacher (p. 154)". The organization of responsibility and the integrated and inclusive embedding of support mechanisms to enable the student to take advantage of the school also display consistency in actions and thoughts.

### **Implications and Limitations**

Ever since the 1980s, neoliberal economic policies in Turkey has enlarged the gap between social strata, which deepened even more in recent years with the introduction of practices such as the use of the address-based population registration system. For several decades now, the agenda of sociology of education studies in Turkey have emphasized social inequalities, quality of schooling and deprivation of working class and poor families. However, this usually has no meaning other than being the object of reproduction for the working class or the subject of research for researchers. If we cannot reduce social inequalities and claim that achievement differences between schools are due to these, then we should turn the gaze to what can be done within the school and move from critique to critical, as suggested by Sever (2012). Sever (2012) argues that critical qualitative research has lost its transformative power, and criticizes the lack of a tendency to unite around larger policies to transform injustice. Otherwise, this situation carries the risk of creating mental barriers for both researchers and policymakers about what can be done to ensure the effective participation of disadvantaged groups in schools or to increase their academic achievement. Therefore, despite all the criticisms against schools and the social function of education, schools are still the primary option for the disadvantaged to access certain social benefits. For this reason, it may be more useful to talk about strengthening a compensatory role rather than struggling within limits determined by the reproductive function of education.

The data set of the present study was obtained not in the context of any educational policy, but through the practices carried out by individuals entirely on their own initiative and mostly from individuals independent of each other. I attempted to discover the patterns in them and reveal how compensation could work. Therefore the study is different from the evaluation of the effectiveness of an interruption/intervention program. It covers a narrower area. The study is neither contextual nor longitudinal, which presents a limitation for displaying outputs in the transition between levels and for long-term systematic effects. Therefore, a future study may be conducted which would include all subjects related to the collective operation of this system in certain school contexts. In addition, the experiences of people who have been able to rectify the disadvantages of their home and achieve vertical mobility thanks to schools may also be studied.

Besides, in line with the research findings, the following recommendations regarding in-school practices can be made regarding how educators may support the compensation mechanisms of school. Schools can be evaluated in its own right, externally and independently of standard criteria, and work plans can be created within the framework of feasibility studies to be conducted in school. However, unlike these needs assessment studies, we can consider it a monitoring system. In this respect,

Lezotte and Bancroft (1985) propose the concept of “data driven”. Therefore, as suggested by the research findings, we can expect that this will help compensation support that will be given to students to be individualized, concretized, and sustainable. We expect that these support strategies which will be applied may differ from one school to the next. Regarding this, intervention points can be determined through a map to better understand the needs of the school. Increasing students’ knowledge on forming learning environments outside of school, modifying in-school activities in accordance with school’s needs and internal dynamics after the diagnosing process of the above-mentioned practices and determining strategies for developing collective responsibility.

### **Conflicts of Interest**

I acknowledge that there is no conflict of interest.

### **Author Bio**

Ayşe Soylu is an assistant professor in sociology of education. Her research concentrates on critical pedagogy and social stratification especially on class-based schooling, inequality, education of migrants, and distribution of power. She also took part in projects on supporting education of disadvantaged students.

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## The Effects of Video Priming on Facilitating the Transition of Children with Autism Spectrum Disorder between Activities and Settings\*

### Otizm Spektrum Bozukluğu Olan Çocukların Etkinlikler ve Ortamlar Arası Geçişlerini Kolaylaştırmada Hazırlayıcı Videoların Etkililiği

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**ABSTRACT:** Preschool children with disabilities spend more time when transitioning between activities and settings than their typically developing peers. Extended transition duration leads to reducing the time spent on teaching. Various antecedent-based transition strategies are used to increase independent transition and decrease the transition duration of children with autism spectrum disorder. One of these strategies is video priming. This study aimed to examine the efficacy of video priming, an antecedent-based transition strategy, on increasing independent transitions of children with autism spectrum disorder and decreasing the time these children spent in transitions. Also, identifying opinions of parents of and teaching staff for participating children regarding the acceptability of video priming was aimed. Four children with autism spectrum disorder between the ages of 4 and 6 participated in the study. An ABAB design was used to evaluate the effects of video priming. Results indicated that video priming effectively increased all children's independent transitions and decreased transition duration. The results also showed that the parents and teaching staff had a highly positive opinion about the video priming and its acceptability. This study provided additional evidence that video priming can facilitate children's transition with autism spectrum disorder. The implication for future research and practice were discussed.

**Keywords:** Autism spectrum disorder, video priming, transition duration, transition strategies.

**ÖZ:** Okul öncesi dönemdeki özel gereksinimi olan çocuklar, etkinlikler ve ortamlar arası geçişler sırasında akranlarına oranla daha fazla zaman harcamaktadır. Uzayan geçiş süreleri de öğretim için ayrılan sürenin kısalmasına neden olmaktadır. Alanyazında, otizm spektrum bozukluğu olan çocuklara bağımsız geçiş davranışlarını kazandırmak ve çocukların geçişlerde harcadıkları süreleri kısaltmak üzere çeşitli öncül temelli geçiş stratejileri bulunmaktadır. Bu geçiş stratejilerinden birisi de hazırlayıcı videolardır. Çalışmanın amacı, öncül temelli bir geçiş stratejisi olan hazırlayıcı videoların, otizm spektrum bozukluğu olan çocukların bağımsız geçişlerini artırma ve geçişlerde harcadıkları süreyi kısaltmadaki etkililiğini incelemektir. Ayrıca, hazırlayıcı videoların kabul edilebilirliğini ortaya koymak üzere katılımcı çocukların ebeveynlerinin ve öğretmenlerinin görüşlerinin belirlenmesi amaçlanmıştır. Çalışmaya, yaşları 4-6 arasında değişen, otizm spektrum bozukluğu tanısı olan dört çocuk katılmıştır. Hazırlayıcı videoların etkililiğini değerlendirmek için ABAB deseni kullanılmıştır. Bulgular, otizm spektrum bozukluğu olan çocukların bağımsız geçişlerini artırma ve geçişlerde harcadıkları süreleri kısaltmada hazırlayıcı videoların etkili olduğunu göstermektedir. Sosyal geçerlik bulguları da ebeveynlerin ve öğretmenlerin hazırlayıcı videoların kabul edilebilirliği hakkındaki görüşlerinin oldukça olumlu olduğunu göstermektedir. Sonuç olarak, çalışmanın bulguları hazırlayıcı videoların otizm spektrum bozukluğu olan çocukların geçişlerini kolaylaştırabileceğini ortaya koymaktadır. Çalışmada, ileri araştırmalara ve uygulamalara yönelik öneriler sunulmuştur.

**Anahtar kelimeler:** Otizm spektrum bozukluğu, hazırlayıcı video, geçiş süresi, geçiş stratejileri.

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Transitions occur naturally in daily living and educational settings. For many children, especially children with disabilities, it is challenging to complete timely transitions without challenging behaviors (Sullivan et al., 2017). Due to the less structured nature and unclear behavioral expectations than instructional activities, transitions may lead children to exhibit more challenging behaviors (Angell et al., 2011; Waters et al., 2009). Challenging behaviors during transitions increase transition duration and reduce the instructional time allocated for children with disabilities and their peers with typical development (Banda & Kubina, 2006; Hume et al., 2014; Lequia et al., 2015; Sterling-Turner & Jordan, 2007). Previous studies indicated that children with disabilities, including autism spectrum disorder (ASD), spend more time during transitions than peers with typical development (Ergin & Bakkaloglu, 2019; Rakap, 2019; Sainato et al., 1987).

Children with ASD have difficulty transitioning and adapting to changes as they demonstrate adherence to specific routines (Cihak, 2011; Lequia et al., 2015). Flannery and Horner (1994) hypothesized that transitions' unpredictability might make them incredibly difficult for children with ASD. Studies have demonstrated that when transitions' predictability is enhanced, transition duration (Hine et al., 2015), challenging behaviors, and dependency on the adult decrease (Schreibman et al., 2000; Sterling-Turner & Jordan, 2007), and instructional time as well as academic success increase (Banda & Kubina, 2006; Hine et al., 2015). Thus, various transition strategies enhance the predictability of transitions for children with ASD (Banda & Grimmer, 2008; Graber-Juhnke, 2015; Gülboy & Yücesoy-Özkan, 2017; Hume et al., 2014). One of these strategies is antecedent-based transition strategies (Banda & Grimmer, 2008; Graber-Juhnke, 2015; Hume et al., 2014). Antecedent-based transition strategies are used before or during transitions to facilitate transitions and create a positive transition climate by enhancing predictability for children experiencing problems due to changes in activities, routines, or settings (Bambara & Kern, 2005; Kern & Clemens, 2007; Mechling & Savidge, 2011).

Several studies have investigated the efficacy of different antecedent-based transition strategies to facilitate transitions for children with ASD. These studies revealed that antecedent-based transition strategies, such as visual schedules (Dettmer et al., 2000; Macdonald et al., 2018; Pierce et al., 2013), finished boxes (Dettmer et al., 2000), timers (Dettmer et al., 2000), behavioral momentum (Banda & Kubina, 2006; Fisher et al., 2018; Hu et al., 2021), and transition songs (Graber-Juhnke, 2015; Kern et al., 2007; Mercurio et al., 2021) are effective on increasing independent transition behaviors and decreasing transition duration between activities and settings in children with ASD. Another strategy used to facilitate the transitions for children with ASD is video priming (Hume, 2008).

Priming is a way to manipulate antecedent events or set up establishing operations; a child previews future events to become more predictable (Flannery & Horner, 1994; Schreibman et al., 2000). Video priming is a strategy that presents a video clip displaying the next activity or setting to the child and then starts the transition shown in the video clip (Schreibman et al., 2000). Video priming allows children to prepare for an upcoming and unfamiliar situation by making it more predictable (Humphrey-Rush, 2020). Video priming has excellent potential to prepare children with ASD for a new experience before it occurs (Gardner & Wolfe, 2019). Video priming

also contributes to acquiring timely and appropriate transition behaviors (Jot, 2020; Sterling-Turner & Jordan, 2007). It lets students know what will happen before they experience it, potentially reducing anxiety and uncertainty (Humphrey-Rush, 2020). Several studies have indicated that video priming may be used effectively to prepare children with ASD for different or new situations, including toilet training (Bainbridge & Smith-Myles, 1999), oral/dental assessments (Cuvo et al., 2010a), physical exams (Cuvo et al., 2010b), air travel (Ruddy et al., 2015), and paid employment (Humphrey-Rush, 2020; Jot, 2020). To date, one study has examined the effectiveness of video priming in facilitating transitions of children with ASD.

Schreibman et al. (2000) investigated the effectiveness of video priming to reduce or eliminate challenging behaviors during transitions in community settings in three young children (3-6 years) with ASD. Researchers prepared 1-4 min-long video clips for each child individually based on their strengths and needs. The video clips consisted of transitions from one setting to another, and no models appeared in these clips (point-of-view) to control the effect of priming rather than modeling. Before each transition, the child watched the video clip and was immediately taken to the transition situation shown in the video clip. The results indicated that video priming was effective in reducing challenging behaviors during transitions for all children. Moreover, this reduction typically generalized to untrained transition and was maintained one month later.

The preliminary findings revealed that video priming is a potential intervention for facilitating transitions and decreasing challenging behaviors of children with ASD during transitions. In the light of the knowledge that children with ASD spend much time in transitions and can benefit from video technology, video priming might be an effective intervention in reducing transition duration by increasing the predictability and familiarity (Flannery & Horner, 1994; Schreibman et al., 2000). Koegel et al. (2003) found that providing video priming the upcoming display transition led to a reduction in challenging behaviors and increased academic response for students with ASD. For these reasons, additional research on video priming is needed to address the facilitating transition (Sterling-Turner & Jordan, 2007). The current study aimed to examine the effectiveness of video priming on increasing independent transition behaviors of young children with ASD and decreasing the transition duration. Moreover, the opinions of the parents and teaching staff for participating children on the importance of the study, acceptability of the intervention, and significance of the findings were investigated. Research questions guiding the present study were as follows:

1. Is video priming effective in improving independent transition behaviors of children with ASD during transitions between activities and settings?
2. Is video priming effective in reducing the amount of time children with ASD spend in transitions between activities and settings?
3. What are the opinions of parents and staff about the importance of the study, acceptability of the intervention, and significance of the results?

## Method

### Experimental Design

Since this study's dependent variables (independent transition and transition time) were reversible behaviors, and all participants were in the same class, an ABAB design was used to evaluate the effectiveness of video priming. The procedure consisted of five phases, including the first baseline (A<sub>1</sub>), the first video priming (B<sub>1</sub>), the second baseline (A<sub>2</sub>), the second video priming (B<sub>2</sub>), and generalization (Kazdin, 2011; Rakap, 2021; Tekin-İftar, 2019). Phase change decisions were made based on the number of independent transitions. When all the participants completed 90% or more of their transitions independently for two consecutive sessions, the intervention was withdrawn, and the second baseline phase was implemented. The experimental procedure was carried out simultaneously with the whole group.

In the current study, the design standards recommended by Kratochwill et al. (2013) were followed to assess the quality of the design. Considering these standards, care was taken to ensure that the study included at least four phases and at least three data points in these phases. In addition, this study was conducted with four children, and care was taken to ensure that the number of replicates was greater than three. In this direction, it can be said that the study meets the necessary standards for the ABAB design.

### Participants

#### *Recruitment and Ethical Procedure*

The first author is a research assistant at the university-based research center, where children with ASD and developmental disabilities receive special education services. The first author observed the classroom where children were spending a long-time during transitions by exhibiting challenging behaviors such as escaping, refusing or resisting transitions, lying down, and yelling/crying during transitions between activities and settings. Then he conducted observations for two weeks in this classroom as an assistant teacher. Four children with ASD attended group training in the same classroom at the center between 9.00 am and 12.00 pm every weekday. After identifying the potential participants for the study, he informed the participants' parents about the intervention. He asked for their written informed consent for their children to participate in the study. He obtained ethical approval (decision no 121430 dated 25/11/2016) from the Ethical Board of Anadolu University.

#### *Child Participants*

Four boys with ASD participated in the study. Owen and Ethan were four years old; Thomas was five years old, and Michael was six years old. All children's names are pseudonyms. Before the study, the Anadolu-Sak Intelligent Scale [ASIS] (Sak et al., 2016), Gilliam Autism Rating Scale-2 Turkish Version [GARS-2] TV (Diken et al., 2012), and Gazi Early Childhood Assessment Tool [GECAT] (Temel et al., 2005) were administered by the researcher to obtain detailed information about the children's intellectual and developmental characteristics. The ASIS scores indicate that Owen, Thomas, and Michael had a mild intellectual disability, and Ethan had a moderate intellectual disability. The GARS-2 TV scores indicated that all four children were

more likely to be affected by ASD. Moreover, the GECAT scores indicated that all four children have developmental delays. Table 1 presents child characteristics and assessment results.

Table 1

*The Children's Characteristics and Assessment Results*

	Owen	Ethan	Thomas	Michael
Age	4:9	4:9	5:6	6:3
Gender	Male	Male	Male	Male
Diagnosis	ASD	ASD	ASD	ASD
Autism Rating				
GARS-II TV Score	92	101	112	118
GARS-II TV possibility	High	High	High	High
Intelligence Assessment	Mild	Moderate	Mild	Mild
ASIS score	72	54	60	68
General development areas				
GECAT PD total of theme	50	53	69	71
GECAT PD T Score	06	09	27	42
GECAT CD total of theme	34	36	50	52
GECAT CD T Score	13	15	22	29
GECAT LD total of theme	36	42	58	55
GECAT LD T Score	03	09	45	22
GECAT SED total of theme	43	44	52	54
GECAT SED T Score	18	19	17	37

*Note.* GARS-II TV: Gilliam Autism Rating Scale-2 Turkish Version; ASIS: Anadolu Sak Intelligence Scale; GECAT: Gazi Early Childhood Assessment Tool; GECAT PD: GECAT psychomotor development; GECAT CD: GECAT cognitive development; GECAT LD: GECAT language development; GECAT SED: GECAT social-emotional development

Owen complies with three-word instructions that specify two actions and expresses himself with one word. He participates in recreational and structured group activities, works on the activity for 2-3 minutes, takes turns, waits in line, sits and waits, and puts toys away when prompted. He expresses his anger, unhappiness, and sadness with gestures and facial expressions.

Ethan follows three-word instructions that specify two actions and expresses himself with one word, accepting what he wants and rejecting what he does not wish to. He participates in recreational and structured group activities, working on the exercise for 2-3 minutes, taking turns, and sitting and waiting when prompted. He shows his emotions with gestures and facial expressions.

Thomas follows four-word instructions that specify two actions and expresses himself with two words. He participates in recreational and structured group activities, works on activities for 3-4 minutes, takes turns, waits in line, sits and waits, and puts toys away when asked. Follows directions, communicates with friends through gestures, sounds, or words, says thank you, and answers questions. He expresses his feelings through gestures and facial expressions expresses his wishes in two or three terms.

Michael follows four-word instructions that specify three actions and expresses himself using three words. He participates in recreational and structured group activities, works on activities for 3-4 minutes, takes turns, waits in line, sits, and waits when asked. He follows directions and communicates with friends through gestures, sounds, or words. He expresses his emotions through gestures and facial expressions.

### ***Instructors***

Two teachers and a researcher participated in the study as instructors. The lead teacher and assistant teacher had primary responsibility in the children's classroom. The lead teacher (42 years old) is a special education teacher with bachelor's and master's degrees in special education. She had 19 years of professional teaching experience with children with disabilities and ten years of experience working with children with ASD. The assistant teacher (26 years old) is a preschool teacher with two years of professional experience working with children with ASD. The first author (28 years old) acted as the second assistant teacher during the intervention. He had a bachelor's degree in special education and two years of professional experience working with children with ASD. The first author was an instructor in the baseline and intervention sessions, while the lead teacher was an instructor during the generalization.

### ***Parents and Teaching Staff Participants***

Social validity data were collected from the parents (three mothers and one father) of participating children and 26 teaching staff employed at the institution. Mothers' ages ranged from 30 to 42 years ( $M=34.5$ ). One mother had a high school degree, while the other parents were college graduates. The teaching staff consists of 10 research assistants, five teachers, five assistant teachers, and six practicum students. Of these, 19 were female, and seven were male; six were high-school graduates, nine had bachelor's degrees, 10 had master's degrees, and one had a doctoral degree. The ages of the teaching staff ranged from 20 to 42 years ( $M=28$ ). They had two to 20 years of teaching experience. All parents and teaching staff volunteered and gave written approval to collect social validity data.

### ***Settings and Materials***

The sessions were conducted in the classroom, playroom, kitchen, restroom, and halls the children used throughout the day at the center between 9.00 am and 12.00 pm every weekday in small groups. Separate video clips were created for each transition during the school day. A video camera, a laptop computer, and video editing software were used to make video clips, a video player program, and a tablet (9.7" iPad) to play the video clips. The fixed camera system was used in the classroom for transitions between activities, and a mobile handheld video camera was used for transitions between settings. The materials also include event recording to collect the independent



transition data, duration recording to collect data on the transition duration (Yücesoy-Özkan, 2021), and a questionnaire form to collect social validity data.

### **Video Clips**

The types and number of transitions performed during each school day were determined when creating video clips for video priming. There were 17 transition opportunities in the classroom during a school day, including ten transitions between activities (e.g., greeting, gross motor activity, leisure, and circle time) and seven transitions between the settings (e.g., classroom, kitchen, playground, and restroom). Next, the problematic transitions were identified based on the participants' challenging behaviors, observations, and teachers' opinions. The scenarios were then prepared based on the participants' behavior before the study, and the related video clips were created in natural settings using classroom materials. The point-of-view was used in video clips. Video clips did not include any narration or instruction. The average duration of video clips was 20 s (range=6-37 s). The video clips were presented shortly before the transition between activities and settings. For instance, when children completed the painting activity, the researcher took all children's attention to a video about the next activity (e.g., circle time). All children watched the video clip together.

### **Dependent Variables**

#### ***Independent Transition***

An independent transition is the initiation of a transition within 10 s of receiving the transition instruction, with behaviors such as nodding, verbal confirmation, or following classmates and ending the transition between activities and settings. The transition between activities or settings was completed when the children started the new activity or arrived in the new setting at the predetermined time. Independent transition should be completed within 30 s and 2 min between activities and setting, respectively. This time was determined to be an appropriate timeframe to complete transitions based on previous studies (Ergin & Bakkaloglu, 2019; Sainato et al., 1987; Schmit et al., 2000) and classroom observations. If a child did not initiate the transition within 10 s after transition instruction or did not complete the transition within a predetermined time, his behavior was recorded as a non-independent transition—the independent transition data was collected using controlled event recording (Alberto & Troutman, 2013). To calculate the percentage of independent transitions, the number of independent transitions was divided by the total number of transitions during the day and multiplied by 100 (Alberto & Troutman, 2013).

#### ***Transition Duration***

The transition duration is defined as the time passed between the transition instruction and participants' completing the transition. The duration of the video clip watching (video priming) is also included in the transition duration. Duration recording was used to determine the length of transitions (Alberto & Troutman, 2013). Duration data were recorded by a fixed camera system in the classroom during transitions between activities and a mobile handheld camera during transitions between settings. The time spent in transitions was divided by the total time spent at school during the

day and multiplied by 100 to calculate the percentage of time spent in transitions (Alberto & Troutman, 2013).

## **Procedures**

### ***Baseline Sessions (A<sub>1</sub> and A<sub>2</sub>)***

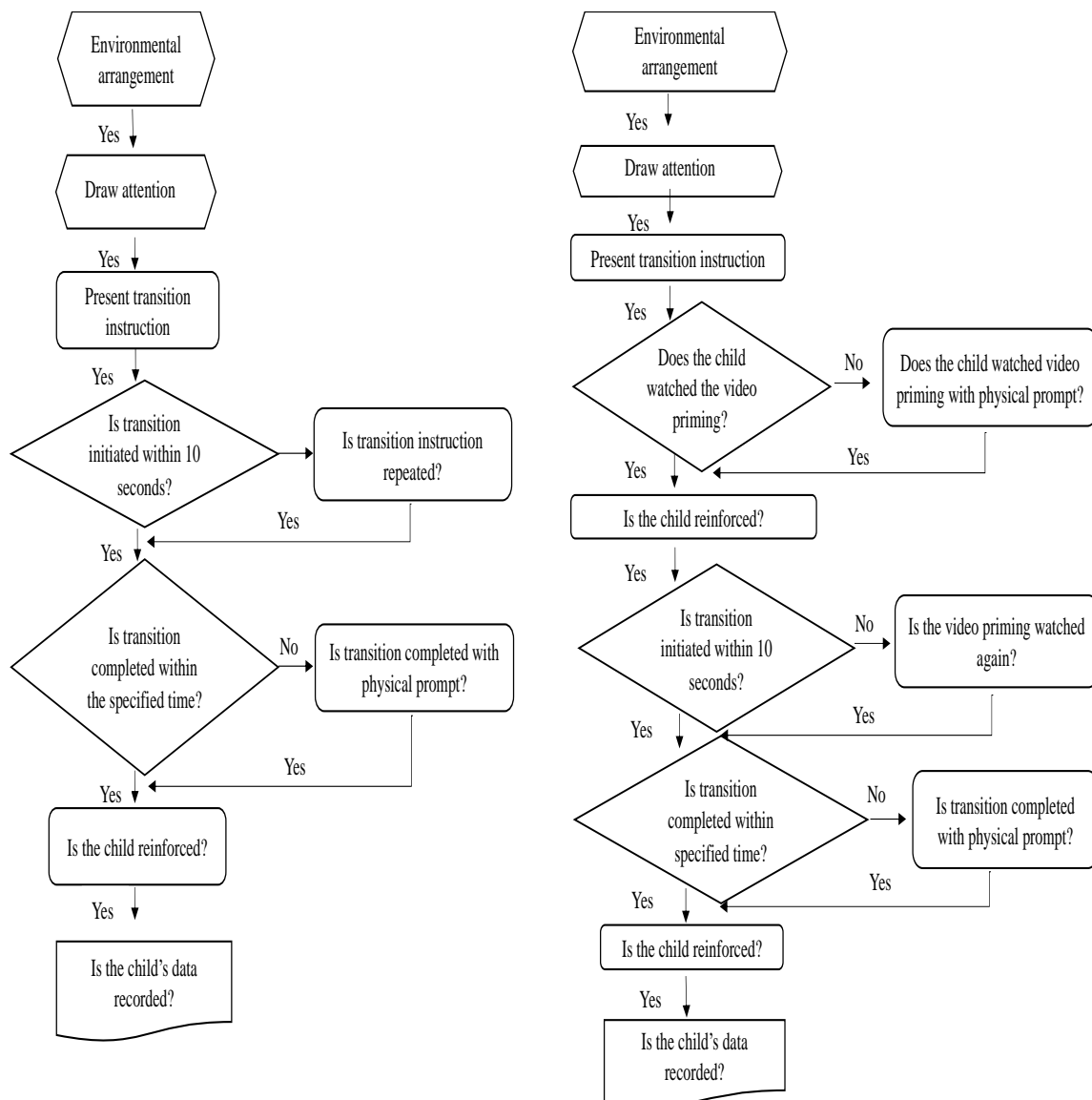
During the baseline sessions, the researcher arranged the environment and provided instruction for transition to all children simultaneously. If a child initiated the transition within 10 s and completed the transition within the predetermined time, his behavior was recorded as an independent transition and praised verbally. The children who had completed the transition independently continued with the next activity. The researcher repeated the instruction if a child did not initiate the transition within 10 s. If a child did not start the transition within 10 s after the second transition instruction or did not complete the transition within the predetermined time, his behavior was recorded as a non-independent transition. If a child did not complete the transition by himself, the researcher had the children complete the transition using a physical prompt. The independent transition and transition duration data were collected for each child. Procedures used during A<sub>1</sub> and A<sub>2</sub> conditions were identical.

### ***Video Priming Sessions (B<sub>1</sub> and B<sub>2</sub>)***

In video priming sessions, the researcher drew children's attention to the transition (e.g., "Children! Activity is over. Before we start a new activity, we are going to watch a video."). When children were ready (e.g., Finishing the activity and collecting activity materials or watching the iPad), the researcher provided instructions to them for watching the video (e.g., "Watch the video!"). Following the instruction, the researcher started the video. All children watched the video clip together, and the researcher praised the children's watching behavior when the video was over. When a child did not watch the video clip (e.g., Watching around), the researcher used a physical prompt to redirect the children's attention to the video clip. The researcher presented a transition instruction (e.g., "Go to the kitchen for a snack") when children completed watching the video clip. When a child initiated the transition within 10 s and completed the transition within the predetermined time, his behavior was recorded as an independent transition and praised. The lead teacher began the new activity with children who completed the transitions independently. If the transition was not initiated within 10 s after the transition instruction, the researcher had children re-watch the video clip and give transition instruction for a second time as an error correction. If a child did not start the transition within 10 s after the second transition instruction or did not complete the transition within the predetermined time, his behavior was recorded as a non-independent transition. If a child did not complete the transition by himself, the researcher had the child complete the transition using a physical prompt. The independent transition and transition duration data were collected for each child. Challenging behaviors such as refusing or resisting transitions yelling/crying exhibited by children during transitions were ignored. Children were brought back to the setting when they exhibited escaping behaviors. Procedures used during B<sub>1</sub> and B<sub>2</sub> phases were identical. The flow of intervention and baseline sessions is shown in Figure 1.

Figure 1

The Flowchart of Baseline (on the left) and Video Priming Sessions



### Generalization

The same procedures as in the intervention (video priming) condition were followed during the generalization. In this condition, the lead teacher presented the transition instructions, provided the video priming intervention, praised the children who completed the transition independently, and prompted those who did not complete the transition independently. The researcher was not involved in this condition. The purpose of this condition was to transfer the intervention procedures to the classroom teacher to ensure that video priming was used as a proactive strategy to increase independent transitions and decrease transition duration in natural settings.

### Social Validity

To determine the social validity, opinions of the parents and teaching staff on the importance of the study, acceptability of the intervention, and significance of the findings were investigated. The social validity data were collected from parents ( $n=4$ ) of participating children and from research assistants, teachers, assistant teachers, and practicum students ( $n=26$ ) who provided training in the research center, using a

questionnaire form developed by researchers (1=strongly agreed, 5=strongly disagreed) consisting of 10 items. To develop the social validity questionnaires, publications in the literature on acceptability and social validity were examined (Calvert & Johnston, 1990; Carr et al., 1999; Olive & Liu, 2005). Based on previous research, questions were developed regarding the importance of the purpose of the study, the acceptability of the strategy used in the study, and the significance of the findings obtained as a result of the research. The possible questions developed were sent to three experts with doctoral degrees in special education to assess their appropriateness. The statements in the social validity questionnaire were revised and rearranged based on the experts' opinions and suggestions, and the forms were put into final form.

The social validity questionnaire is seen in Table 2. All parents were invited to observe their children during the study using the observation room adjacent to the classroom in which the study took place. At the end of the study, parents and teaching staff watched the videos of the children's performance during baseline (A<sub>1</sub> and A<sub>2</sub>) and video priming (B<sub>1</sub> and B<sub>2</sub>) conditions. The researcher explained how to fill out the questionnaire, and then the parents and staff completed the questionnaire based on the children's performance in transitions.

### **Reliability**

Interobserver agreement (IOA) and treatment integrity (TI) data were collected by a doctoral student in special education who holds a master's degree in Applied Behavior Analysis in Autism. The observer is 32 years old and has seven years of experience working with children with ASD. The IOA data were collected at least 20% of all sessions for each condition and child. The IOA data were collected from the video recording by a secondary observer. The different formulas were used to calculate the IOA for each dependent variable. The IOA for the independent transition was calculated by using the "[Agreement / (Agreement + Disagreement) x 100]" formula (Kazdin, 2011; Yücesoy-Özkan, 2021), and IOA for transition duration by using "[Smaller duration / Larger duration) x 100]" formula (Kazdin, 2011; Yücesoy-Özkan, 2021). The IOA was analyzed separately for each participant across each condition and for each dependent variable. Mean IOA was 99% (range=98-100%) overall and 100%, 98% (range = 94-100%), 99% (range = 97-100%), and 100% for Owen, Ethan, Thomas and Michael respectively for independent transitions. Mean IOA was 96% (range=95-96%) overall and 96% (range 92-99%), 96% (range=92-99%), 95% (range=90-99%), and 96% (range=91-99%) for Owen, Ethan, Thomas, and Michael respectively for transition duration.

The TI data were collected to determine whether the independent variable was implemented as planned. The TI data were collected for each condition and each child for at least 20% of the sessions by the same observer who collected the IOA data. The TI was calculated by dividing the number of observed instructors' behaviors by the number of planned instructors' behaviors and multiplying by 100 (Alberto & Troutman, 2013; Gülboy & Yücesoy-Özkan, 2017). For the baseline (A<sub>1</sub> and A<sub>2</sub>) and video priming sessions (B<sub>1</sub> and B<sub>2</sub>), the planned instructor's behaviors are shown in Figure 1. TI data were analyzed separately for each participant and each condition. The TI percentage scores were 100%, 100%, and 96% (range=81-100%) for the baseline, video priming, and generalization conditions.

Table 2  
Social Validity Questionnaire

Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
<b>Importance of the Study</b>					
1. I think, my child/student;					
a) needs support during transitions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) spends a lot of time during transitions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) shows challenging behaviors during transitions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Acceptability of the Intervention</b>					
2. I think, I;					
a) need support to make my child's/student's transition more manageable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) can easily create/prepare the video priming.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) can easily use video priming.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) can recommend to other parents/teachers the use of video priming.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Significance of the Findings</b>					
3. I think, the video priming;					
a) increased my child's/student's independent transitions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) shortened the time my child's/student's spent during transitions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) reduced the challenging behaviors of my child's/student's during transitions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Data Analysis

The effects of video priming on independent transition and transition duration were examined via visual analysis. The visual analysis allows a comparison of changes in level, trend, and variability within and across consecutive phases (Kazdin, 2011). Although visual analysis is the primary method for evaluating treatment effect in single-case experimental designs, researchers have suggested using effect size estimates as additional result interpretation aides for evaluating treatment effect in single-case experimental designs (Parker et al., 2011; Rakap, 2015, Rakap et al., 2020; Yucesoy-Ozkan et al., 2020). In the current study, the Tau-*U* statistic was calculated to determine the effect sizes using the web-based online calculator (Parker et al., 2011). Tau-*U* effect size values are between 0 and 1. Tau-*U* effect size scores were interpreted as follows: an effect size was considered very effective if .80 or above, effective when in the range of .60 to .79, moderately effective when in the range of .20 to .59, and mildly effective if less than .20 (Rakap, 2015, Rakap et al., 2020; Vannest & Ninci, 2015). To calculate Tau-*U*, each A-B condition was compared individually. The data on the social validity of the research were analyzed quantitatively through descriptive analysis.

## Results

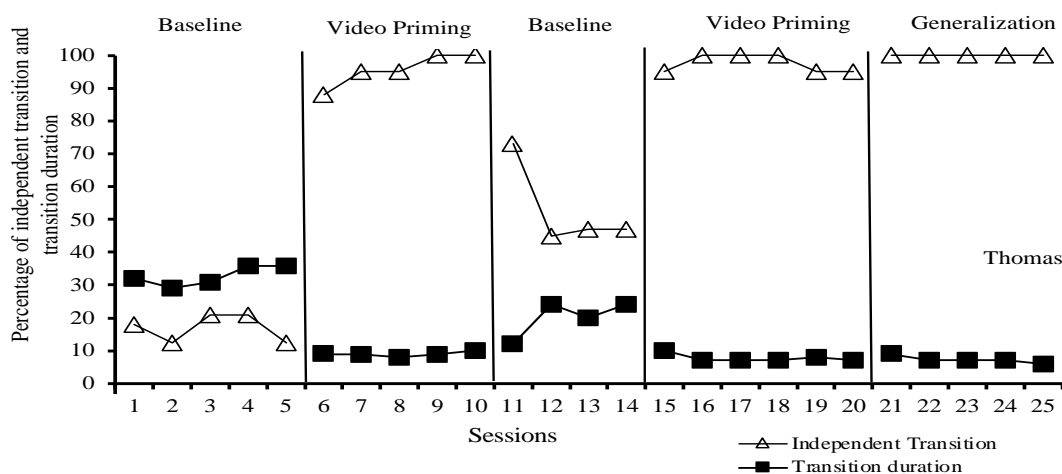
### Effectiveness Results

A total of 17 transitions were determined in line with the children's daily routines. Some of these transitions were not carried out in the baseline sessions due to the time spent in transitions. For this reason, values for both independent transition and transition duration in the baseline sessions were calculated according to the transition opportunities performed during the day. All transitions during the video priming sessions were carried out as planned. The number of sessions is not equal for each child for the baseline and video priming phase, as children cannot attend school on some days due to health problems.

Thomas independently performed an average of 18% (range=12-21%) of transitions in the A<sub>1</sub> and 94% (range=88-100%) of transitions in the B<sub>1</sub>. He independently performed an average of 53% (range=45-73%) of the transitions in the A<sub>2</sub> and an average of 98% (range=95-100%) of transitions in the B<sub>2</sub>. In the generalization phase, he carried out transitions with 100% independence. On average each school day, Thomas spent 34% ( $M=45$  min) of his time in transitions during A<sub>1</sub>, 10% ( $M=12$  min) during B<sub>1</sub>, 20% ( $M=30$  min) during A<sub>2</sub>, and 10% ( $M=12$  min) during B<sub>2</sub>. Thomas spent 7% of each school day ( $M=10$  min) in transitions during the generalization phase. Tau- $U$  was 1.0 between baseline and intervention phases for independent transition and the transition duration. The percentages of independent transitions and transition duration for Thomas are shown in Figure 2.

Figure 2

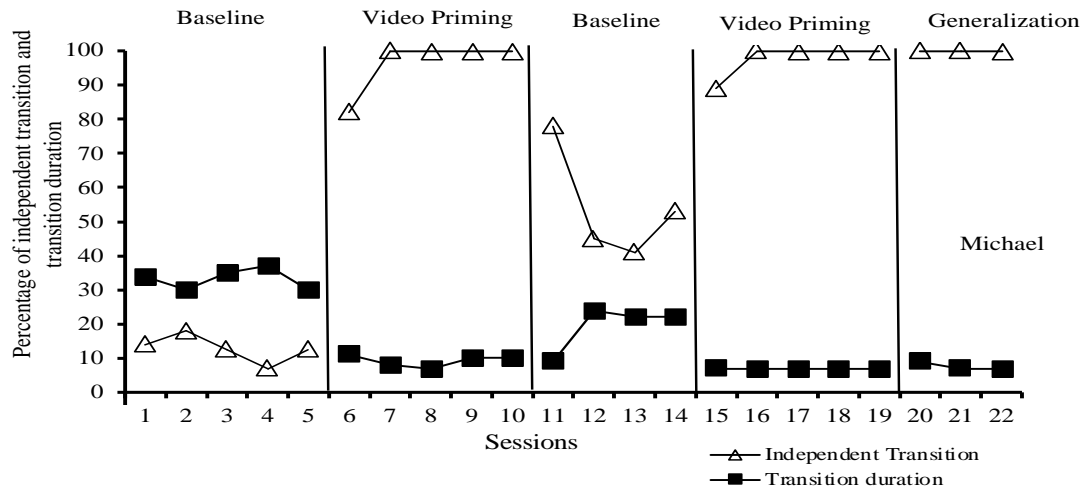
#### *Percentages of Independent Transitions and Transition Duration for Thomas*



Michael independently performed an average of 12% (range=7-18%) of transitions in the A<sub>1</sub> and 98% (range=82-100%) of transitions in the B<sub>1</sub>. He independently performed an average of 54% (range=41-78%) of the transitions in the A<sub>2</sub> and an average of 95% (range=89-100%) of transitions in the B<sub>2</sub>. In the generalization phase, he carried out transitions with 100% independence. On average each school day, Michael spent 33% ( $M=43$  min) of his time in transitions during A<sub>1</sub>, 9% ( $M=12$  min) during B<sub>1</sub>, 19% ( $M=28$  min) during A<sub>2</sub>, and 7% ( $M=12$  min) during B<sub>2</sub>.

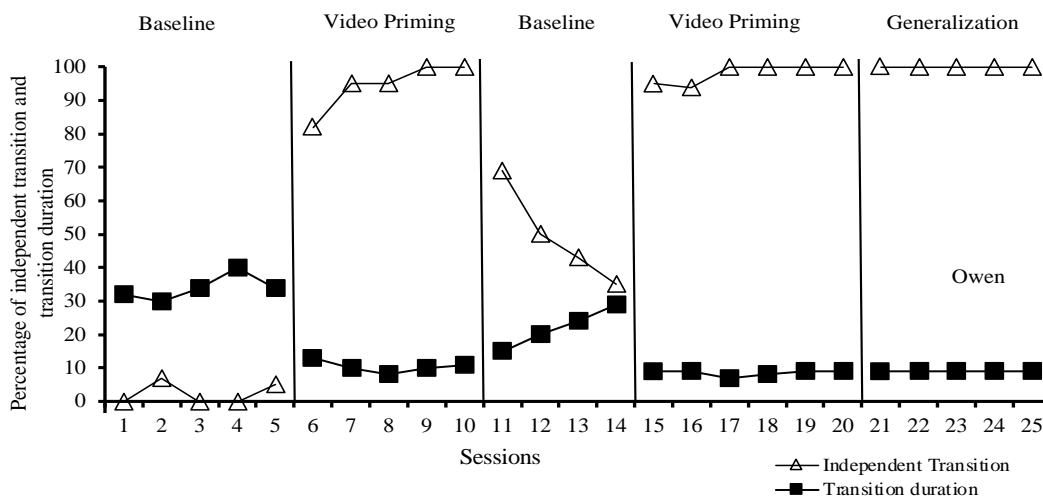
phase. Michael spent 9% of each school day ( $M=10$  min) in transitions during the generalization phase. Tau- $U$  was 1.0 between baseline and intervention phases for independent transition and the transition duration. The percentages of independent transitions and transition duration for Michael are shown in Figure 3.

Figure 3  
Percentages of Independent Transitions and Transition Duration for Michael



Owen independently performed an average of 2% (range=0-7%) of transitions in the A<sub>1</sub> and 94% (range=82-100%) of transitions in the B<sub>1</sub>. He independently performed an average of 49% (range=35-69%) of transitions in the A<sub>2</sub> and 98% (range=94-100%) of transitions in the B<sub>2</sub>. In the generalization phase, he carried out transitions with 100% independence. On average each school day, Owen spent 34% ( $M=45$  min) of his time in transitions during A<sub>1</sub>, 11% ( $M=14$  min) during B<sub>1</sub>, 22% ( $M=33$  min) during A<sub>2</sub>, and 9% ( $M=11$  min) during B<sub>2</sub>. Owen spent 9% of each school day ( $M=12$  min) during the generalization phase in transitions. Tau- $U$  was 1.0 between baseline and intervention phases for independent transition and the transition duration. The percentages of independent transitions and transition duration for Owen is shown in Figure 4.

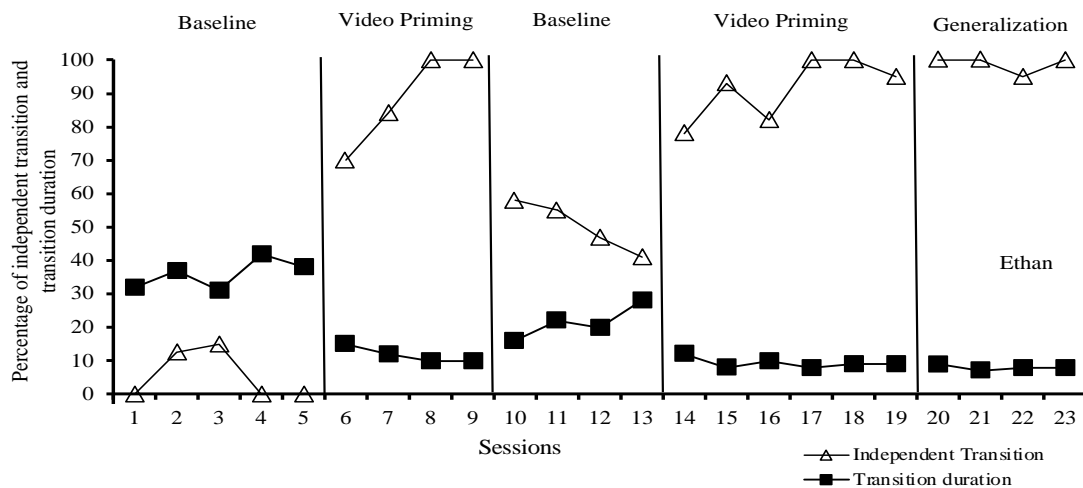
Figure 4  
Percentages of Independent Transitions and Transition Duration for Owen



Ethan independently performed an average of 6% (range=0-15%) of transitions in the A<sub>1</sub> and 88% (range=70-100%) of transitions in the B<sub>1</sub>, and he independently performed an average of 50% (range=41-58%) of the transitions in the A<sub>2</sub> and an average of 91% (range=78-100%) of transitions in the B<sub>2</sub>. In the generalization phase, he transitioned with 99% (range=95-100%) independence. On average each school day, Ethan spent 36% ( $M=54$  min) of his time in transitions during A<sub>1</sub>, 12% ( $M=14$  min) during B<sub>1</sub>, 22% ( $M=33$  min) during A<sub>2</sub>, and 10% ( $M=14$  min) during B<sub>2</sub>. Ethan spent 8% of each school day ( $M=12$  min) in transitions during the generalization phase. Tau- $U$  was 1.0 between baseline and intervention phases for independent transition and the transition duration. The percentages of independent transitions and transition duration for Ethan are shown in Figure 5.

Figure 5

*Percentages of Independent Transitions and Transition Duration for Ethan*



### Social Validity Results

All parents (100%) and teaching staff stated (100%) that children spent significant amounts of time during transitions, and therefore they needed support during changes. All parents (100%) and 93% of teaching staff stated that they needed support to facilitate children's transition, so they found the study's findings meaningful. Most parents (75%) and teaching staff (85%) responded positively to the use of video priming, and all parents (100%) and teaching staff (100%) reported that the treatment was acceptable. They could recommend video priming to other parents or colleagues. All parents (100%) and teaching staff (100%) expressed their opinions on the significance of the findings, emphasizing that video priming increased participants' independent transitions and decreased transition duration.

### Discussion

This study aimed to determine the effectiveness of video priming on increasing independent transition behaviors of young children with ASD and decreasing the transition duration. Moreover, the opinions of the participating children's parents and teaching staff on the importance of the study, acceptability of the intervention, and significance of the findings were determined. The findings indicate that video priming was effective in increasing independent transitions and decreasing transition duration



for all four children. The results also demonstrated that parents' and teaching staff's opinions concerning the importance of the study, acceptability of the intervention, and significance of the results were highly positive.

Findings demonstrated that all four children independently performed nearly all of the transitions. This finding is consistent with previous studies that showed that antecedent-based transition strategies such as visual schedules (Dettmer et al., 2000; Pierce et al., 2013), finished boxes (Dettmer et al., 2000), timers (Dettmer et al., 2000), behavioral momentum (Banda & Kubina, 2006), and transition songs (Graber-Juhnke, 2015; Kern et al., 2007). Acquiring independent transition behavior helps children with ASD to benefit more effectively from general education settings. Children with ASD often have difficulty changing activities and transitioning to new settings that cause interruptions in their access and participation in the general education curriculum. When children with ASD learn independent transition behaviors, they will need less adult assistance and have more time to engage in the general education curriculum activities, which will increase their success in school (Hine et al., 2015). Also, considering the increased use of technology (e.g., tablets, computers) to mediate instruction for children with ASD (e.g., Bewley, 2017; Hine et al., 2015), the findings of the current study contribute to the growing body of literature by examining the effect of video priming on increasing independent transitions within the school setting.

The study indicated that video priming is effective in decreasing the transition duration of young children with ASD. Time spent in transitions decreased for all children during video priming intervention. This finding supports a previous study indicating that antecedent-based transition strategies, such as finished boxes and transition songs, effectively decrease transition duration (Dettmer et al., 2000; Graber-Juhnke, 2015). This finding is consistent with previous studies investigating the length of time children spent in transitions (Ergin & Bakkaloglu, 2019; Sainato et al., 1987; Schmit et al., 2000). Moreover, an increase in the quality and quantity of instructional activities was observed after the video priming intervention was implemented. Sometimes some activities could not be performed due to prolonged transition duration. With the implementation of the video priming intervention, all scheduled activities were completed. For example, the daily classroom schedule included 17 activities, and during the initial baseline, 14 were completed. In addition, teachers' motivation increased because of the increased time available for instructional activities. During the first video priming phase, the lead teacher stated, "We are making less effort during the day, and positive progress in children's behaviors make us happy," which supported this observation.

The final finding is that parents' and teaching staff's opinions regarding the study were very positive, indicating high social validity. A limited number of studies have collected social validity data related to the effectiveness of transition strategies on increasing independent transitions of children with ASD and decreasing transition duration (Kern et al., 2007; Massey & Wheeler, 2000; Pierce et al., 2013), and no social validity findings were found in studies that examined the effectiveness of video priming. Therefore, the current study differs from previous studies because we collected social validity data on the acceptability and efficacy of video priming; thus, the study contributes to the literature.

Since the video priming was administered in the group instructional arrangement, both the efficiency and social validity increased (Gardner & Wolfe, 2019). All four participants were in the same classroom, the video clips were shown to the children simultaneously, and they carried out the transitions together. The intervention was efficient in exerting this effort only once. It helps expose children to the intervention without separating them from their peers. It is consistent with the idea that teachers working with children with ASD prefer interventions that can be used with all children at the same time rather than interventions that require individualized attention to each child (Harlacher et al., 2006)

The study was carried out in a natural setting during scheduled transitions. The children were not taken out of their natural settings during the study, and no modifications were made to the teaching settings. The current study's findings confirm that practices implemented in natural settings support the acquisition, maintenance, and generalization of new behaviors (Taylor et al., 2004; Westling & Fox, 2004).

The study has some limitations that should be considered when interpreting the findings. The first limitation is that video priming was not faded at the end of the study. We transferred the intervention to the teacher to ensure that video priming was used as a proactive strategy to increase independent transitions and decrease transition duration in a natural setting. However, incorporating the fading process in the study could facilitate maintenance and generalization, reduce prompt dependency, and supports newly acquired behaviors (Jowett et al., 2012; Sigafos et al., 2006). The second limitation is that videos were presented to all children simultaneously, so they may have learned transition behaviors by observing each other. We could not control this limitation because we offer a class-wide intervention and expect all children to facilitate transitions simultaneously. Third, the current study included four children with ASD in a research institution, and, therefore, the results should not be overgeneralized.

Based on the current study's findings, several suggestions for future practice and research can be made. In further studies, the effectiveness of video priming should be examined individual cases. Video priming can be used in community settings to inform and prepare children who have difficulty during transitions. Future studies could compare the effectiveness of video priming and other transition strategies. While video clips are created for video priming in natural settings, different viewpoints and narrations can be added to video clips. The effects of other transition strategies and video priming can be examined. Future studies should also compare the effectiveness of video priming and different transition strategies.

### **Conclusion**

The study's findings suggest that video priming effectively increases independent transition behaviors and decreases transition duration. However, students have decreased their transition duration between classroom activities and setting and increased independent transition behaviors due to video priming. However, further studies are needed to investigate the effectiveness of this strategy. The video priming strategy should be replicated with different student characteristics and ages to strengthen effects and generalization. Although further studies are recommended to confirm the results of this study, it can be said that video priming is a promising transition strategy to regulate students' transition behavior.

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**Statement of Responsibility**

Emrah Gulboy and Serife Yucesoy-Ozkan contributed equally to the design and implementation of the research, the analysis of the results, and the writing of the manuscript.

**Conflicts of Interest**

The authors declare no conflict of interest.

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## Role of Teacher Quality and Working Conditions in TIMSS 2019 Mathematics Achievement\*

### Öğretmen Kalitesi ve Çalışma Koşullarının TIMSS 2019 Matematik Başarısındaki Rolü

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Mehtap ÇAKAN\*\*\* 

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**ABSTRACT:** This correlative study examined the role of teacher qualities and working conditions in 4<sup>th</sup> and 8<sup>th</sup>-grade Turkish students' mathematics achievement in TIMSS 2019. Teacher qualifications were defined based on the teacher questionnaire used in TIMSS 2019 and were discussed in three categories: personal characteristics, teacher qualifications, and teacher practices. Data were analyzed using multilevel regression analysis. According to the results, working conditions explained most of the variance in the achievement scores (49% in the 4<sup>th</sup>-grade and 40% in the 8<sup>th</sup>-grade), while teachers' characteristics explained the least variance (19% in the 4<sup>th</sup>-grade and 11% in the 8<sup>th</sup>-grade). Teacher qualifications explained about one-third of the between-schools variance (35% in the 4<sup>th</sup>-grade and 26% in the 8<sup>th</sup>-grade). Teacher practices explained the one-fifth of the between-schools variance (23% in the 4<sup>th</sup>-grade and 27% in the 8<sup>th</sup>-grade). Some variables had a high correlation with TIMSS achievement in 4<sup>th</sup> and 8<sup>th</sup>-grade, such as teachers' age, experience, teaching limited by students not ready for instruction, and parental pressure on teachers. Other significant predictors were having a major in education and mathematics, bringing interesting materials to class, using long-term assessment projects, having too many administrative tasks, and the number of students in the class.

**Keywords:** Teacher quality, working conditions, mathematics, teacher questionnaire, TIMSS 2019.

**ÖZ:** İlişkisel desende tasarlanan bu araştırmada öğretmen kalitesinin ve çalışma koşullarının, 4. ve 8. sınıf Türk öğrencilerinin TIMSS 2019 matematik başarısındaki rolü incelenmiştir. Öğretmen kalitesi, TIMSS 2019'da kullanılan öğretmen anketine dayalı olarak tanımlanmıştır ve üç kategoride ele alınmıştır: Kişisel özellikler, öğretmen nitelikleri ve öğretmen uygulamaları. Araştırma verisi çok düzeyli regresyon kullanılarak analiz edilmiştir. Araştırmanın sonuçlarına göre başarıdaki varyansı en fazla çalışma koşulları (4. sınıfta %49 ve 8. sınıfta %40) ve en az öğretmenlerin kişisel özellikleri açıklamaktadır (4. sınıfta %19 ve 8. sınıfta %11). Okullar arası varyansın üçte birini öğretmen nitelikleri (4. sınıfta %35 ve 8. sınıfta %26) ve beşte birini öğretmen uygulamaları (4. sınıfta %23 ve 8. sınıfta %27) açıklamaktadır. Öğretmenlerin yaşı, deneyimi, öğretimi sınırlandıran öğrenciden kaynaklı sorunlar ve velilerden çok fazla baskı hissetme gibi bazı değişkenler 4. ve 8. sınıftaki TIMSS başarısı ile yüksek korelasyon göstermiştir. Başarıyı yordayan diğer bazı önemli değişkenler ise şunlardır: Eğitim ve matematik alanlarında uzmanlaşma, sınıfa ilginç materyaller getirme, değerlendirmede uzun süreli projeler kullanma, çok fazla idari göreve sahip olma ve sınıftaki öğrenci sayısı.

**Anahtar kelimeler:** Öğretmen kalitesi, çalışma koşulları, matematik, öğretmen anketi, TIMSS 2019.

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Several factors related to student, home, school, curriculum, and teaching methods correlate with school achievement. Besides, it is emphasized that teacher quality plays a critical role in student achievement. Teachers are one of the school-related factors that most correlate with the development of students' knowledge and skills (Harris & Sass, 2011; Provasnik & Young, 2003; Rice, 2003).

It has been an issue that has been inquired about since 1960, that is characteristics and behaviors of teachers affect student achievement positively (Hill et al., 2005). Toraman (2019) stated that effective teacher characteristics include competence in subject matter knowledge, teaching skills, personal characteristics, and professional development. However, there is no consensus yet on the teachers' important qualifications in explaining students' achievement (Harris & Sass, 2011; Lee & Lee, 2020; Rivkin et al., 2005; Scheerens & Blömeke, 2016).

The number of studies investigating the relationship between teacher characteristics and student achievement is quite high. Several variables such as experience, education level, certification status, participation in professional development activities, general skills, pedagogical content knowledge, and practices have been addressed within the scope of teacher quality (Goe, 2007; Harris & Sass, 2011; Lee & Lee, 2020; Liang et al., 2015).

Apart from the critical variables in teacher quality, many studies categorize these qualities. For example, according to Scheerens and Blömeke (2016), teacher quality is a multidimensional concept that includes cognitive (knowledge) and non-cognitive factors (e.g., beliefs, attitudes). Goe (2007) presented a new teacher quality model with concrete indicators. There are four categories of teacher quality: personal characteristics, teacher qualifications, teacher practices, and teacher effectiveness.

There are contradictory results in the literature regarding the relationship between teachers' experience and student achievement. For example, according to Hong (2012), teachers' experience predicts mathematics achievement in Trends in International Mathematics and Science Study (TIMSS), positively in developing countries and negatively in developed countries. Hegarty and Rutkowski (2019) also stated no strong evidence for the correlations between student achievement and teacher effectiveness described by the common variables in TIMSS for different countries. On the contrary, it was found that teachers' subject matter knowledge and pedagogical content knowledge, which are the variables not measured within the scope of TIMSS, correlated with students' mathematics achievement (Baier et al., 2019).

International exams such as TIMSS and Programme for International Student Assessment (PISA) provide the most comprehensive data about teacher characteristics and students' scores. TIMSS is survey research first conducted in 1995 and is held every four years. According to the TIMSS 2019 mathematics achievement test scores, Turkey ranked 23 out of 58 countries in the 4<sup>th</sup>-grade level, indicating that Turkey was above the TIMSS international average (Ministry of National Education [MONE], 2020). According to previous assessments, there had been an increase in mathematics scores compared to the last eight years and more students ranked among high (28% proportion) and advanced (15% proportion) international benchmark. In the 8<sup>th</sup>-grade level, Turkey ranked 20 out of 39 countries, indicating that Turkey was below the TIMSS international average (MONE, 2020). According to previous assessments, more

students ranked among intermediate (24% proportion), high (20% proportion) and advanced (12% proportion) international benchmark.

TIMSS is one of the most comprehensive international comparative studies that assess 4<sup>th</sup> and 8<sup>th</sup>-grade students' knowledge and skills in mathematics and science. It collects nationally representative data from large teacher, student, and school characteristics samples. The TIMSS results provide insight into education policymakers, administrators, teachers, and researchers about the issues surrounding education systems and reforms (Martin & Mullis, 2012). Countries make important decisions and changes in their education systems considering the TIMSS results. However, few studies examine the teacher questionnaire, which includes variables related to teachers that play a critical role in mathematics achievement in the TIMSS. Some studies discussed TIMSS items to evaluate the instructional quality (Eriksson et al., 2019) and participation in professional development activities (Liang et al., 2015).

Many studies in the literature examine student, home, and school-related variables related to TIMSS mathematics achievement. Some variables related to students, such as confidence in mathematics, like learning mathematics, and value mathematics, were determined to be associated with TIMSS mathematics achievement (Akyüz-Aru, 2020; Çavdar, 2015; Şahin & Boztunç-Öztürk, 2018; Sarier, 2020). In general, the literature findings indicated that teaching limited by students' needs, challenges, parental involvement, home educational resources, job satisfaction, and experience significantly predicted students' mathematics achievement (e.g., Akyüz, 2006; Akyüz-Aru, 2020; Batı, 2021; Çavdar, 2015; Sarı et al., 2017; Sarier, 2020; Yetkiner Özel & Özel, 2013). However, this finding could vary by country. For example, teaching limited by students' needs was not correlated with mathematics achievement on TIMSS 2015 in Dinaric region countries such as Albania, Croatia, Kosova, and Serbia (Elezović et al., 2022); but was negatively correlated in Turkey (Sarı et al., 2017). In addition, the studies have shown that there were many differences between schools in Turkey, and therefore multilevel analyzes should be made according to schools (Akyüz-Aru, 2020; Arıkan et al., 2020; Sarı et al., 2017). However, Suna and Özer (2021) pointed out that the difference in achievement between schools decreased partially in TIMSS 2019 compared to other TIMSS assessments.

Because this current study examined all the questions in the TIMSS 2019 teacher questionnaires and inquired the teacher-level variables that explained the differences between schools, it would contribute to the literature. Also, it was important for the studies to examine different variables related to teachers. The findings and results of the study would guide policymakers to take concrete and practical steps to improve education policies and TIMSS scores. Besides, as a result of this research, a description of essential teacher qualifications for students' mathematics achievement would provide guidelines for effective teacher training programs and comprehensive planning of in-service training programs for teachers.

### **Study Goal**

The study aimed to explore the role of teacher quality and working conditions in 4<sup>th</sup> and 8<sup>th</sup>-grade Turkish students' mathematics achievement in TIMSS 2019. It also aimed to reveal to what extent teacher attributes were influential in students'

mathematics achievement and improve the TIMSS teacher questionnaire. The research questions are as follows:

1. To what extent do teachers' characteristics predict 4<sup>th</sup> and 8<sup>th</sup>-grade students' mathematics achievement in TIMSS 2019?
2. To what extent do teacher qualifications predict 4<sup>th</sup> and 8<sup>th</sup>-grade students' mathematics achievement in TIMSS 2019?
3. To what extent do teachers' practices predict 4<sup>th</sup> and 8<sup>th</sup>-grade students' mathematics achievement in TIMSS 2019?
4. To what extent do working conditions predict 4<sup>th</sup> and 8<sup>th</sup>-grade students' mathematics achievement in TIMSS 2019?

## Method

### Study Sample

TIMSS 2019 assessment employed a two-stage random sample design (LaRoche et al., 2020). In the first stage, the sample of schools was selected in which each school had a chance of selection proportional to the number of their eligibility. In the second stage, one or more entire classes of sampled schools were selected with equal probability.

The sample consisted of 4<sup>th</sup> and 8<sup>th</sup>-grade Turkish students at public and private schools in 2019 and their mathematics teachers. Details about the sample are presented in Table 1.

Table 1  
*Demographic Characteristics of Teachers*

Variables	Category	4 <sup>th</sup> -Grade		8 <sup>th</sup> -Grade	
		<i>f</i>	%	<i>f</i>	%
Gender	Female	110	62.1	93	53.1
	Male	67	37.9	82	46.9
Majored area	Education and mathematics	109	61.6	96	54.9
	Education	3	1.7	31	17.7
	Mathematics	63	35.6	42	24.0
	Other	2	1.1	6	3.4
Educational status	Undergraduate	166	93.8	163	93.1
	Postgraduate	10	5.7	12	6.9
	No response	1	.6	-	-
Experience	Five and below	77	43.5	52	29.7
	6 – 10 years	38	21.5	49	28.0
	11 – 15 years	31	17.5	36	20.6
	16 – 20 years	19	10.7	27	15.4
	21 years or more	12	6.8	11	6.3

As seen in the table, there were 4028 students, 181 teachers, and 180 schools in the 4<sup>th</sup>-grade. There were 4077 students, 181 teachers, and 181 schools in the 8<sup>th</sup>-grade. Following the missing data and extreme values analysis, the sample included 3942 students, 177 teachers, and 177 schools in the 4<sup>th</sup>-grade; 3922 students, 175 teachers, and 175 schools in the 8<sup>th</sup>-grade. As seen from the table, there was one teacher in each school.

According to Table 1, 177 mathematics teachers in the 4<sup>th</sup>-grade participated in this survey, with 110 female (62.1%) and 67 male (37.9%). More than half of the teachers' majors were education and mathematics ( $f=109$ , 61.6%). Almost all teachers had only one bachelor's degree ( $f=166$ , 93.8%), and ten teachers had master's or doctorate degrees (5.7%). Almost half had five years or less teaching experience ( $f=77$ , 43.5%).

In addition, 175 mathematics teachers in the 8<sup>th</sup>-grade participated in this survey, with 93 female (53.1%) and 82 male (46.9%). More than half of the teachers' majors were education and mathematics ( $f=96$ , 54.9%). Almost all teachers had only a bachelor's degree ( $f=163$ , 93.1%), and 12 teachers had master's or doctorate degrees (6.9%). More than half had ten or fewer years of teaching experience ( $f=101$ , 57.7%).

Also, in the final analysis, 3942 4<sup>th</sup>-grade students participated in our survey, with 2052 girls (52.1%) and 1882 boys (47.7%), and eight students did not report their gender. In 8<sup>th</sup>-grade, 3922 students were incorporated into the analysis, with 1954 girls (49.8%) and 1950 boys (49.7%), and 18 students did not report their gender.

### **Instruments**

The study was performed using TIMSS 2019 data from the official website of TIMSS (International Association for the Evaluation of Educational Achievement, 2021). Mathematics achievement test for Turkish students and the teacher questionnaire for mathematics teachers in 4<sup>th</sup> and 8<sup>th</sup>-grade were obtained.

In the TIMSS 2019 mathematics achievement test of 4<sup>th</sup> graders, 50% of the total test score was from the numbers, 30% was from measurement and geometry, and 20% was from data. In the test of the 8<sup>th</sup> graders, 30% of the total test score was from numbers, 30% was from algebra, 20% was from geometry, and 20% was from data and probability.

Each of the 4<sup>th</sup>-grade and 8<sup>th</sup>-grade teacher questionnaires had 23 items. Both questionnaires were very similar. Some items were identical, but some sub-items were different. Both surveys included questions about teachers' personal information (e.g., teaching experience, age, gender), thoughts about being a teacher (e.g., job satisfaction), their workplaces and working conditions (e.g., school environment, number of students in the class), mathematics topics taught to the TIMSS class, mathematics teaching activities, assessment practices, homework assignments, and professional development activities.

### **Design and Procedure**

This study used the predictive correlational design in which the correlations between variables were examined, and the other variables were predicted based on one or more variables without any intervention or manipulation (Fraenkel & Wallen, 2010).

The study aimed to determine the predictive level of teacher characteristics on students' mathematics achievement.

According to Goe's teacher quality model (2007), the questionnaires applied to 4<sup>th</sup> and 8<sup>th</sup>-grade teachers were categorized. Two achievement points are required to determine the category of teacher effectiveness, so the other three categories (i.e., personal characteristics, teacher qualifications, and teacher practices) were used in the study.

Personal characteristics involve (i) attitudes and beliefs that are resistant to change; (ii) stable or generational characteristics such as race and ethnicity; and (iii) the features that can be changed, such as the ability to communicate with a second or third different language, collaboration skills, job satisfaction, self-confidence in teaching mathematics, gender, and age. Teacher qualifications refer to the knowledge and experiences that a teacher brings to the classroom - for example, teaching practices and experience, higher education programs, internships, and professional development. Teacher practices include a teacher's behaviors, in-class practices, teaching planning, and strategies in the classroom, such as paying attention to the consistency between teaching practices and assessment procedures, setting explicit learning goals and student performance expectations, using formative assessment, and active learning techniques.

The mathematics teachers' answers to the TIMSS 2019 teacher questionnaire were examined considering teacher quality (personal characteristics, teacher qualifications, and teacher practices) and working conditions. The given four categories and relevant variables are shown in Table 2. Also, information about the questionnaire items and the scale scores calculated by TIMSS was given below. Dummy coding was used for categorical variables. All the yes/no sub-questions (e.g., Do you participate in professional development activities?) were coded as (1) yes and (0) no. The item code "ATB..." was for 4<sup>th</sup>-graders, and the code "BTB..." was for 8<sup>th</sup>-graders.

Table 2

*Teacher Quality and Working Conditions Variables*

Category	Variables
Teacher characteristics	(1) Gender*, (2) age, (3) job satisfaction
Teacher qualifications	(1) Teaching experience, (2) major in education and mathematics*, (3-9) participating in professional development activities in the past two years* (activities for mathematics content, mathematics pedagogy/instruction, mathematics curriculum, integrating technology into mathematics instruction, improving students' critical thinking or problem-solving skills, mathematics assessment, addressing students' needs), (10-16) the need for professional development activities in the future* (activities for mathematics content, mathematics pedagogy/instruction, mathematics curriculum, integrating technology into mathematics instruction, improving students' critical thinking or problem-solving skills, mathematics assessment, addressing students' needs), (17) hours spent on professional development in the past two years
Teacher practices	(1-8) In-class teaching practices (e.g., relate the lesson to students' daily lives, bring interesting materials to class**), (9-16) guiding students (e.g., ask students do the exercises on their own), (17) allowing students to use calculators*, (18) the frequency of assigning mathematics homework, (19-23) mathematics assessment (e.g., use long-term projects)

Working conditions	(1) School emphasis on academic success, (2) safe and orderly schools, (3) student-oriented problems/classroom teaching limited by students not ready for instruction, (4) classroom size, (5) availability of a computer for students in the classroom*, (6-13) working conditions (e.g., the excessive number of students in
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\* Categorical. \*\* It is only available in the 4<sup>th</sup>-grade.

Teachers' job satisfaction was a scale measured by TIMSS (ATBGTJS, BTBGTJS). The 4-point Likert-type scale (i.e., often, sometimes, rarely, and never) consisted of five items such as "I am content with my profession as a teacher" and "My work inspires me." The Cronbach alfa coefficient was .92 in 4<sup>th</sup>-grade and .93 in 8<sup>th</sup>-grade. Teachers' high scores on this scale refer to high job satisfaction.

School emphasis on academic success was a scale measured by TIMSS (ATBGEAS, BTBGEAS). The 5-point Likert-type scale (i.e., very high, high, medium, low, very low) consisted of 12 items such as "Parental involvement in school activities" and "Students' desire to do well in school." The Cronbach alfa coefficient was .89 in 4<sup>th</sup>-grade and .90 in 8<sup>th</sup>-grade. Teachers' high scores on this scale refer to high job satisfaction.

Safe and orderly schools were a scale by TIMSS (ATBGSOS, BTBGSOS). The 4-point Likert-type scale (e.g., agree a lot, agree a little, disagree a little, disagree a lot) consisted of eight items such as "I feel safe at his school" and "The students respect school property." The Cronbach alfa coefficient was .90 in 4<sup>th</sup>-grade and .88 in 8<sup>th</sup>-grade. Similarly, teachers' high scores on this scale meant that they accepted the school as a safe place.

The scale "classroom teaching limited by students not ready for instruction" was created by TIMSS (ATBGLSN, BTBGLSN). The 3-point Likert-type scale (i.e., not at all, some, a lot) consisted of eight items such as "Uninterested students" and "The students respect school property." The Cronbach alfa coefficient was .82 in 4<sup>th</sup>-grade and .83 in 8<sup>th</sup>-grade. Teachers' higher scores indicated fewer factors limiting teaching.

However, some questions were not considered scale items in the teacher questionnaire. Teachers' in-class teaching practices were measured with eight items using a 4-point Likert-type scale (every or almost every lesson, about half of the lessons, some lessons, never). The items were as follows (ATBG12, BTBG12):

1. Relate the lesson to students' daily lives,
2. Ask students to explain their answers,
3. Bring interesting materials to class,
4. Ask students to complete challenging exercises that require them to go beyond the instruction,
5. Encourage classroom discussions among students,
6. Link new content to students to students' prior knowledge,
7. Ask students to decide their own problem-solving procedures,
8. Encourage students to express their ideas in class.

Teachers' guidance practices in the class were measured with eight items in a 4-point Likert type scale (i.e., every or almost every lesson, about half of the lessons, some lessons, never). The items were as follows (ATBM02, BTBM15):

1. Ask to listen to the teacher when explaining new mathematics content,
2. Ask to listen to the teacher when explaining how to solve problems,
3. Ask to memorize rules, procedures, and facts,
4. Ask to practice procedures on students own,
5. Ask to apply what students have learned to new problem situations on their own,
6. Work problems together in the whole class with direct guidance from the teacher,
7. Work in mixed ability groups,
8. Work in same ability groups.

Teachers' mathematics assessment practices were measured with five items in the 3-point Likert type scale (i.e., a lot, some, none). The items were as follows (ATBM07, BTBM20):

1. Observing students as they work for assessing mathematics,
2. Asking students to answer questions during class for assessing mathematics,
3. Include the lesson short, regular written assessments,
4. Use longer tests (e.g., unit tests or exams),
5. Use long-term projects.

Teachers' working conditions in class and school were measured with eight items in the 4-point Likert type scale (agree a lot, agree a little, disagree a little, disagree a lot). The items were as follows (ATBG09, BTBG09):

1. Too many students in the classes,
2. Having too much material to cover in class,
3. Having too many teaching hours,
4. Need more time to prepare for class,
5. Need more time to assist individual students,
6. Feeling too much pressure from parents,
7. Difficulty keeping up with all of the changes to the curriculum,
8. Having too many administrative tasks.

Although all items in the teacher questionnaire were examined in this study, some variables were not included in the analysis. These variables had more than 20% missing data (e.g., If the students in the class did not have a computer/tablet, the teachers left the items about using computers in classroom activities blank.). Also, some variables had no variance (e.g., the number of students who had difficulty understanding the language of the test, the duration of the mathematics lesson, the current state of teaching TIMSS subjects). These variables were not shown in Table 2.

### **Data Analysis**

This study tested the predictive level of teacher quality (personal characteristics, teacher qualifications, and practices) and working conditions on mathematics achievement by using multilevel regression analysis. The analysis used the TIMSS mathematics achievement scores as the dependent variable and teacher quality and working conditions as independent variables. Students' mathematics scores were five plausible values (ASMMAT01-ASMMAT05 and BSMMAT01-BSMMAT05).



TIMSS assessments were completed using a stratified two-stage cluster sample design. There was a hierarchical structure since the data were collected from the students and their teachers. Accordingly, in multilevel regression analysis, students were at the first level, and the teachers were at the second level. Since there was a teacher in each school, there were also schools at the second level. In this study, teacher quality and working conditions were variables at the teacher/school level (between variables). There was no variable at the student level (within variables). Teacher-level variables are shown in Table 2.

Also, Arıkan et al. (2020) suggested using sample weights and plausible values in data analysis in large-scale international assessments. Thus, a multilevel structure was taken into account using five plausible values and sample weights. For level one, the product of class weights and student weights (WGTADJ2, WGTFAC2, WGTADJ3, WGTFAC3), and for level two, the product of school weights (WGTADJ1, WGTFAC1) were used accordingly. Before analyzing multilevel regression models, whether the variability at the group level is sufficient was also checked (Şen, 2020).

The multilevel regression analyses were performed using the MPLUS 6.12 program, which could take into account the characteristics of TIMSS data (Muthén & Muthén, 2015). In statistical analysis, the  $\alpha$  value was set at .05. The standardized  $\beta$  coefficient was used to interpret the regression coefficients. Also, the effect size index ( $f^2$ ) was calculated by using the explained variance for the overall model (Cohen, 1992). The effect size index is interpreted as small between .02-.14, a medium between .15-.34, and large between .35 and above. This formula is as follows:

$$f^2 = \frac{R^2}{1 - R^2}$$

Before the data analysis, the missing data pattern was examined using Little's MCAR test. The test results revealed .11% missing data in the 4<sup>th</sup>-grade, which was not statistically significant ( $p=.25$ ). It was measured at .08% for the 8<sup>th</sup>-grade, which was insignificant ( $p=.10$ ). In other words, the data from the 4<sup>th</sup> and 8<sup>th</sup>-grade teachers were missing completely at random. Since many variables contained missing data, the missing data were handled using multiple imputations. MPLUS 7.4 programs were used and weighted least squares mean-variance adjusted (WLSMV) was chosen as the parameter estimator. The questionnaire items contained more than 15% missing data, and an 8<sup>th</sup>-grade mathematics teacher who did not answer at all and her students were not included in the analysis.

Also, the extreme values were examined using a box plot. Teachers and students with extreme values were excluded from the analysis. The analysis process was carried out using the data from 177 teachers and 3942 students in the 4<sup>th</sup>-grade and 175 teachers and 3922 students in the 8<sup>th</sup>-grade.

In addition, normality and multicollinearity problems, linearity assumptions, and homogeneity of variances were examined. When Q-Q plot was examined (Alpar, 2013), it was seen that the values of some variables were separated from the expected values (straight diagonal line). Accordingly, it indicated that the normal distribution is not met for some variables (e.g., the kurtosis value of school emphasis on academic success was 1.21 in 8<sup>th</sup>-grade; experience kurtosis value was -1.71 in 4<sup>th</sup>-grade). In addition, these values did not range from -1 to +1. Since the normal distribution was not achieved, the

weighted least squares mean adjusted parameter estimation method (WLSM) was used in the multilevel regression analysis.

Lastly, VIF values were between approximately 1.01 and 2.08. Since VIF values were less than 10, it is assumed that there was no multicollinearity problem (Stevens, 2009). The relationships between standardized errors and predicted values were checked with scatter plots to examine the linearity and variance homogeneity. In the residual scatter plots, the residuals were randomly distributed around zero in a rectangular form, and the errors had a normal distribution. Accordingly, linearity and variance homogeneity were assumed to be provided (Alpar, 2013; Stevens, 2009).

### **Ethical Procedures**

Ethics committee approval is not required for this study. No suspicious process was carried out in the analysis of the research data. The authors paid attention not to interfere with the research data except for the necessity of analysis and to interpret the results objectively.

### **Results**

In this section, first of all, the necessity of multilevel analysis was examined, and the intra-class correlation coefficient was calculated. Then, the findings regarding the level of predicting mathematics achievement of teachers' personal characteristics, teacher qualifications and practices, and working conditions for 4<sup>th</sup> and 8<sup>th</sup>-grade were presented.

The intra-class correlation coefficient was calculated as .427 in the 4<sup>th</sup>-grade level and .395 in the 8<sup>th</sup>-grade level. These values represented that students' mathematics scores were not independent, and the scores of students who had the same math teacher (or at the same school) were correlated. In the 4<sup>th</sup>-grade, 43% and in the 8<sup>th</sup>-grade, 40% of the total variance came from teacher variance. Also, in the 4<sup>th</sup>-grade, 57%, and the 8<sup>th</sup>-grade, 60% of the total variance came from teacher variance. Therefore, multilevel regression analyses were necessary. Analysis results for each teacher quality category (personal characteristics, teacher qualifications, and teacher practices) and teachers' working conditions are below.

### **Teacher Characteristics Predicting 4<sup>th</sup>-Grade and 8<sup>th</sup>-Grade Students' Mathematics Achievement**

Table 3 shows the variables related to teacher characteristics, multilevel regression equation results, and the standardized  $\beta$  coefficients in the 4<sup>th</sup> and 8<sup>th</sup>-grade levels. The independent variables related to the teachers' characteristics in the TIMSS 2019 research involved gender, age, and job satisfaction.

Table 3  
 Teacher Characteristics Predicting Mathematics Achievement

Variables	4 <sup>th</sup> -Grade		8 <sup>th</sup> -Grade	
	Coefficient	Std. Error	Coefficient	Std. Error
1. Gender (Female)	-.080	.078	-.069	.079
2. Age	.397***	.081	.310***	.088
3. Job satisfaction	.105	.078	.011	.070
Between-class explained variance	18.5%		10.7%	
$f^2$	.23		.12	

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

As seen in Table 3, the age of teachers predicted mathematics achievement in both 4<sup>th</sup> ( $\beta = .40$ ) and 8<sup>th</sup> ( $\beta = .31$ ) grade levels. Gender and job satisfaction were not included in the regression equations as they did not show a significant correlation with mathematics achievement. Also, there was a positive relationship between age and mathematics scores.

In 4<sup>th</sup>-grade, the results showed that the variables of teacher characteristics explained 18.5% of the variance, and the regression equation had a medium effect size ( $f^2 = .23$ ). Also, in the 8<sup>th</sup>-grade, teacher characteristics' variables explained 10.7% of the variance, and the regression equation had a small effect size ( $f^2 = .12$ ).

### Teacher Qualifications Predicting 4<sup>th</sup>-Grade and 8<sup>th</sup>-Grade Students' Mathematics Achievement

Table 4 shows the variables related to teacher qualifications, multilevel regression equations' results and the standardized  $\beta$  coefficients in the 4<sup>th</sup> and 8<sup>th</sup>-grade. The independent variables related to the teachers' qualifications in the TIMSS 2019 involved teaching experience, major in education and mathematics, professional development activities participated in the last two years and the need for future professional development activities. The professional development topics were related to mathematics content, mathematics pedagogy/instruction, mathematics curriculum, integrating technology into mathematics instruction, improving students' critical thinking or problem-solving skills, mathematics assessment, addressing individual students' needs.

Table 4  
*Teacher Qualifications Predicting Mathematics Achievement*

Variables	4 <sup>th</sup> -Grade		8 <sup>th</sup> -Grade	
	Coefficient	Std. Error	Coefficient	Std. Error
1. Experience	.383***	.080	.415***	.102
2. Major in education and mathematics	.132	.068	.176*	.080
3. Mathematics content (participating in PD)	.017	.114	.021	.135
4. Mathematics pedagogy/instruction (participating in PD)	-.072	.116	.003	.121
5. Mathematics curriculum (participating in PD)	-.117	.098	.040	.099
6. Integrating technology into mathematics instruction (participating in PD)	.130	.084	.098	.123
7. Improving students' critical thinking or problem-solving skills (participating in PD)	.013	.099	.016	.110
8. Mathematics assessment (participating in PD)	-.157	.095	-.079	.113
9. Addressing individual students' needs (participating in PD)	.275**	.085	.145	.127
10. Mathematics content (the need for PD)	-.213	.131	.073	.129
11. Mathematics pedagogy/instruction (the need for PD)	.030	.115	-.189	.110
12. Mathematics curriculum (the need for PD)	.101	.128	-.064	.103
13. Integrating technology into mathematics instruction (the need for PD)	-.010	.082	.160	.110
14. Improving students' critical thinking or problem-solving skills (the need for PD)	-.040	.127	-.006	.124
15. Mathematics assessment (the need for PD)	-.127	.109	-.030	.134
16. Addressing individual students' needs (the need for PD)	-.040	.104	-.098	.125
17. Hours spent on professional development in the past two years	.012	.078	-.072	.115
Between-class explained variance	35.0%		26.1%	
$f^2$	.54		.35	

PD= Professional Development. \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

In order of importance, the significant predictors of mathematics achievement in 4<sup>th</sup>-grade were teachers' experience ( $\beta = .38$ ) and participating in professional development in the last two years and addressing individual students' needs ( $\beta = .28$ ). Other variables related to teacher qualifications were not significant predictors of mathematics achievement. Accordingly, while the other variables were constant, as the experience of the 4<sup>th</sup>-grade teacher increased, mathematics achievement would also increase. Similarly, the teacher's professional development in the last two years and addressing students' needs increased student achievement.

In order of importance, the significant predictors of mathematics achievement in 8<sup>th</sup>-grade were teachers' experience ( $\beta=.42$ ) and major in education and mathematics ( $\beta=.18$ ). Other variables related to teacher qualifications were not significant predictors of mathematics achievement. Accordingly, while the other variables were constant, as the experience of the 8<sup>th</sup>-grade teacher increased, mathematics achievement would also increase. Similarly, teachers' majors were education and mathematics, which increased their achievement.

In 4<sup>th</sup>-grade, the results showed that teacher qualifications' variables explained 35% of the variance, and the regression equation had a large effect size ( $f^2=.54$ ). Also, in the 8<sup>th</sup>-grade, teacher qualifications' variables explained 26.1% of the variance, and the regression equation had a large effect size ( $f^2=.35$ ).

### Teacher Practices Predicting 4<sup>th</sup>-Grade and 8<sup>th</sup>-Grade Students' Mathematics Achievement

Table 5 shows the variables related to teacher practices in TIMSS class, the results of multilevel regression equations, and the standardized  $\beta$  coefficients in the 4<sup>th</sup> and 8<sup>th</sup>-grade. The independent variables related to the teachers' practices in the TIMSS 2019 research involved in-class teaching practices, practices for guiding students, allowing students to use calculators, frequency of assigning mathematics homework, and mathematics assessment practices. Bringing exciting materials to the class was only available in the 4<sup>th</sup>-grade.

Table 5

#### *Teacher Practices Predicting Mathematics Achievement*

Variables	4 <sup>th</sup> -Grade		8 <sup>th</sup> -Grade	
	Coefficient	Std. Error	Coefficient	Std. Error
1. Relate the lesson to students' daily lives	-.094	.114	.051	.112
2. Ask students to explain their answers	.018	.103	.030	.118
3. Bring interesting materials to class	-.215*	.099	-	-
4. Ask students to complete challenging exercises that require them to go beyond the instruction	.117	.107	.240*	.109
5. Encourage classroom discussions among students	.038	.098	.007	.118
6. Link new content to students to students' prior knowledge	.081	.106	.165	.109
7. Ask students to decide their own problem-solving procedures	.068	.119	-.145	.104
8. Encourage students to express their ideas in class	.129	.136	-.106	.099
9. Ask to listen to the teacher when explaining new mathematics content	-.166	.155	.062	.166
10. Ask to listen to the teacher when explaining how to solve problems	.078	.141	-.090	.170

Variables	4 <sup>th</sup> -Grade		8 <sup>th</sup> -Grade	
	Coefficient	Std. Error	Coefficient	Std. Error
11. Ask to memorize rules, procedures, and facts	-.193*	.077	-.094	.105
12. Ask to practice procedures on students own	-.170	.108	-.113	.103
13. Ask to apply what students have learned to new problem situations on their own	.104	.123	.184	.108
14. Work problems together in the whole class with direct guidance from the teacher	.024	.096	.100	.114
15. Work in mixed ability groups	-.108	.111	-.192	.116
16. Work in same ability groups	-.083	.096	.160	.111
17. Allowing students to use calculators	-.088	.084	-.169	.097
18. Frequency of assigning mathematics homework	-.029	.079	-.065	.073
19. Observing students as they work for assessing mathematics	-.026	.109	-.041	.118
20. Asking students to answer questions during class for assessing mathematics	.033	.122	.027	.083
21. Include the lesson short, regular written assessments	.034	.085	-.035	.094
22. Use longer tests (e.g., unit tests or exams)	.010	.083	.007	.091
23. Use long-term projects	-.055	.092	-.342***	.092
Between-class explained variance	23.4%		27.1%	
$f^2$	.31		.37	

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

In the 4<sup>th</sup>-grade, the significant predictors of mathematics achievement were the variables of bringing interesting materials to the class ( $\beta = -.22$ ) and asking students to memorize rules, procedures, and facts ( $\beta = -.19$ ). Accordingly, while the other variables were constant, the increase in those variables decreased mathematics achievement. Other variables related to teacher practices were not significant predictors of mathematics achievement.

In the 8<sup>th</sup>-grade, the significant predictors of mathematics achievement were the variables of using long-term projects for assessment ( $\beta = -.34$ ) and asking students to complete challenging exercises that require them to go beyond the instruction ( $\beta = .24$ ). Accordingly, asking students to do challenging exercises positively correlated with achievement, but using long-term projects was negatively associated with achievement. It was also determined that other variables related to teacher practices were not significant predictors of mathematics achievement.

In the 4<sup>th</sup>-grade, the results showed that teacher practices explained 23.4% of the variance, and the regression equation had a medium effect size ( $f^2 = .31$ ). Also, in the 8<sup>th</sup>-grade, teacher practices explained 27.1% of the variance, and the regression equation had a large effect size ( $f^2 = .37$ ).

## Working Conditions Predicting 4<sup>th</sup>-Grade and 8<sup>th</sup>-Grade Students' Mathematics Achievement

Table 6 shows the variables related to teachers' working conditions, the results of multilevel regression equations, and the standardized  $\beta$  coefficients in the 4<sup>th</sup> and 8<sup>th</sup>-grade. The independent variables related to the working conditions in the TIMSS 2019 were schools' emphasis on academic success, safe and orderly schools, classroom teaching limited by students not ready for instruction, number of students in the class, availability of a computer for students in the classroom and the variables about working conditions in class and school (e.g., too many students in the classes).

Table 6

### *Working Conditions Predicting Mathematics Achievement*

Variables	4 <sup>th</sup> -Grade		8 <sup>th</sup> -Grade	
	Coefficient	Std. Error	Coefficient	Std. Error
1. School emphasis on academic success	.107	.084	.037	.097
2. Safe and orderly schools	.149	.086	-.013	.097
3. Classroom teaching limited by students not ready for instruction	.468***	.058	.407***	.056
4. Number of students in the class	-.143*	.073	-.083	.099
5. Availability of a computer for students in the classroom	.168*	.073	.090	.066
6. Too many students in the classes	.119	.088	-.053	.089
7. Having too much material to cover in class	-.022	.103	.233	.156
8. Having too many teaching hours	-.291**	.097	-.147	.144
9. Need more time to prepare for class	.179*	.078	.031	.084
10. Need more time to assist individual students	-.115	.071	-.116	.081
11. Feeling too much pressure from parents	.276***	.072	.387***	.073
12. Difficulty keeping up with all of the changes to the curriculum	.089	.082	.023	.078
13. Having too many administrative tasks	-.098	.069	-.186**	.070
Between-class explained variance	49.2%		39.8%	
$f^2$	.97		.66	

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

In order of importance, the significant predictors of mathematics achievement in 4<sup>th</sup>-grade were classroom teaching limited by students not ready for instruction ( $\beta = .47$ ), having too many teaching hours ( $\beta = -.29$ ), feeling too much pressure from parents ( $\beta = .28$ ), needing more time to prepare for class ( $\beta = .18$ ), availability of a computer for students in the classroom ( $\beta = .17$ ), and the number of students in the class ( $\beta = -.14$ ). Other variables related to working conditions were not significant predictors of mathematics achievement. Accordingly, there was a positive correlation between achievement and teaching limited by students, feeling too much pressure from parents,

needing more time to prepare for class, and availability of a computer for students in the classroom. There was a negative correlation between achievement and having too many teaching hours, and the number of students in the class.

In order of importance, the significant predictors of mathematics achievement in 8<sup>th</sup>-grade were classroom teaching limited by students not ready for instruction ( $\beta=.41$ ), feeling too much pressure from parents ( $\beta=.39$ ), and having too many administrative tasks ( $\beta=-.19$ ). Other variables related to teacher conditions were not significant predictors of mathematics achievement. Accordingly, there was a positive correlation between achievement and teaching limited by students and parental pressure. Teachers' having too many administrative tasks was negatively associated with achievement.

In 4<sup>th</sup>-grade, the results showed that working conditions explained 49.2% of the variance, and the regression equation had a large effect size ( $f^2=.97$ ). Also, in the 8<sup>th</sup>-grade, working conditions explained 39.8% of the variance, and the regression equation had a large effect size ( $f^2=.66$ ).

### Discussion and Conclusion

The current study revealed that the most explaining variance of mathematics achievement in TIMSS 2019 was the teachers' working conditions (49% in the 4<sup>th</sup>-grade and 40% in the 8<sup>th</sup>-grade). Sarı et al. (2017) stated that the regression model, in which the predictors of TIMSS 2015 mathematics achievement in the 8<sup>th</sup>-grade were examined, explained 29% of the variance between schools. Similarly, there were school-level variables in the model, such as teaching limited by student needs, schools' emphasis on academic success, safe and orderly schools, teachers' job satisfaction, and challenges of teaching. Several studies pointed out significant differences between schools (e.g., Akyüz-Aru, 2020; Çavdar, 2015; Eriksson et al., 2019; Mohammadpour & Ghafar, 2014; Suna & Özer, 2021).

In the current study's working conditions category, the most influential variable at both grades was teaching limited by students not ready for instruction. It was measured by TIMSS and could be considered a factor of school climate (Elezović et al., 2022). It examined teachers' perceptions of the severity of limitations that negatively correlated with classroom atmosphere, problematic student behaviors such as disruptive or disinterested actions, and lack of basic nutrition. The current study concluded that a decrease in the related variable might lead to an increase in the mathematics achievement of Turkish students. The literature findings also supported that classroom factors and challenges significantly correlated with students' mathematics achievement, which overlapped with the current results (Akyüz, 2006; Sarı et al., 2017). However, this result could vary according to different countries.

Another variable in teachers' working conditions related to students' mathematics achievement in both grades was parental pressure on teachers. It was found that an increase in this variable increased mathematics achievement. Similarly, Güven and Sezer (2020) found that parental pressure had a positive relationship with mathematics achievement in Turkey, Germany, and the USA, while there was no significant relationship in Finland. Nevertheless, it was not clearly understood how parents exerted pressure on teachers (such as shouting, complaining to authority, forcing them into teaching activities). For example, the literature suggested that parental involvement (e.g., out-of-school math support) significantly and positively correlated



with mathematics achievement at both grade levels (Sarı et al., 2017; Yalcin et al., 2017). Similarly, Batı (2021) stated that parental involvement (e.g., out-of-school math support), educational resources at home, parents' perceptions of mathematics, and their children's education significantly predicted students' performances.

In addition, the study found that 4<sup>th</sup>-grade students' mathematics achievement was positively related with the variables of the need for additional time to prepare for class and availability of a computer for students in the classroom; and negatively correlated with having too many teaching hours and the number of students in the class similar to findings of the studies done by Akyüz (2006) and Mohammadpour and Ghafar (2014). Also, it was determined that having too many administrative duties was negatively related to mathematics achievement in the 8<sup>th</sup>-grade, similar to Akyüz (2006).

It was also found that other different variables (e.g., schools' emphasis on academic success, safe and orderly schools) in the working conditions category were not a strong predictor of mathematics achievement. Similarly, there were many studies in the literature that the variable of safe and orderly schools was not associated with mathematics achievement (Arifoğlu, 2019; Elezović et al., 2022; Sarı et al., 2017). Similarly, Elezović et al. (2022) pointed out school's emphasis on academic success was not correlated with mathematics achievement. Nevertheless, some studies showed that the school's emphasis on academic success positively correlated with mathematics achievement on TIMSS 2015 (Arifoğlu, 2019; Coşkun, 2021; Sarı et al., 2017).

In the 4<sup>th</sup> and 8<sup>th</sup>-grade, teachers' characteristics explained the slightest variance in TIMSS 2019 mathematics achievement (19% in the 4<sup>th</sup>-grade and 11% in the 8<sup>th</sup>-grade) and regression equations had small or medium effect sizes. Teachers' age had a positive relationship, but other variables (gender and job satisfaction) had no significant correlation with achievement. Teachers' experience explained the relationship between teachers' age and students' mathematics achievement because older teachers had more experience than younger teachers. Similarly, there was no significant correlation between TIMSS 1999 mathematics achievement and gender in the literature, except for the students of male teachers in Turkey and the Czech Republic and the students of female teachers in Hungary and the Netherlands (Akyüz, 2006). Studies in the literature also found no correlation between job satisfaction and TIMSS 2015 mathematics achievement (Arifoğlu, 2019; Sarı et al., 2017). Nevertheless, some studies showed that teachers' job satisfaction positively correlated with mathematics achievement (Çavdar, 2015; Toropova et al., 2019; Yıldırım & Bilican Demir, 2014).

Teacher qualifications predicted TIMSS 2019 mathematics achievement with large effect size and explained one-third of the between-schools variance (35% in the 4<sup>th</sup>-grade and 26% in the 8<sup>th</sup>-grade). The most influential variable in the regression equations was teachers' experience in both grades. Similarly, several studies in the literature suggested that teaching experience was a good predictor of mathematics achievement (e.g., Hong, 2012; Şahin & Boztunç-Öztürk, 2018; Toropova et al., 2019; Yetkiner Özel & Özel, 2013; Zuzovsky, 2009), but some studies indicated no significant relationship between these two variables (e.g., Jepsen, 2005; Palardy & Rumberger, 2008; Sandoval-Hernandez et al., 2015). Rivkin et al. (2005) also stated that teachers had the most professional development in the first year; it continued in the second and third years with a decreasing rate and almost stopped in the three years or above.

Besides, teachers' majoring in education and mathematics had a significant relationship with mathematics achievement in the 8<sup>th</sup>-grade, but it was not significant in the 4<sup>th</sup>-grade. In many studies, it had been determined that there was no significant relationship between teachers' major areas and mathematics achievement on TIMSS (e.g., Mohammadpour & Ghafar, 2014; Palardy & Rumberger, 2008; Zuzovsky, 2009). However, it was determined that the mathematics achievement and teachers who majored in mathematics and education were higher in Turkey, Lithuania, the Czech Republic, and Oman (Mohammadpour & Ghafar, 2014; Yetkiner Özel & Özel, 2013). According to the Turkish education system, the "major in education and mathematics" variable could be called "primary mathematics teacher." Nevertheless, Oz (2021) stated that teachers could misunderstand a survey question regarding their major due to the teacher training system. Therefore, it would not be appropriate to describe those teachers as primary school mathematics teachers.

Professional development was also discussed under teacher qualifications. Such practices were widely used to move teaching mathematics from teacher-centered to student-centered (Hwang, 2021). According to the results, participation in professional development activities in the last two years about addressing individual students' needs predicted only 4<sup>th</sup>-grade mathematics achievement. Similarly, Liang (2015) indicated that TIMSS 2003 or 2017 mathematics assessment in the USA had a significant relationship with other professional development topics such as mathematics content, pedagogy/instruction, and mathematics assessment. However, in the current study, it was observed that other subjects, such as mathematics assessment mathematics curriculum, were not related to achievement. The need for professional development activities did not correlate with mathematics achievement. The TIMSS 2019 teacher questionnaire could be insufficient to define professional development as limited to topics. Similarly, Toraman (2019) also determined that effective teachers should follow the developments in the subject matter area, produce original ideas, learn lifelong, and make self-assessments within the scope of professional development.

Teacher practices predicted TIMSS 2019 mathematics achievement with medium or large effect size and explained the one-fifth of the between-schools variance (23% in the 4<sup>th</sup>-grade and 27% in the 8<sup>th</sup>-grade). Teachers' in-class teaching practices included items such as relating to daily life and prior knowledge, responding to student needs and encouraging students to participate in the discussion. The current study showed that asking students to complete challenging exercises, which required them to go beyond the instruction, was an important predictor of mathematics achievement and had a positive relationship in 8<sup>th</sup>-grade. However, although bringing materials to the classroom was a significant predictor of mathematics achievement but correlated negatively in the 4<sup>th</sup>-grade. It might stem from teachers' inability to use the materials effectively.

Within the scope of guiding the students in the class, the students were asked to show some behaviors in the lesson (e.g., explaining the problem-solving process, listening to the teacher, applying what they learned). Besides, teachers were asked about their working in mixed and same ability groups. According to the findings, asking students to memorize rules, procedures, and facts predicted 4<sup>th</sup>-grade mathematics achievement significantly and negatively, resulting from TIMSS questions focused on real-life situations and students' inability to adapt to questions involving daily life

situations. Eriksson et al. (2019) stated that in Sweden, memorizing formulas and listening to the teacher were positive predictors of TIMSS 8<sup>th</sup>-grade mathematics achievement, whereas relating to daily life was a negative predictor.

Finally, the scope of mathematics included observing students, asking students to answer questions in the class, using short and regular written assessments during the lesson, using long tests (e.g., unit tests or exams), and using long-term projects. According to the regression equation results, long-term projects predicted 8<sup>th</sup>-grade mathematics achievement significantly and negatively, and the others did not correlate significantly. Similarly, Şahin and Boztunç-Öztürk (2018) determined that teachers' mathematics assessment did not predict achievement.

On the other hand, it is known that teachers' subject matter knowledge and pedagogical content knowledge, which are among the variables that are not measured within the scope of TIMSS, significantly correlated with students' mathematics achievement (Hill et al., 2005; Telese, 2012). Burroughs and Chudgar (2017) found that teacher quality partially influenced teaching. However, the information and knowledge required for mathematics instruction are vast. The importance of specific knowledge and practices in mathematics teaching, such as general pedagogy, subject matter knowledge, field teaching, and the appropriate use of resources, materials, and samples/activities considering students' needs were among the central discussion topics in the literature (Ball et al., 2008; König et al., 2021; Lee & Lee, 2020).

In summary, when the results in the 4<sup>th</sup> and 8<sup>th</sup> grades were considered together, the most crucial category was working conditions, and the least important category was personal characteristics. It had been observed that teacher quality and working conditions in the 4<sup>th</sup>-grade level explained TIMSS 2019 mathematics achievement with a medium or large effect size. It was determined that teachers' working conditions explained the difference between schools' variance in mathematics achievement (49%) with a large effect size. It was also found that teacher qualifications (35%) with large effect size, teacher practices (23%) with medium effect size, and personal characteristics (19%) with medium effect size explained the differences between schools, respectively.

Additionally, it had been observed that teacher quality and working conditions in the 8<sup>th</sup>-grade explained TIMSS 2019 mathematics achievement with small or large effect size. It was determined that the working conditions of teachers explained the difference between schools in the variance in mathematics achievement (40%) with large effect size. Then, it was determined that teacher practices (27%) with large effect size, teacher qualifications (26%) with large effect size, and personal characteristics (11%) with small effect size explained the differences between schools, respectively.

This study was limited to Turkey data. As seen above, the variables for achievement differed depending on the sociological structure of the countries. This study was also limited to the teacher questionnaire used in the TIMSS 2019. TIMSS has also made changes in the teacher questionnaire in recent years. For example, self-confidence in teaching mathematics and collaboration among teachers were not included in the TIMSS 2019 questionnaire. Additional questions were added, such as the need for professional development activities in the future. However, a new scale prepared by TIMSS on teacher practices was not used in this survey. Also, this study could not examine the relationship of some variables that were not usable for data

analysis. Some variables had a high amount of missing data (e.g., using computers in classroom activities). Most teachers in Turkey responded with the same/closer answers (e.g., the duration of the mathematics lesson).

Indeed, today, many large-scale exams are criticized regarding the variables they attempt to measure. A similar criticism is made for the PISA and No Child Left Behind (NCLB) Act (The Guardian, 2014). Palardy and Rumberger (2008) stated that policies and reform efforts should focus more on teacher practices and attitudes than teachers' qualifications as highlighted in the NCLB Act. According to Eriksson, Helenius, and Ryve (2019), the items measuring the teaching quality on the TIMSS data should be included in the student questionnaire to provide more helpful information. A study conducted on TIMSS 2007 Turkey data revealed that the questionnaire items were ambiguous and had vague wording (Yıldırım & Yıldırım, 2009). It was seen that the students in the same classroom gave different answers about the frequency of activities they did in the classroom.

### **Implications**

Some recommendations are made considering the findings. The teacher questionnaire in TIMSS should include certain variables (e.g., special field teaching techniques), especially determining teachers' mathematics teaching practices because this current study revealed that few variables in teacher practices were associated with mathematics achievement. However, the teacher's in-class practices (such as using activities and student-centered approaches) and subject matter knowledge were also important in increasing achievement. In addition, more professional development questions can be added to the TIMSS teacher questionnaire. Because participation in professional development activities was among the attributes of effective teachers, however, in this current study, it was determined that education subjects had a low correlation. Teachers' working conditions should also be addressed in teacher quality models since, in the current study, the most variance in mathematics achievement was explained by the category of working conditions. Teachers should be provided with in-service training on integrating technology into education because this variable was found to have a high correlation with mathematics achievement.

For researchers, they may conduct. Using multilevel statistical techniques would be more proper in dealing with school-level data. Also, it would be useful to carry out cross-cultural studies with similar study goals and cross-cultural comparisons. Also, to offer suggestions to the education system, researchers may carry out especially intercultural studies on the relationship between teachers' practices and TIMSS achievement.

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**Statement of Responsibility**

The authors declare that the study has no unethical issues and that research and publication ethics have been observed carefully. All authors discussed methodology, formal analysis, the results and contributed to the final manuscript.

**Conflicts of Interest**

The authors declared no potential conflicts of interest concerning this article's research, authorship, and publication.

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## The Effect of Using Scientific Scenarios in Teaching Socioscientific Issues in Science Course on Students' Logical Thinking Skills\*

### Fen Bilimleri Dersinde Sosyobilimsel Konuların Öğretiminde Bilimsel Senaryo Kullanımının Öğrencilerin Mantıksal Düşünme Becerileri Üzerine Etkisi

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**ABSTRACT:** In recent years, countries have focused specifically on improving thinking skills in their science education programs. One of the science lesson methods that can be used to activate the use of thinking processes is scientific scenarios. In this direction, the aim of the study is to investigate the effect of socioscientific subject-based instructional experience, which includes scientific scenarios in science lessons, on students' logical thinking skills. The study was carried out in the "DNA and Genetic Code" unit, which especially includes some socioscientific issues. The research was designed according to the quasi-experimental pattern with unequal control group among the pre-test-post-test control group designs, and it was conducted with a total of 36 eighth grade students from the experimental and control groups. The data were collected using the logical thinking group test and an individual information form. According to the study findings, it was understood that scenario-based teaching had an important effect on developing students' logical thinking and in passing their developmental period to the next stage. This finding shows that the processing of some socioscientific science issues with scientific scenarios is effective in increasing students' logical thinking skills.

**Keywords:** Logical thinking skills, science, scientific scenario, socioscientific issues.

**ÖZ:** Son yıllarda ülkeler fen eğitimi programlarında özellikle düşünme becerilerini geliştirmeye odaklanmışlardır. Düşünme süreçlerinin kullanımını aktif hale getirmede kullanılabilecek fen dersi yöntemlerinden biri de bilimsel senaryolardır. Bu doğrultuda çalışmanın amacı, fen bilimleri dersinde bilimsel senaryoların yer aldığı sosyobilimsel konu temelli öğretimsel deneyimin, öğrencilerin mantıksal düşünme becerilerine etkisini araştırmaktır. Çalışma, özellikle bazı sosyobilimsel konuları içeren "DNA ve Genetik Kod" ünitesinde gerçekleştirilmiştir. Araştırma, ön test-son test kontrol gruplu desenlerden eşit olmayan kontrol gruplu yarı deneysel desene göre tasarlanmış, deney ve kontrol gruplarından toplam 36 sekizinci sınıf öğrencisiyle gerçekleştirilmiştir. Veriler mantıksal düşünme grup testi ve bireysel bilgi formu ile toplanmıştır. Araştırmanın bulgularına göre senaryo temelli öğretimin öğrencilerin mantıksal düşüncelerini geliştirmede ve buldukları gelişimsel dönemi bir sonraki aşamaya geçirmelerinde önemli etkisi olduğu anlaşılmıştır. Bu bulgu, fen dersindeki bazı sosyobilimsel konuların bilimsel senaryolarla işlenmesinin öğrencilerin mantıksal düşünme becerilerini artırmada etkili olduğunu göstermektedir.

**Anahtar kelimeler:** Mantıksal düşünme becerileri, bilim, bilimsel senaryo, sosyobilimsel konular.

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Countries have focused on developing various scientific process skills and thinking skills in science education programs in recent years. Countries such as Singapore, Kazakhstan (Yazıcıoğlu & Pektaş, 2019), America (National Research Council, 2014) and Canada (Özcan & Gücüm, 2020) are among the prominent countries in terms of these skills in science education programs. Similarly, with the revisions made in 2005, 2013 and 2018 an emphasis on teaching some skills was made also in science course programs in Turkey (Ministry of National Education [MoNE], 2005, 2013, 2018). These skills are scientific process skills, life skills and engineering and design skills. While scientific process skills, among these aforementioned skills, provide individuals with ways to learn science and reach concepts (Nugraha et al., 2018), in this process, the development of problem solving and thinking skills (Mahanal et al., 2019) and the use of engineering and design skills and the development of cognitive skills (Fiteriani et al., 2021) are associated with the point of producing a solution to the problem. In this whole process, resources have been added showing its relationship with scientific process skills, life skills and engineering and design skills, which are shown as thinking skills such as individuals use logical thinking processes in the process of evaluating situations related to problem solving, conducting scientific processes and making decisions (Osterhaus et al., 2020). All of the mentioned skills are closely related to thinking skills. Thinking skill is an important quality that enables people to perceive their environment and nature. It can be said that thinking is a mental process and a phenomenon of logic in which the unknown is obtained by establishing a connection between the propositions. Logical thinking is the key to making correct decisions and solving complex problems. Logical thinking skill, which is among the thinking skills, is described as the seventh skill that should be included in the 21st-century individuals among the 2020 cognitive abilities in the “World Economic Forum” report (Global Challenge Insight Report, 2016). In other words, one of the essential skills required to be found in the individuals of the future is considered as logical thinking skill. The vision of the renewed 2018 science curriculum states that developing high-level thinking skills, such as reasoning ability, scientific thinking habits and decision-making skills, can be achieved by using socioscientific issues (MoNE, 2018, pp. 9). Socioscientific issues in the science curriculum are issues that include social dilemmas with both scientific and social issues, which are open to discussion, do not have a definite answer, need to be addressed in a multifaceted way, and concern society (Zeidler et al., 2019). The fact that a subject can be a socioscientific subject, basically depends on two features. These features are social significance and scientific content (Eastwood et al., 2012). Lessons in teaching socioscientific issues; video demonstration (Bossér & Lindahl, 2019), with a question (Kim et al., 2014), reading a text, dilemma or scenario (Atabey & Topçu, 2017; Lin & Hung, 2016; Yahaya et al., 2016). The term scenario refers to texts that are frequently used in international exams such as PISA, which are presented to students thematically to complete high-level tasks related to the case / event / situation (Organisation for Economic Co-operation and Development [OECD], 2019, pp. 41). Socioscientific issue scenarios include topics that relate scientific concepts to daily life, do not have a single answer, and require more than one solution (Kolstø, 2001). In the content of the scenario, different ideas are presented impartially in a way that they do not prevail (Tsai, 2018), and preliminary information is provided on the subject (Dawson & Carson, 2017). Due to the aforementioned features, we decided to use scientific scenarios in teaching socioscientific issues in the study.

Romine et al. (2020) presented socioscientific issues with scenarios. The authors state that reasoning on socioscientific issues is the key to taking a conscious position. It is stated that scenarios are bridges in terms of competences such as students' understanding of complex situations, questioning, and seeing multiple perspectives in reasoning on socioscientific issues. In another study, Proudfoot and Kebritchi (2017) performed scenario-based learning and STEM applications in a mobile laboratory environment. Scenario-based learning is considered as an approach to improve learner engagement and understanding by engaging students with real-world learning experiences. The study revealed that a scenario-based e-Learning can positively affect students' interest and success in their courses. Ramirez-Villarin (2020), on the other hand, examines the relationship between students' attachment to place (regionalism) and socioscientific reasoning in socioscientific issues. While scenarios involving regional socioscientific issues were used in the control group, to examine this relationship, scenarios containing socioscientific issues belonging to different regions were used in the experimental group. The author used the number of evidence-based reasons students used in discussions to evaluate changes in their reasoning and decision-making skills. In the study, it was determined that the experimental group of students used more evidence-based reasoning in the discussions. Instead of one single study such as it is stated that students establish emotional bonds with local and global scenarios affecting the planet and gain environmental awareness. Kinslow et al. (2019) examined socioscientific reasoning change with a six-week intervention focusing on the environmental socioscientific issue. Socioscientific reasoning assessments were based on scenarios containing open-ended questions. Triangulation was used to explain student artifacts (e.g., written assignments and diary entries) collected throughout the course, increases documented through quantitative analysis. In this setting, students' pre / post-tests revealed statistically significant increases in socioscientific reasoning with medium to large effect sizes. The similarity between the prominent topics in the classroom and the scenarios used for evaluation is seen as a limitation of the study. Although the study provides evidence that there will be improvement in students' socioscientific reasoning, it does not provide evidence that they can pass on to a topic that is not similar to practice. In the context of this information presented by the literature, in this study, the effect of the socioscientific subject-based instructional experience in the science lesson on the logical thinking skills of the students will be examined.

## **Literature Review**

### ***Socioscientific Issues***

Socioscientific issues, which are based on science, are based on problems that can be encountered in real life, which are controversial and do not have a clear solution. Socioscientific issues, which first came to the agenda in the 1970s, have become one of the focal points in science lessons today (Levinson, 2006). It is aimed to include the teaching of socioscientific issues (National Research Council, 2012; Sadler & Zeidler, 2009), which is one of the important goals of modern education, in the curriculum of many institutions (American Association for the Advancement of Science, 1990; MoNE, 2013; National Research Council, 2012) and organizations around the world and to raise conscious individuals on these issues. The importance of teaching

socioscientific subjects in raising individuals with scientific knowledge is emphasized. (Driver et al., 2000). However, in Turkey, despite the emphasis on science-society-environment with the teaching reform in 2005, in the 2013 science program revision (Aydın & Silik, 2020; MoNE, 2013), it was clearly addressed as one of the skills that should be acquired (MoNE, 2013) in order to explain the relationships between science-technology-society-environment (Topçu, 2015). Finally, in renewed 2018 science curriculum objectives in Turkey, with the statement “reasoning ability using socioscientific issues, develop scientific thinking habits and decision-making skills” (MoNE, 2018, pp. 9), necessity and importance of teaching socioscientific issues are clearly stated. The aforementioned program emphasized that socioscientific issues help improve judgment and decision-making skills in addition to scientific thinking (Özcan & Kaptan, 2020). In this context, by including socioscientific issues, it is aimed to improve students’ ability to question, reasoning (Kinslow et al., 2019), analyze-synthesize-evaluate (Drummond & Fischhoff, 2017), and understand the relationships between socioscientific issues (Owens et al., 2020). Learning environments in which science teaching is provided through socioscientific issues are related to students’ knowledge of these subjects (Lewis & Leach, 2006), increase their knowledge of scientific content (Jho et al., 2014; Klosterman & Sadler, 2010), and improve decision-making skills (Dauer et al., 2017; Gutierrez, 2015; Ladachart & Ladachart, 2021; Zo’bi, 2014), supports the development of higher-order thinking skills such as logical thinking (Cian, 2020; Zeidler et al., 2019) and encourages them to develop positive attitudes towards science (Pelch & McConnell, 2017; Sadler, 2009). In addition, socioscientific issues are seen as contexts that include the learning process that enables students to bridge social contexts through their school experiences (Sadler et al., 2017). Socioscientific issues may be related to daily life and may be encountered in the immediate environment, as well as related issues that take place in many parts of the country or the world. It should not be forgotten that individuals may have to take responsibility for society or make decisions in situations that affect the future of the country (Stefanova et al., 2010), and socioscientific issues should be integrated into teaching practices at an early age (Zeidler, 2014).

### ***The Relationship Between Logical Thinking Skills and Scientific Scenario***

In the information society, individuals are expected to have new skills and competencies to cope with their problems. These expected skills and competences are called 21st century skills (Aygün et al., 2016; Bakırcı et al., 2018). Among the skills that are among the 21st century skills, it includes the skills necessary for logical thinking, establishing the cause-effect relationship of facts, events or situations (Ding, 2018), understanding scientific knowledge and concepts, and perceiving the nature of science (Dawson & Carson, 2017; Koerber et al., 2015). Koray and Azar (2008) state that logical thinking includes mental processing skills such as abstraction and generalization used in the problem solving process. Ding (2018) states that reasoning skill is called scientific reasoning, scientific thinking, logical thinking or critical thinking in the literature. Despite the different discourses mentioned, reasoning skill consists of sub-skills (correlational reasoning, proportional reasoning, control of variables, probabilistic reasoning, and combinatorial reasoning). Correlational reasoning identifies relationships between variables in an event, identifies combinations, identifies all possible combinations of events, and solves ambiguous situations by considering

variables associated with the ultimate result (Ash-Shiddieqy et al., 2018). Proportional reasoning requires thinking about the proportions of learners in relation to a whole (Newcombe et al., 2018). Probabilistic reasoning is the estimation of all the results that will be obtained when an event is repeated in a broad context from the initial state to the final state (Erlina et al., 2018). Combinatorial reasoning is the process that systematically considers all theoretical and empirical relationships (Aini et al., 2020) to construct complex structures (Adey & Csapó, 2012) from a set of specific elements satisfying explicitly given or deduced conditions. In this study, logical thinking skills were used as an action to analyze a situation, to use reasoning skills to examine a problem objectively, and to find a logical solution. It is stated that there is a link between individuals' ability to use these reasoning skills mentioned in the developmental process and their individual development.

According to Piaget's theory, the individual perceives and interprets the events in his environment and society according to his logical thinking skill. This skill develops in parallel with mental development (Woolley et al., 2018). According to Piaget's cognitive development theory, four stages should be overcome respectively in the cognitive development of individuals. These developmental stages are, respectively, sensory-motor, pre-operational, concrete operations and abstract processes. The last two stages, in particular, are considered as the basic structure of logical inference for cognitive development (Guey et al., 2010). Piaget states that in cognitive development stages, one cannot move to another stage without passing one stage. The reason for this is that the previous stage is the precursor of the developmental skills in the next stage.

It is stated that the ages of individuals to enter and complete these developmental stages may differ from individual to individual, and when the stages are completed, the individual completes his development (Senemoğlu, 2011). It is generally stated that individuals between the ages of 7-11 are in the concrete operational period. Despite this, it is also known that there are individuals who cannot advance to a higher level even though they are in the higher age group or who perform skills at a higher level despite being at a lower level (Lazonder & Janssen, 2021; Osterhaus et al., 2020). In fact, Denison and Xu (2014) suggested that even babies can use proportional information to make decisions in probabilistic comparison situations. Individuals in the period of concrete operations can grasp logical principles and apply what they grasp to concrete entities, events, facts, or situations (Bybee & Sund, 1990). Individuals use logical thinking skills in solving concrete problems at this stage. Considering the ages of the middle school students who constitute the sample level of this study, it can be said that they are at the end of the concrete operations period and are about to move to the abstract operations period. Students who encounter a problem in their environment, life or classroom environment will use their knowledge, skills and abilities to find a solution (Karpudewan & Roth, 2018; Owens et al., 2020). In this context, Piaget states that individuals interpret the events around them according to their logical thinking skills (Güler, 2010). Students will try to understand all aspects of the event to solve the dilemma or problems they face. After examining the situation from a critical point of view, it can be thought that they will try to interpret the event or situation by using their logical thinking skills and go on the way to produce solutions. In this case, it is clear that students will use their logical thinking skills on controversial and dilemma issues. King and Socioscientific issues, which are one of the most specific examples of

dilemmas in science education, are issues that are closely related to the society, contain moral and ethical aspects, have scientific, social and ethical dimensions (Tsai & Jack, 2019), and it is difficult to make a full and definite judgment (Dawson & Carson, 2017).

Teachers used the mentioned subjects in a limited number of classes, it is expressed that the reasons for this are that they are not supported in terms of applications (Hofstein et al., 2011), and the lack of teaching environments and how to implement the applications (Sadler et al., 2017). One of the most important points in planning socioscientific education is the presentation of socioscientific issues to teaching (Presley et al., 2013). The texts used in socioscientific subject teaching in the literature are based on case studies (Knight & McNeill, 2015), dilemmas (Shea et al., 2015) or short stories (Tomas & Ritchie, 2015). The most common usage expression for these texts is scientific scenario (Atabey et al., 2018). These scenarios should allow making moral and ethical inquiries about social issues of life, and should have an appealing structure and valid scientific content (Gustafsson & Ohman, 2013). In addition, scenarios should be appropriate to the class level, program requirements and subject (Lenz & Wicox, 2012), and should contain information about the subject (Kalypso & Constantinou, 2014). Students should be able to discuss, defend their own ideas and make evaluations on the ideas of their friends using the information on the subject through the scenarios provided (Dawson & Carson, 2017). It is especially very important to give opposite ideas about the subject we want the students to discuss, reasoning and decide on using logical filters (Bossér & Lindahl, 2019). Based on this, it can be said that a good scenario pattern prepared in the teaching of socioscientific issues is the most important keystone in terms of developing various skills (such as discussion, questioning, judging, reasoning, logical thinking) that students are expected to acquire in the teaching phase.

### ***The Place of the “DNA and Genetic Code” Unit in Socioscientific Issues***

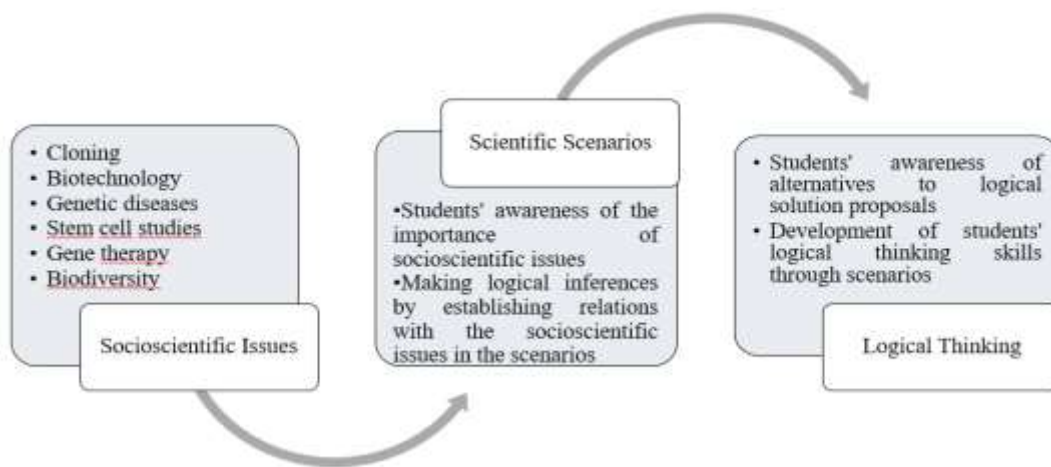
Socioscientific issues (SSIs) are complex and open-ended dilemmas regarding the environment, health, society and economics. In a curriculum that focuses on socioscientific issues, science concepts emerge in an interdisciplinary context that emphasizes the interconnections between science, environment, health and society. Examples of socioscientific issues include energy, nuclear energy, climate change, the use of genetically modified foods, air and water pollution, and (Karpudewan & Roth, 2018). Some of the socioscientific issues that are frequently expressed, discussed and on the agenda, in all segments of society today, can be defined as: genetic tests, genetically modified organisms (GMOs) expressed as the manipulation of the living organism's gene sequences (World Health Organization [WHO], 2005) by transferring genes from plants, animals, bacteria and viruses with the aim of bringing new properties to living creatures or changing existing characteristics, (GDO), stem cell studies, gene therapy (Woolley et al., 2018), cloning, vaccination, genetic engineering applications (Chen & Xiao, 2020) and biodiversity (Bermudez & Lindemann-Matthies, 2020).

In the secondary school 8th grade's science programs in Turkey, related concepts such as nucleotide, gene, DNA, chromosome, inheritance, mutation, modification, adaptation, selection, variation, which are in the “DNA and Genetic Code” unit of the high school 8th grade level, genotype-phenotype characteristics, subtopics such as crosses and character prediction are related to socioscientific issues

(MoNE, 2018). In order to establish connections between the aforementioned interrelated concepts, sequential thinking and sequential ordering of information will require the active use of logical thinking skills, and the active use of reasoning and logical thinking skills to discover the relationships between them. In addition, it was thought that giving the students a pattern with step-by-step scientific scenarios about real-life events related to the concepts in the unit, would attract the attention of the individuals during the activities and require them to use their logical thinking skills actively by focusing on the situation. The structure that summarizes the theoretical framework of the study and modeling of the research question is presented in Figure 1.

Figure 1

*Modelling of Research Structure*



Argumentation in the teaching of socioscientific issues (Dawson & Venville, 2009; Rebello et al., 2013; Suephatthima & Faikhamta, 2018; Zeidler & Nichols, 2009) or scenario (Carson & Dawson, 2016; Khishfe, 2014; Kinskey & Zeidler, 2021; Lin & Hung, 2016; Ottander & Simon, 2021; Saad et al., 2017; Zeidler & Nichols, 2009) seems to be widely used. In this study, the use of scientific scenarios in the teaching of socioscientific issues was deemed appropriate. “In this direction, the aim of the study is to investigate the effect of socioscientific subject-based instructional experience, which includes scientific scenarios in science lessons, on students’ logical thinking skills.”

## Method

### Research Design

The study was conducted in the science course in the secondary school in the Aegean region of Turkey during the second semester of academic year 2018-2019. In this study, quasi-experimental design with the pretest-posttest control group, one of the experimental models, was used. Quasi-experimental researches are interpreted as real-life studies (Vanderstoep & Johnston, 2009). It is not possible to make random selection in real-life environments. In the designs where random selection cannot be applied, researchers make use of quasi-experimental design (Marczyk et al., 2005).



## Participants

In teaching some of the socioscientific issues in science classes, the working group of this research in which the effect of scientific scenario use on logical thinking skills of 8th grade students is examined, is composed of students in a medium-size school of Manisa. There are 18 (10 girls and 8 boys) students in the experimental group and 18 (9 girls and 9 boys) students in the control group. Accordingly, it can be said that the distribution of female and male students in the experimental and control groups is balanced. The students in the study group are in the age range of 12-14.

## Development of Scenarios

Scenarios based on the subject and scope suitable for the achievements of the “DNA and Genetic Code” unit have been prepared by examining the media reports, scientific news, and studies in the literature. After the topics of the scenarios were determined, they were written in a way that could be understood by most of the 8th grade students. The scenarios are written in short, simple language and provide sufficient content to scientifically understand the problem. The students were asked to make a decision from the perspective of the script characters. It is aimed that students benefit from their own knowledge instead of just reproducing the information in the script. Event patterns and roles of heroes in prepared scientific scenarios; it starts with an introduction that will attract students’ attention, encourages students to think and allows them to structure their knowledge. Therefore, it is important to establish a cause-effect relationship in scenarios, run the problem solving process, and include operations requiring abstraction, generalization, and analysis in this process. Nine scenarios prepared before being applied to the students were examined by three teachers and two academicians who are experts in the field. These teachers and field experts gave feedback on the content and terminology of the scenarios. Based on his feedback, minor text changes were made. Information about the content of the nine scenarios is as in Table 1.

Table 1

*The Course Process of The Applications, The Scientific Scenarios Used in The Process and The Content of The Scenarios*

Lesson Process	Scientific Scenarios Used	The Subject Content Of The Scenarios Related To The Unit
October 15-21, 2018	Let’s Learn DNA Language	Structure of DNA
October 22-28, 2018	Who Do I Look Like?	Gregor Mendel and Crossover/Genealogy
Oct. 29-Nov. 4, 2018	The New Member of Our core Family	Gender Determination / Genetic Diseases / Consanguineous Marriage
	Explosion of Chromosomes	Chromosome/Mutation
November 5-11, 2018	What is this Colour Change!	Phenotype/Modification
November 12-18, 2018	Visit to the land of Frozen	Adaptation
November 19-25, 2018	Minor Changes	Gene Transfer/Cloning
November 26-30, 2018	Professor’s Historic Decision	Biotechnological Applications
	Sleeping Sickness: Huntington	Gene Therapy

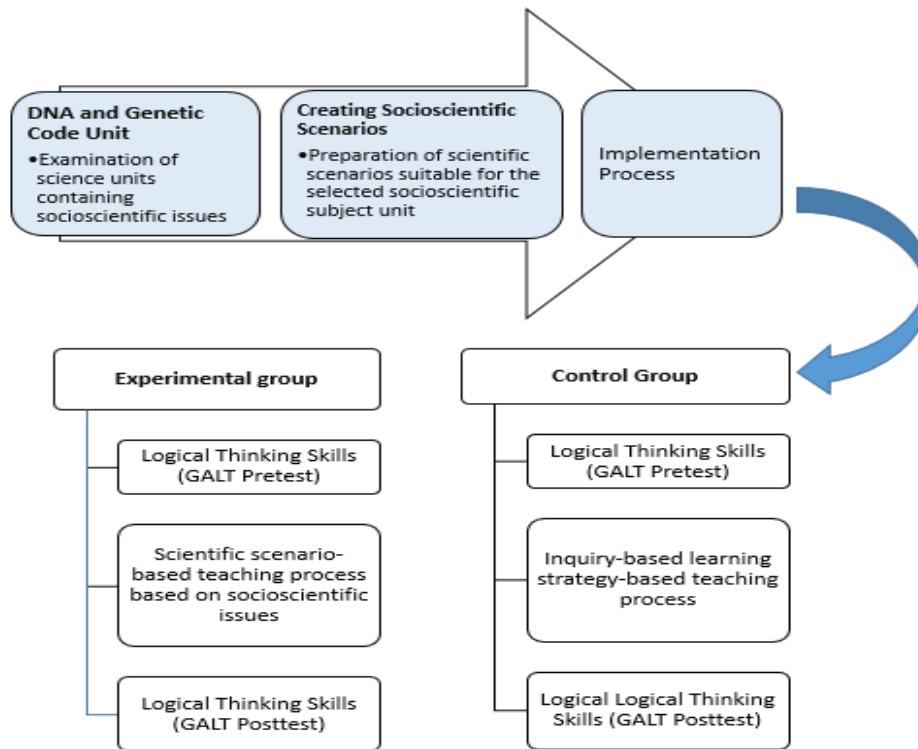
When Table 1 is examined, it is seen that a total of nine different scientific scenarios were applied in the study. Two scientific scenarios were used in the weeks of October 29- November 4 and November 26-30, and one scientific scenario was used in the other weeks. Concepts in the content of the aforementioned scenarios (Structure of DNA, Gregor Mendel and Crossover / Pedigree, Sex Determination / Genetic Diseases / Consanguineous marriage, Chromosome / Mutation, Phenotype / Modification, Adaptation, Gene Transfer / Cloning, Biotechnological Applications, Gene Therapy) are individually given in Table 1. In this case, it is seen that the scenarios deal with different socioscientific issues within the scope of the unit in terms of subject content.

To give a little more detailed information about the scenarios, in the scientific scenario called “Let’s Learn the Language of DNA”, the dream of the character named “Elif” and the structure of DNA, nucleotides, genes and chromosomes are discussed through her magic glasses that magnify everything in this dream fifty million times. In the scientific scenario named “Who Do I Look Like?”, the character named “Emre” watches the scientist documentary “Gregor Mendel” and the subject of the character’s eye colour different from the eye colour of his parents, family tree, hereditary characteristics, external appearance (phenotype) and crosses are mentioned. The scientific scenario called “The New Member of Our Core Family” begins with the analysis of the factors that determine the sex and the rate of determining the sex of the sibling who will be born of the character “Zeynep”. In the scenario that deals with genetic diseases that may occur due to consanguineous marriage, the path followed by the character named “Zeynep” was given and the questions were asked to be answered. In another scientific scenario called “Explosion of Chromosomes”, the dispersal of the beads of the pearl necklace of the teacher named “Fatma” and the arrangement of the chromosomes were correlated. In the scenario, mutations and their effects that will occur because of misalignment of beads are compared to chromosomes. In the scientific scenario called “What’s This Colour Change!”, the friendships of the characters “Felix” and “Özgür” living in different countries are mentioned. Two friends with different skin colours are arguing that the skin colour change is due to the effect of the sun’s rays and is not permanent. With this event, the concept of modification in the scenario and examples related to it (primrose) are discussed. The scientific scenario called “Visit to the Land of Frozen” deals with the adaptations of the creatures living in the polar regions on the journey of two brothers named “Tuğba” and “Metem” with a time machine. In the scientific scenario called “Minor Defects”, the gene transfer performed by the engineer named “Mr. R” on strawberry is discussed Tissue and organ donation, cloning issues are explained with the character of Mr. R, who uses a potion to go to the future for studies on living things. The scenario named “Professor’s Historical Decision” deals with the social examination of the effect of wild African cats on natural selection, which a scientist copied using biotechnological methods at a meeting. The scientific scenario called “Sleeping Disease: Huntington” deals with the fact that an individual named “Melih” from the couple who wants to have a child has a genetic disease. The scenario includes the applicability of a gene therapy method that has not been done before and the development of biotechnological methods. One of the scenarios used within the scope of the study is presented in Appendix 2.

## **Process**

The research was carried out in an 8th grade on the “DNA and Genetic Code” unit in the first semester of the 2018-2019 academic year. One of the ten specific objectives of science teaching programs in Turkey is expressed as “making decision ability using socioscientific issues, develop scientific thinking habits and decision-making skills” (MoNE, 2018). Therefore, the whole process of the study has been shaped in line with the specific purpose mentioned. However, the goal of the said unit is expressed as following by Turkey-Ministry of Education (2018): “In this unit, it is aimed for students to explain the concepts related to DNA and genetic code and to discover the relationships between them, to be aware of the applications of inheritance, mutation, modification, adaptation, selection, variation, genetic engineering and biotechnology, and to gain knowledge and skills about discussing their positive/negative effects”. For this reason, suitable scientific scenarios were created in the study for the purpose of the unit. The literature and expert opinions were used in the creation of scientific scenarios. In the next process, after the preliminary tests of the data collection tools used in the research were carried out, the application phase was started. During the nine-week practice, nine scientific scenarios were used for the experimental group lessons, depending on the conceptual sequence and limitation in the relevant unit. The scientific scenarios and socioscientific issues that include the mentioned concepts are taught step by step, sticking to their place in the science program. The related unit learning outcomes and concepts are presented in the additional text are given in Appendix 1. Lessons in the experimental group were carried out with a scientific scenario-based teaching process based on socioscientific issues, and in the control group, with an inquiry-based learning strategy-based teaching process. In the research-based learning strategy-based teaching process, the activities in the Education Information Network, which is open to the use of teachers in Turkey, were used. It was aimed to teach the same unit concepts with the strategy-based activities mentioned in the control group. In both groups, applications were carried out within the scope of the science course, four hours a week. After this application process, post-tests were applied to both groups. The schematic representation of the application process is as in Figure 2.

Figure 2  
Scheme of The Implementation Process

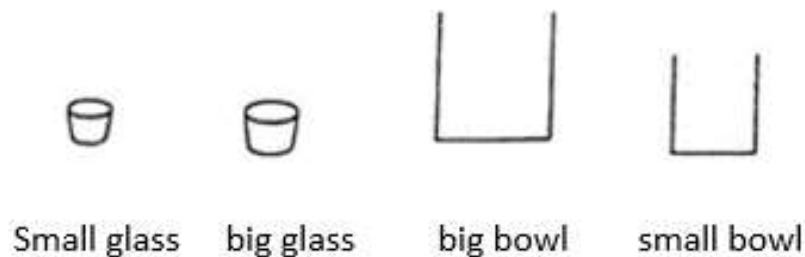


### Data Collection

The Logical Thinking Group Test (GALT), originally developed by Roadrangka et al. (1983), was used to measure students' logical thinking skills in the study. The test was translated into Turkish by Aksu et al. (1991) and was created by selecting items with high validity and reliability from the tests that were previously developed in this field and measure different thinking skills. GALT measures six logical operations, including conservation of matter, correlational reasoning, proportional reasoning, control of variables, probabilistic reasoning, and combinatorial reasoning. The scale consists of 21 items in two stages. In the first 18 of these items, students are asked to choose the correct answer among the options in the first stage, and mark the reason for choosing the correct answer from the given options in the second stage. In the last three items of the scale, students are asked to answer the given situations with an explanation. An example of the questions in the scale is as follows:

Question 8: Glass Size 2

The figure below shows two glasses, one small and one large, and two bowls, one large and the other small.



It takes 15 small or 9 large glasses of water to fill the large bowl. The small bowl is filled with 10 small glasses of water.

How many large glasses of water does it require to fill the small bowl?

- a) 4
- b) 5
- c) 6
- d) Other

Reason:

1. Less than 5 small glasses of water are required to fill the small bowl. So less than 5 large glasses of water are required to fill the same bowl.
2. The ratio of large and small glasses will always be 5 to 3.
3. The small glass is half the size of the large glass. Therefore, the same small bowl is completely filled with approximately half the number of large glasses with water.
4. It is impossible to predict.

In the first 18 multiple choice questions of the test, the student who gave the answer correctly together with the reason is given 1 point, and the student who answered any of them incorrectly is given 0 point. Since the last three questions are open-ended, students are asked to write the correct answer. Considering the correct answers written by the students, the answers are scored as 1 and 0. The highest score students will get from this test is 21. In scoring the scale, the use of sources that developed the scale (Roadranga et al., 1983) and adapted it to Turkish (Aksu et al., 1991) was applied exactly. The cognitive development periods of the students according to the scores they got from the GALT test are as in Table 2.

Tablo 2

*Operational Levels of Students According to GALT Test Results*

Scores from the GALT Test	Student's Operational Period
0-8 score	Concrete operational period
9-15 score	Transition period
16-21 score	Abstract operational period

The scores obtained from the GALT test are evaluated as concrete operations (0-8 score), transition (9-15 score) and abstract operations period (16-21 score) (Bitner,

1991; Hacıömeroğlu & Hacıömeroğlu, 2018). The reliability coefficient (Cronbach's alpha) of the mentioned scale was found to be .85 (Roadrangka et al., 1983), and the reliability coefficient was found as .88 (Aksu et al., 1991) in the Turkish version. In addition, the reliability calculation was made with the data in this study and the reliability coefficient (Cronbach's alpha) was found as .81. When the value obtained from this study is examined, it can be said that there is consistency between the answers given by the participants to the scale items (Pallant, 2017). The appropriate response time for the Logical Thinking Group Test is 60 minutes.

### Data Analysis

First of all, the normality distribution of the pre-test and post-test scores of the groups was examined and interpreted by taking Shapiro-Wilk values into account. As a result of the analysis, it was found that the Logical Thinking Skills pre-test scores showed normal distribution in the experimental and control groups ( $p_{\text{exper}}=.230$ ;  $p_{\text{control}}=.436$ ). It is observed that the post-test scores do not show normal distribution in the experimental and control groups ( $p_{\text{exper}}=.024$ ;  $p_{\text{control}}=.035$ ). Then, in order to make sure that the groups were in the same place in terms of the dependent variable before the experimental procedure, it was tested for independent groups with the t-test whether the mean scores of the pre-test were equal or not. The t-test results of the logical group test (GALT) pre-test scores for the experimental and control group students and for the independent groups are given in Table 3.

Table 3

*T-Test Results of The GALT Test Pre-test Scores for Independent Groups*

Group	<i>n</i>	$\bar{X}$	<i>S</i>	<i>sd</i>	<i>t</i>	<i>p</i>
Experiment	17	.185	.125	32	1.195	.241
Control	17	.140	.091			

\*  $p < .05$

According to Table 3, it can be said that the logical thinking skill levels of the students in the “DNA and Genetic Code” unit in the science lesson before the experimental study were the same as the students in the control group ( $\bar{X}=.140$ ) and the students in the experimental group ( $\bar{X}=.185$ ). Before the experimental study started, it was observed that there was no significant difference between the logical thinking skill levels of the students ( $t=1.195$ ;  $p=.241$ ). It was observed that the mean scores of the logical thinking group tests were equivalent to each other in the experimental and control groups before the study. The operational period in which the students participated in the logical thinking group test was revealed with descriptive statistics (% , frequency). In order to determine whether the experimental process had an effect on the logical thinking group test (because the test did not provide the assumption of normality), the data were analysed with the Mann Whitney U-test. Before and after the experimental application, whether there was a significant difference in the logical thinking skills of the students according to the operational period they were in was analyzed with the Wilcoxon signed-rank test.

Non-parametric tests are used in cases where the number of samples is small or the data do not show normal distribution (Pallant, 2017). In cases where a normal distribution is provided, the use of parametric tests is always recommended as a better option (Can, 2019). Effect size is useful because it provides an objective measure of the significance of the effect (Field, 2009). For this reason, effect size values were calculated because they increase the comprehensibility of the results (Büyüköztürk, 2014).

### Ethical Approval of the Study

All necessary ethical permissions were obtained before the data of this study were collected. The research was carried out by the Ethics Committee of Science and Engineering Sciences of Manisa Celal Bayar University with the ethical permission dated 01/10/2018 and numbered 46544. In addition, all participants were informed about the study and the students participating in the research were included in the study on a voluntary basis. In addition, since the participants were between the ages of 12 and 14, permission was obtained from both the students and their parents with the “parent consent form” and “voluntary participation form” documents for ethical consent for the study.

### Results

Statistical information about the periods in which the experimental and control group students took part in pre and post-tests in terms of their logical thinking skills are given in Table 4.

Table 4

*Statistical Information of The Experimental and Control Group Students in terms of Their Logical Thinking Skills*

	Pre-test				Post-test			
	Experimental group		Control group		Experimental group		Control group	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Concrete Period (0-8 scores)	16	94.12	17	100	13	76.47	17	100
Transition Period (9-15 scores)	1	5.88	0	.00	3	17.65	0	.00
Abstract Period (16-21 scores)	0	.00	0	.00	1	5.88	0	.00
Total	17	100	17	100	17	100	17	100

\* Since there was a lack of post-tests of one student in both experimental and control groups, these students were not included in the analysis.

According to Table 4, it is seen that all (100%) of the control group students took part in the concrete period, before and after the experimental process. It is observed that 94.12% of the experimental group students took part in the concrete period and 5.88% in the transition period before the experimental process. After the experimental process, it is understood that 76.47% of the experimental group students took part in the concrete period, 17.65% in the transition period and 5.88% in the abstract period.

The minimum and maximum values of the logical thinking skills pre-test and post-test scores of the experimental group and control group students are given in Table 5.

Tablo 5

*Minimum Maximum Values of Students' Logical Thinking Skills Pre-Test and Post-Test Scores by Groups*

Group	n	Median	Pre-test		Post-test		
			Minimum	Maximum	Median	Minimum	Maximum
Experiment	17	3	0	10	4	0	16
Control	17	3	0	7	3	1	6

According to Table 5, it is seen that while the highest score the students in the experimental group got from the pre-test was 10, it increased to 16 points in the post-test. Although the students in the control group got the highest seven points in the pre-test, it was observed that the highest scores in the post-test were six. It is observed that the maximum score obtained by the experimental group students in the lessons carried out with the scientific scenario-based teaching process based on socioscientific issues has increased significantly.

Mann Whitney U-test results of logical thinking group test post-test scores for experimental and control group students are shown in Table 6.

Table 6

*Mann Whitney U-Test Result of Logical Thinking Group Test Post-Test Scores According to the Group*

Group	n	Median	Minimum	Maximum	M-W U	p	Effect size (r)
Experimental	17	4.0	0	16	110.500	.036	.36
Control	17	3.0	1	6			

\*  $p < .05$

According to Table 6, at the end of the experimental study, a significant difference was found between the scores of the students in the logical thinking group test, ( $U=110.500$ ,  $p < .05$ ). Considering the rank averages, it is understood that the students in the experimental group, where the courses were taught using scientific scenarios, had higher logical thinking than the control group students who were applied to the current science curriculum. It shows that the effect size of this difference is  $r=.36$ , the difference has a great effect and 13% of the total variance is explained by the use of scientific scenarios in the teaching of socioscientific issues.

Statistics related to the results of the Wilcoxon signed ranks test regarding whether the operational period in which they are present shows a significant difference



according to the logical thinking skills of the students before and after the experimental application are given in Table 7.

Table 7

*Wilcoxon Signed-Rank Test Results Regarding The Logical Thinking Group Test Scores of The Students in The Experimental and Control Groups*

Groups	PostTest-PreTest	<i>n</i>	Rank average	Rank total	<i>z</i>	<i>p</i>	Effect size ( <i>r</i> )
Experimental	Negative Rank	0	.00	.00	2.00*	.046	.343
	Positive Rank	4	2.50	10.00			
	Equal	13					
Control	Negative Rank	0	.00	.00	1.00*	.317	
	Positive Rank	1	1.00	1.00			
	Equal	16					

\* Based on negative ranks

The results of the analysis show that there is a significant difference between the pre-experiment and post-experiment scores that the students in the experimental group got from the logical thinking group test, [ $z=2.00$ ,  $p<.05$ ,  $r=.343$ ]. Considering the rank average and total of the difference scores, it is seen that this observed difference is in favour of the positive ranks, that is, the post-test score. The effect size of this detected difference,  $r=.343$ , shows that the difference has a moderate effect. It is seen that there is no significant difference between the pre-experiment and post-experiment scores that the students in the control group got from the logical thinking group test, [ $z=1.00$ ,  $p>.05$ ].

### Discussion and Conclusion

In the study, the effect of science teaching activity practices carried out with scientific scenarios within the scope of the science lesson “DNA and Genetic Code” unit on the logical thinking skills of 8th grade students was evaluated. According to the results obtained from the study, it is seen that scientific scenario applications improve students’ logical thinking skills. Before the experimental process, it is understood that both the experimental group and the control group students were mostly involved in the concrete period. After the experimental process, although there was no change in the control group, it was observed that two of the students in the experimental group went through the transition period and one went into the abstract period. When Table 4 and Table 5 are examined together, it is seen that the highest score obtained by the control group students before the application was seven, and the highest score obtained after the application was six. All of the control group students are in the concrete period before and after the application. When it comes to the students in the experimental group, it is seen that the highest score obtained before the application was 10, while this score was 16 after the application. While the period the students are in is a concrete and transitional period before the application, it is seen that there are students who get into the abstract period after the application, and there are some students who are in the

transition period among the students in the concrete period. This may be effective in noticing the problem situation in the scenarios during the teaching process, seeking solutions, making decisions, and making discussions while doing this, and logical thinking being active in the mental process in the whole process. In his study, Ramirez-Villaren (2020) showed that the number of evidence-based justifications used by students in discussions increased in the teaching practice in which scenarios involving socioscientific issues were used, and there was a positive development in their reasoning and decision-making skills. Cian (2020), on the other hand, states in his study that students carry out different logical thinking after the teaching practice with scenarios on socioscientific issues of environment and genetics. Kinslow et al. (2019) encountered a similar situation in their studies and interprets the development of students' reasoning skills as a reflection of students' development of multiple perspectives and inquiry skills in order to understand the dilemmas of scenarios used in socioscientific issues, and thus an increase in their reasoning skills.

Within the scope of another sub-problem of the study, the scores obtained by the students in the logical thinking group test were re-evaluated by considering the score categories of the periods. As a result of the analysis of how the experimental and control group students' score changed before and after the experimental process, it was determined that the increase in the experimental group was statistically significant. In this case, it can be stated that science teaching with scientific scenarios is effective for students to move up from the developmental period they are in. According to Piaget, when the student in the concrete period does not show enough cognitive development, he continues to stay in the concrete period. Therefore, the development of students' logical thinking skills is very important in terms of learning, considering the skills of individuals in the concrete, transitional or abstract period. In the study of Eskandar et al. (2013), it is seen that most of the students are at the level of concrete thinking and only a few students reach the transition level in the analysis of the pre-test results. When the studies on logical thinking skills are examined, it is understood that most of them are at the level of concrete thinking of secondary school students (Baser, 2007; Soylu, 2006; Yenilmez et al., 2006). The study of Tajudin and Chinnappan (2015) also shows that the majority (94%) of secondary school students (16-17 age group) have their cognitive levels at the level of concrete operations. It is stated that students' low logical thinking skills are seen more in exam-based education systems (Fah, 2009). Therefore, it can be stated that school evaluation systems that emphasize only the acquisition of content knowledge cause students to have a low level of logical thinking skills.

According to Piaget's mental development theory, considering the developmental stages that individuals are expected to find according to ages, it is seen that 8th grade students are expected to be in the abstract processing period, that is, to have similar characteristics to adult individuals. In this case, they will be able to benefit society through social interactions. This requires the ability to make decisions in logical ways and to solve problems by adhering to analytical thinking (Salami, 2021). Exposing children to problem situations creates a process that supports their abstract thinking (Berk, 2013). Some studies show that students' logical thinking skills are developed, especially in solving problems given as daily life problems involving abstract concepts (Borges et al., 2017; Gulacar et al., 2013). There are studies showing that logical thinking develops differently in children of the same age (Lazonder et al., 2021), the

developmental pattern is not equally applicable to all children, and that general linear progress is made by some, not all children in a class (Koerber et al., 2015). In a different study, students' logical thinking skills were divided into levels as high, medium and low. It is stated that 35% of the students are high, 29% are medium and 36% are low (Kılıç, 2009). It is stated that individuals with low logical thinking skills have difficulties in perceiving and learning the facts, events, situations or concepts that require abstract thinking (Lawson & Renner, 1975). In addition, it is stated that logical thinking skill is important in understanding science concepts, and it is the most effective predictor of success in solving genetic problems (Cavallo, 1996). Johnson and Lawson (1998) reveal that the important predictor of students' success in biology subjects is their logical thinking skills. Dawson and Venville (2013) state that in their study, genetics, which includes socioscientific issues, can help students to think and reason logically. Cian (2020) and Shea et al. (2015) investigated the effects of students' reasoning about genetics on teaching and learning and they found that they produced logical conclusions in different ways. In this study, the concept, facts and events within the scope of biology are included in the content of the unit where the experimental application is performed. In this case, the development in the logical thinking skills of the students in this study sample can be expressed as an important predictor in the acquisition of the mentioned concepts.

In the study, there is no significant difference between the logical thinking skill levels of the students before the experimental process, due to the analysis performed to evaluate the effect of the use of scientific scenarios in teaching socioscientific issues on the development of students' logical thinking skills. After the experimental process, it was observed that there was a significant difference between the logical thinking skills of the experimental group students in which scientific scenarios were used in teaching compared to the control group students using the current science teaching program ( $p < .05$ ) and the experimental group students' logical thinking skills were higher. This situation shows that the teaching of the lessons with the use of scientific scenarios in the teaching of socioscientific issues in the science course is effective in developing students' logical thinking skills. In this context, although there are different learning teaching methods, techniques and activities in the literature, when the studies using scientific scenarios are examined, it is seen that some of them have an effect on the development of logical thinking skills, and some of them have no effect on the development of logical thinking skills. Aydın and Kaptan (2014) examined the development of logical thinking skills of groups in which argumentation-based education was applied using scenarios. The authors found that by presenting the scenarios, the group in which the argumentation was made developed the logical thinking skills significantly. Similarly, it is stated that there is a significant difference in logical thinking skills in the groups where the scenarios are used in project-based learning and the traditional method, and project-based learning is effective on developing logical thinking skills (Sert-Çıbık, 2006). Zeidler et al. (2009) also reported that the SSI-based teaching (socioscientific issues (SSI)), which they applied for a year, had a positive effect on the development of reflective judgment of senior high school students. Students' being exposed to problem situations supports their abstract thinking (Berk, 2013), and their logical thinking skills can develop by being able to examine the situation in a versatile way. When the nature of the logical thinking skill scales

developed and applied at the secondary school student level in the international literature for the last decade is examined, it is seen that the use of scenarios and the construction of the scales on the script are indispensable (Crocker & Buchanan, 2011; Ibrahim et al., 2016; Lazonder & Janssen, 2021; Lazonder et al., 2021; Osterhaus et al., 2020; Woolley et al., 2018). It is thought that the use of scientific scenarios is important in both developing logical thinking skills and observing existing logical thinking skills.

### **Implications**

As a result of this study, it has been understood that the socioscientific subject-based instructional experience in the science lesson, which includes scientific scenarios, has a supportive effect on students' logical thinking. Of particular interest in this study is the way students reasoning through socioscientific scenarios. With scientific scenarios, students have been exposed to situations similar to real life problems for the subjects and concepts in the "DNA and Genetic Code" unit. It is thought that thinking about solutions to these problems individually and as a group during the lesson, sharing the solutions they found with other students, and making argumentation during the process are thought to be effective in the development of logical thinking skills.

The results of this study were obtained with a limited number of students and nine scientific scenarios in a six-week period. Although it is seen that students' logical thinking skills develop at the end of the instructional process they experience, it is necessary to be careful in making broad claims about how the use of scientific scenarios will affect the development of logical thinking skills of other students. For example, sudden changes in society due to the pandemic process that the whole world is experiencing can rapidly change the way individuals think, discuss, and use logical processes on socioscientific issues related to genetics, such as genes and mutations in this study. Factors limiting the work as the study is limited to the use of logical thinking processes by the participants and its reflection, as a result of the discussions held over scientific scenarios on the subject and scope of the "DNA and Genetic Code" unit, and the educational experiences in which these discussions took place' are specified.

Considering the results obtained from the study, it is thought that the teaching method and activities supporting the development of students' logical thinking skills should be used meticulously by teachers, in classroom practices. In this context, longitudinal studies can be carried out to support students' logical thinking skills, studies for teachers, and activity development activities. In addition, long-term longitudinal studies can be carried out with the use of scientific scenarios in teaching socioscientific issues, as well as different methods suggested in the literature, apart from scenarios. In addition, it is recommended to conduct studies investigating the effect of covering socioscientific issues with scenarios on decision-making skills, critical thinking skills, argumentation skills, and so on. Especially in the literature, there is a need for case studies using multiple methods to eliminate the ambiguities about the methods to be used in teaching socioscientific issues. Thus, it is thought that the concerns of teachers regarding the handling of socioscientific issues in lessons can be eliminated.

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### **Statement of Responsibility**

Fatma Şaşmaz-Ören; conceptualization, determination of the problem situation, determination of the sample group, selection and application of data collection tools, design of the research process, development of activities, data analysis, verification, writing-examination and control, project administration. Ayşegül Karapınar; conceptualization, determination of the problem situation, selection of data collection tools, development of activities, methodology, research, data analysis-writing, writing-draft and original, writing-review and editing. Kübranur Sarı; development of activities, data collection, verification, research. Tuğba Demirer; development of activities, execution of the implementation process, data collection, verification, research.

### **Conflicts of Interest**

The authors declare that there is no conflict of interest.

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## Appendices

### Appendix 1: Learning Outcomes and Concepts of the “DNA and Genetic Code” Unit in which the Applications of the Study are Made

F.8.2.1. DNA and Genetic Code - (1. subtopic that is the same as the name of the unit)

Subject / Concepts: Structure of DNA, self-replication of DNA, nucleotide, gene, chromosome

F.8.2.1.1. Explains the concepts of nucleotide, gene, DNA and chromosome and establish a relationship between these concepts.

F.8.2.1.2. Shows the structure of DNA on the model.

F.8.2.1.3. Expresses how DNA matches itself.

F.8.2.2. Heredity- (2nd subtopic of the unit)

Subject / Concepts: Gene, genotype, phenotype, pure progeny, hybrid progeny, dominant, recessive, cross, gender, consanguineous marriages

F.8.2.2.1. Defines the concepts related to heredity.

F.8.2.2.2. Comments on the results by solving problems with single character diagonals.

F.8.2.2.3. Discusses the genetic consequences of consanguineous marriages.

F.8.2.3. Mutation and Modification -( 3rd subtopic of the unit)

Subject / Concepts: Mutation, modification

F.8.2.3.1. Explains the mutation based on examples.

F.8.2.3.2. Describes the modification based on examples.

F.8.2.3.3. Makes inferences regarding the differences between mutation and modification.

F.8.2.4. Adaptation (Adaptation to the Environment) - (4th subtopic of the unit)

Subject / Concepts: Adaptation, natural selection, variation

F.8.2.4.1. Explains the adaptation of living things to the environment they live in by observing.

F.8.2.5. Biotechnology- (5th subtopic of the unit)

Subject / Concepts: Genetic engineering, artificial selection, biotechnological studies, impact of biotechnology applications on the environment

F.8.2.5.1. Associates genetic engineering and biotechnology.

F.8.2.5.2. Discusses the useful and harmful aspects of these applications for humanity with the dilemmas created within the scope of biotechnological applications.

F.8.2.5.3. Predicts what future genetic engineering and biotechnology applications might be.

Note: A kind of code is used in sciences programs in the Ministry of Education of Turkey. If we take in consideration F.8.2.1. as example;

‘F’ shows that it is a science lesson,

‘8’ shows that it is the 8th grade level,

‘2’ shows that it is the second unit,

‘1’ shows that it is the subject number and that for each one, the number following represents the gain number.



## Appendix 2

### Scenario 5 (November 5-11, 2018)

#### WHAT IS THIS COLOR CHANGE!



Greenland, one of the coldest regions of the Arctic, is a country that is covered with snow all year around, about 82% of which is made up of glaciers. Even in summer, Greenland receives the Sun's rays at an oblique angle, when the temperature is below freezing throughout the year. The geographical location, people, lifestyles and cultures of this country, where there is very little sunshine, cause many researchers and travellers around the world to turn their route to Greenland. One of these travellers is Özgür. Özgür travels

countries and publishes his experiences in a tourism magazine. Özgür, who went to Greenland, encountered more difficult weather conditions than he thought while walking around the capital Nuuk, and was confused by the sadness of not finding anything to eat. Just then, a young man named Felix notices him. Felix approaches Özgür and asks how he can help. At that moment, Özgür observes Felix, as if he had not heard anything. Because he thinks that he has never seen another person with such a light skin colour before. Özgür, who comes to him later, responds to Felix's call for help and they go to dinner together. Felix mentions that he makes his living by hunting whales and polar bears, and that very few vegetables and fruits are grown in Greenland. For this reason, he says that people meet most of their nutritional needs from raw meat. Realizing that he can learn a lot about the city and country from Felix, Özgür asks Felix to help him with his research. Felix, who willingly accepted this, formed a very good friendship with Özgür over time. Özgür, who is very pleased with the friendship between them, never wants to leave Felix. Then, when Özgür comes to the end of his research, he offers Felix to return to Turkey together. Özgür is very confident that his offer will not be rejected, as he learned that his friend is curious about hot countries during their conversation. Özgür, who received a positive answer from Felix as he expected, was very happy and immediately started preparations. Unfortunately, the paths are quite long.

The duo, who set foot in Turkey after a long journey, arrive in Antalya, where Özgür's family lives. Felix is quite surprised when they arrive in Antalya, one of the hottest and sunniest regions in Turkey. Because all his life, he never went out of the house in thin clothes. However, people are very thinly dressed and the sun is very scorching. Felix enjoyed the hot weather and the sun for days and got rid of his thick clothes, and he liked this situation very much. But what is it! While changing in front of the mirror one morning, Felix notices that his skin has turned quite dark. In fact, there are tonal differences in the arm and neck parts where the shirt ends. Horrified, Felix immediately goes to Özgür's room and begins to ask questions one after another. What answers would you give to Felix if you were at Özgür's place?

1. Why has my skin colour changed so much?
2. Will my skin always stay like this?
3. Will these marks on my skin be on my children in the future?

With the answers he received from Özgür, Felix was convinced that this skin colour change was due to the effect of the sun's rays and was not permanent, and finally



took a sigh of relief. This means that the sun's rays can change its external appearance, but this change can return to its former state over time. Felix, who thinks that it is time to return home, thinks how shocked his family will be. Although he has been planning for a long time, he cannot decide on the gift he will buy for his mother when he returns. Felix, who got an idea from Özgür on this subject, finally decides to take a potted plant called primrose to his mother. Because this plant blooms with white flowers and his mother likes the colour white very much. As he has bought his gift, it is now time to go back home, Felix makes a promise to meet his beloved friend Özgür again and says goodbye and sets off. There is still an ocean to cross. As he gets closer to his country, it is possible to notice that the weather conditions are getting harsher and the temperature is decreasing. Worried that his flower will be affected by these weather conditions and die, Felix returns home after a long time with the flower that he has been protecting with great devotion along the way. He excitedly gives his mother the primrose she brought. The mother, who was very happy with the gift she received, put her flower in the most beautiful place of her home. A few days later, while Felix and his mother are having breakfast, his mother's eye catches suddenly the primrose. Because the new flowers of the primrose plant, which had white flowers before, are blooming red. Let us answer the following questions that occur in the minds of the mother and her son, who cannot make sense of this.

1. What is the reason why the newly opened flowers of the primrose are red? Does this have anything to do with changing the environment in which the flower is located?
2. If we take the primrose back to Turkey, will it bloom in white?
3. Has the chromosomal structure of the primrose changed? Please explain.
4. Is there a relationship between the reasons that Felix's skin colour changes and the reason why the newly opened flowers of the primrose are red? Please explain.
5. Can environmental conditions change the external appearance of living things? If your answer is yes, explain with examples.

### References

The pictures used in the scenario were obtained from the following addresses, in order, from beginning to end:

- [https://commons.wikimedia.org/wiki/File:Greenland\\_in\\_the\\_world\\_\(W3\).svg](https://commons.wikimedia.org/wiki/File:Greenland_in_the_world_(W3).svg)
- <https://pxhere.com/tr/photo/488841>
- <https://pxhere.com/tr/photo/1045085>



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