K|E|J

Kastamonu Eğitim Dergisi
Yıl:2023 Cilt:31 No:4

Kastamonu Education Journal
Year: 2023 Volume: 31 Issue:4

Taranmakta olduğumuz dizinler:

İndeks	Logo	İndeks	Logo
TR Dizin ULAKBİM	ULAKBİM TR DİZİN	CrossRef	Crossref
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Kastamonu Eğitim Kastamonu Education Dergisi Journal

| Research Article / Araştırma Makalesi|

Comparison of Instructors' Experiences in Distance Education and Face-to-Face Education Processes[1]

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Abstract

The aim of the study is to reveal the experiences of lecturers regarding this phenomenon in the process of transition to distance education due to the Covid-19 pandemic and to compare these experiences with face-to-face education. For this purpose, a phenomenological design, which is a method of qualitative research, was used in the study, and semi-structured interviews were conducted with 18 lecturers. The interviews were subjected to content analysis and as a result of the analysis, the lecturers' views on distance education were revealed. The lecturers evaluated distance education negatively because of limited interaction, lack of communication, insufficient technological tools and equipment, technical infrastructure problems, measurement and evaluation not reflecting the reality, and this education model is not suitable for applied courses. In the distance education process, there were differences compared to face-to-face education in the general teaching of the course, the methods and techniques used, the activity of the stakeholders, the time used for a course and the completion of the content of the course planned until the end of the semester. The advantages of face-to-face education were listed as the ease of involving students in the course process, the fact that validity and reliability reflect the reality, and the ease of interaction and communication.

Öz

Çalışmanın amacı, Covid-19 pandemisi sebebiyle uzaktan eğitime geçilen süreçte öğretim elemanlarının bu fenomene dair deneyimlerinin ortaya çıkartmak ve bu deneyimlerin yüz yüze eğitimle karşılaştırmaktır. Bu amaçla çalışmada, nitel araştırmanın bir yöntemi olan fenomonolojik desen kullanılmış, 18 öğretim elemanı ile yarı yapılandırılmış görüşme yapılmıştır. Yapılan görüşmeler içerik analizine tabii tutulmuş ve analiz sonucunda öğretim elemanlarının uzaktan eğitime dair görüşleri ortaya çıkartılmıştır. Öğretim elemanları, uzaktan eğitimi; karşılıklı etkileşimin sınırlı olması, iletişim eksikliği, teknolojik araç-gereç yetersizliği, teknik alt yapı sorunları, ölçme ve değerlendirmenin gerçeği yansıtmaması ve uygulamalı dersler için bu eğitim modelinin uygun olmaması nedeniyle olumsuz değerlendirmişlerdir. Uzaktan eğitim sürecinde dersin genel işlenişi, kullanılan yöntem ve teknikler, paydaşların aktifliği, bir ders için kullanılan süre ve dönem sonuna kadar planlanan dersin içeriğinin tamamlanmasında yüz yüze eğitime göre farklılıklar olmuştur. Öğrenciyi ders sürecine dahil edilmesinin kolay olması, geçerlik-güvenirliğin gerçeği yansıtması, etkileşim ve iletişimin kolay sağlanabilmesi ise yüz yüze eğitimin avantajları olarak sıralanmıştır. Öğretim elemanları yüz yüze eğitimde kendilerini başarılı bulur iken, uzaktan eğitimde kısmen başarılı bulmuşlardır.

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INTRODUCTION

Education has been a formation that we encounter in every field and in every community in the acquisition of complex knowledge as well as the acquisition of knowledge and skills in daily life with the existence of human beings. From this perspective, learning at every stage of human life adventure affects the individual's life, cognitive and affective skills and behaviors. The education received by the individual allows him/her to change and improve these qualities (Kaya, 2002).

It is extremely important to meet the educational needs of individuals in order for them to have the knowledge, skills, equipment and abilities required by the age. Social, economic, scientific and technological developments have developed rapidly with the implementation of educational activities (Demir, 20014). Given the current world context with new technological tools and the emergence of internet technology, dimensions of education such as teaching, learning and pedagogy are experiencing a shift (Battro & Fischer, 2012). Yang (2020) emphasized the need to redesign the educational ecosystem to better serve the needs of the current information age with the integration of information technologies. Desai, Hart, and Richards (2008) stated that the change and expansion needed in educational environments can be achieved by using educational technology and the confinement of learning to the physical boundaries of a classroom will end. Distance education has emerged as a result of these developments and efforts (Demir, 2014).

Distance education is a planned arrangement in which teachers and students are in spatially independent environments, where the use of technology is mandatory in order to teach courses and apply teaching methods and techniques (Moore & Kearsley, 2005). Uşun (2006) defined distance education as a planned and systematic technology application in which the teaching and learning processes between the source and the receiver take place in independent environments, which offers "flexibility, independence and individuality" to the receivers in terms of time, age and space, in which printed and written materials, various audio and visual tools are used in teaching processes, and in which the interaction between the source and the receiver can be provided by technologies. Bates ise (2005a) uzaktan eğitimi, öğrencilerin ve eğitimcilerin aynı yerde bir arada bulunmadıkları bir eğitim biçimi olarak tanımlamaktadır. Bates (2005a) aynı zamanda uzaktan eğitimin teknolojiyle iç içe olduğunu ve uzaktan eğitim ile teknolojinin bir bütün olduğunu belirtmiştir.

The elimination of some educational problems in our country and the renewal and development of our education system in accordance with the requirements of the information age can be achieved through distance education (İşman, 2011). When we look at the advantages of distance education, we see that it eliminates inequality of opportunity in terms of the opportunity to access information by offering a different and rich learning environment to learners, contributes to the access of information from the first source by everyone, contributes to the development of learning responsibility and independent learning skills of learners, as well as reducing educational costs and providing a standard in educational programs (Kaya, 2002). Considering these advantages of distance education, it can be said that it is a globally important education model and that it is necessary to contribute to the development and dissemination of this education model. When we look at the limitations of distance education, the most emphasized disadvantages are the inadequacy and problems of technical infrastructure in terms of technology, the difficulties encountered especially in applied courses and the inefficiency of these courses, the difficulties experienced by the individual in taking responsibility for their own learning, the materials being more labor and time consuming, and the limited in-class interaction and communication (Balıkçıoğlu et al. 2019; Duman, 2020; Demirdağ & Altun, 2022).

In late 2019, with the coronavirus disease (Covid-19), which emerged in Wuhan, the capital of China's Hubei province, affecting the world in a very short time, it is thought that distance education has gained more importance. With the announcement of the Covid-19 pandemic, education has been the most affected area among the areas that have been changed globally. Many countries have decided to suspend their spatial education activities and switch to distance education thanks to digital platforms. With the first Covid-19 case in our country on March 10, 2020, some measures have been taken, especially in social and social areas. The first of these was the suspension of education on March 12, 2020 and the transition to distance education (Soylu, 2020). The number of students affected by the suspension of education and training activities carried out spatially in our country is approximately 25 million (UNESCO, 2020a). It has been stated that our perspective on education and the way we interpret education has changed with the Covid-19 pandemic (Bozkurt & Sharma, 2020).

The importance of distance education carried out with technology and the digital transformation of academic institutions such as universities has once again been understood in order to prevent the interruption of education and training activities when the pandemic has not disappeared or when any epidemic or disaster is encountered in the future. From this perspective, it is extremely important to know the advantages and disadvantages of distance education and to eliminate the disadvantages. It is of great importance in this digital age for our present and future to reveal the views of the lecturers, who are one of the stakeholders most affected by the new system, to offer solutions to them by indicating the negativities they have experienced, to examine the researches on this subject and to conduct new researches that will contribute to the field. In this study, the opinions of the lecturers working at the Faculty of Education of a university in the Western Black Sea region about their experiences in the distance education process carried out with the Covid-19 pandemic were determined and compared with face-to-face education. For this purpose, it was tried to determine the experiences of the lecturers on the following topics.

Study Problems

In this study, the opinions of the lecturers working at the Faculty of Education of a university in the Western Black Sea region about their experiences in the distance education process carried out with the Covid-19 pandemic were determined and compared with face-to-face education. For this purpose, answers to the following sub-problems were sought from the lecturers;

- What are the experiences of lecturers about the general functioning of a course in face-to-face and distance education?
- What are the experiences of instructors about the benefits and limitations of face-to-face and distance education?
- What are the experiences of lecturers about the difficulties experienced in distance education?
- What are the lecturers' self-evaluations of face-to-face and distance education?

METHOD

This research is a qualitative study aiming to obtain the opinions of the lecturers about their experiences in the distance education process, which was transitioned with the Covid-19 pandemic, and the comparison of these experiences with face-to-face education. Qualitative research can be conducted to understand the context or environment in which participants address a problem or issue. Qualitative research is a data collection process in which researches on events and situations are carried out in their natural environments through interview, observation, and document review (Başkale, 2016).

Research Design

This study was conducted with a phenomenological study, which is a design of qualitative research. Phenomenological study is defined as understanding the experiences of individuals (Van Manen, 2007). Phenomenology is a qualitative research design in which individuals reflect their feelings and perspectives on how they perceive any phenomenon, concept or situation as a result of their experiences (Rose et al. 1995). In the Covid-19 pandemic, with the transition to distance education in Turkey as of March 2020, it is thought that the lecturers experienced this process for the first time and gained a perspective accordingly. In this study, it was concluded that the distance education experience gained by the lecturers could be revealed with phenomenological research, which is a design of qualitative research.

Study Group

The research was conducted by selecting purposive sampling. Purposive sampling is preferred to shed light on the questions to be answered in the study in detail (Patton, 2014). The study group consisted of 18 instructors working in a faculty of education in the Western Black Sea region. At the same time, the lecturers emphasized that they actively taught their courses in face-to-face education, that both the students and themselves were active in the face-to-face education process, and that they did not have any experience with distance education. The number of participants in the study was determined according to data saturation and data were collected from 18 instructors on the basis of volunteerism.

Data Collection Tools

Semi-structured interview technique was used to collect data from the instructors. The biggest advantages of the semi-structured interview technique are that the questions are prepared in advance by the researcher, flexibility can be provided on the questions during the interview, and a discussion environment can be provided by changing the order of the questions according to the course of the interview (Çepni, 2012). The questions prepared for this research are related to face-to-face education conducted spatially and distance education that was introduced with the Covid-19 pandemic. Particular attention was paid to ensure that the questions were clear, simple and understandable so that the participants could understand them comfortably. Approximately 25-30 questions were directed to the participants to serve the sub-problem of the research. With the permission of the ethics committee and the consent of the participants, the questions directed to the participants and the answers to these questions were recorded using a voice recorder. The audio recordings were transcribed and coded in order to be written. The duration of the interviews conducted within the scope of the research varies between 25-60 minutes. The questions in the semi-structured interview prepared for the data to be obtained from the research were formulated after reviewing the relevant literature. Some of the questions directed to the lecturers are as follows;

- How did you conduct a course in face-to-face education? Are there any methods/techniques/strategies you used while teaching the course? If yes, what are they?

- How did you conduct a course in distance education? Are there any methods/techniques/strategies you use in distance education? What are they, if any?

- Can you compare distance education and face-to-face education in terms of benefits and limitations (stakeholders, technical dimension, technological possibilities, etc.)?

- How would you evaluate yourself in all these two education models?

Data Collection and Implementation Process

The questions in the semi-structured interview prepared for the data to be obtained from the research were formulated after reviewing the relevant literature. In order to determine whether the prepared questions serve the purpose or not, the opinions of an expert with qualitative studies were taken. In line with the opinions received, additions and deletions were made in some questions. Then, a pilot study was conducted to understand whether the prepared questions worked or not. The pilot study was carried out with two lecturers working in the faculty of education of a university and the final form of the questions was obtained by applying to the expert opinion again. For the interviews to be conducted within the scope of the research, 18 lecturers were contacted on a voluntary basis and an appointment was requested at a convenient time for them. Interviews with 18 lecturers were conducted on different days and this process was completed in approximately one month. The interviews were conducted in the rooms of the lecturers where no one else was present except the participants and the researcher.

Data Analysis

Qualitative data collection tools are realized through observation, document review or interview (Cansız Aktaş, 2019). In this study, interview technique was used as a data collection tool. The data obtained were subjected to content analysis. Analysis in qualitative studies consists of four parts. These are; collecting data, creating themes and codes from the data obtained, organizing themes and codes, and defining and interpreting the findings (Miles & Huberman, 1994).

Transcripts were made in order for the data to be written down. The written data were analyzed in detail and codes and main themes were identified. From this perspective, the research involves an analysis process based on induction according to the Miles and Huberman model. In order to ensure the reliability of the codes and themes obtained from the research, they were re-coded by an expert lecturer in qualitative study and the codes and themes were compared. The reliability of the codes and themes determined by the researcher and the expert was calculated with the consistency between the coders. As a result of the calculation, the inter-coder consistency of the research was found to be 90%. The concepts in the light of the data obtained and the relationships between these concepts were revealed.

Validity and Reliability of the Study

While validity and reliability are expressed with numerical indicators in quantitative studies, validity and reliability cannot be achieved with numerical indicators in qualitative studies. For this reason, the validity and reliability of qualitative studies should be addressed with different dimensions (Başkale, 2016). It has been emphasized that validity and reliability in qualitative studies can be achieved through credibility and this credibility can be achieved through some criteria. These criteria are credibility, reliability, confirmability and transferability (Guba & Lincoln, 1982). There are multiple methods to increase credibility in a qualitative research. The most common of these are participant checking and peer debriefing (Holloway and Wheeler, 1996). In order to ensure validity and reliability in this study, participant confirmation was sought. For the missing or incomprehensible points in the transcript of the data, the participant was asked to complete the missing or incomprehensible points. In addition, some participants were interviewed again and asked for their opinions on the accuracy of the meanings derived from the analysis of the data. Another method used to ensure validity and reliability is expert review. In this study, the expert provided feedback to the researcher by looking critically at all processes from the research design to the data collected, data analysis and writing the results. At the same time, the expert was asked to evaluate the codes and themes and the inter-coder agreement, which corresponds to the concept of internal consistency in the Miles and Huberman (1994) model, was found to be 90%.

FINDINGS

The experiences of the teaching staff about face-to-face and distance education were categorized under 4 headings. These are the general teaching of a course in face-to-face and distance education, the benefits and limitations of face-to-face and distance education, the difficulties experienced in distance education, and self-evaluations of face-to-face and distance education experiences.

Findings about the general functioning of a course in the face-to-face and distance education experiences of the instructors

In table 2, the themes of "strategies-methods and techniques used, time used, activity and content completion" and the codes belonging to these themes are given regarding the general functioning of a course in face-to-face education and distance education. In the findings, the instructors were coded as A1, A2, A3...and the statements of the participants were included.

Table 2. Instructors' experiences about the general functioning of a course in face-to-face and distance education

Theme	Code	Face-to-Face Education f	Distance Education f
Strategies Used	Presentation	15	18
	Research Review	3	0
Methods and Techniques Used Lecture	Used Lecture	9	15
	Question and Answer	5	3
	Discussion	5	3
	Group Work	3	0
Time Used	0-30 minutes	0	9
	30-45 minutes	5	9
	45-90 minutes	9	0
	90-120 minutes	3	0
	120-180 minutes	1	0
Activism	Academician	3	12
	Academician+studen	15	6
Content Completion	Yes	8	11
	No.	10	7

The lecturers were asked questions about the general teaching of a course in face-to-face education conducted spatially and distance education conducted due to the pandemic. When Table 2 is examined, while the instructors stated that the strategy they used in face-to-face education was mostly the way of presentation (f=15), three instructors preferred the research-study strategy. With the transition to distance education, it is seen that all instructors preferred the presentation strategy (f=18). When the same table is continued to be analyzed, it is seen that the instructors mostly expressed the methods and techniques used in face-to-face education as lecture (f=9), question and answer (f=5) and discussion (f=5). In distance education, almost all instructors stated that the method and technique they used in the teaching of a course was lecture (f=15). The lecturer coded A4, who stated that he preferred the research-examination strategy in face-to-face education, expressed the strategy he used in his course with the transition to distance education as follows; "*I can say that the strategies in the direction of presentation have increased in distance education.*" The lecturer coded A5, who stated that he used less traditional strategies-methods-techniques in face-to-face education, justified that he had to prefer traditional methods with the transition to distance education as follows; "*Compared to face-to-face education, I can say that while I prefer less traditional in face-to-face education, I use more traditional presentation methods in distance education, I can say that I can experience the difficulty of making students active in this process.*"

The lecturers were asked to indicate the time used for teaching a course in face-to-face and distance education. While the lecturers expressed the time used in face-to-face education as 30-45 minutes (f=5), 45-90 minutes (f=9), 90-120 minutes (f=3), 120-180 minutes (f=1), with the transition to distance education, there were changes in these durations and they expressed this situation as 0-30 minutes (f=9) and 30-45 minutes (f=9). The lecturer coded A5 stated that with the transition to distance education, a lesson hour lasted less than 30 minutes due to the lack of interaction as follows; "*In distance education, it was definitely less than what we planned, that is, the planned time was 40 minutes for example and it was impossible to fill it. Because there is no interaction... since you could not make eye contact with the students, we could not understand where they were bored and we completed our lessons with the feeling that we were talking to the wall, so I can say that it lasted about 20 minutes.*"

Instructors were asked to indicate whether the content of a course they planned until the end of the semester was completed or not. There were instructors who stated that they could complete the content of a course in face-to-face education (f=8) and that they could not (f=10). The lecturer coded A13 stated that he could not complete the content of the course he planned in face-to-face education, especially in theoretical courses, as follows; "*We could complete it for applied courses, they were usually given three hours anyway, they were enough, but we could not complete it in our theoretical courses.*" The same instructor stated that he was able to complete the content of the course he had planned with the transition to distance education due to the lack of student interaction as follows; "*I completed it, it was generally completed. If I hadn't done 45 + 45, it wouldn't have been completed, but when I did it that way and there was no student interaction, it was completed.*" The lecturer coded A8 explained that he could not complete the content of the course he planned in face-to-face education and how he followed a path for this situation as follows; "*I could never complete it, I give the children publications about the subjects that were not completed and they read them.*" The lecturer coded A14 stated that he could complete the content of a course in face-to-face education, but with the transition to distance education, he could not complete the content of the course as follows; "*It did not catch up in distance education, because of the time given to us by the portal. I tried to complete this situation by giving homework to the students.*"

Findings on the benefits and limitations of instructors' face-to-face and distance education experiences

Instructors were asked to compare the benefits and limitations of face-to-face and distance education. In this context, the lecturers mostly explained the benefits of face-to-face education as the ease of including the student in the process (f=15), validity and reliability giving more precise results (f=13), providing mutual interaction (f=13), easy classroom management (f=9), providing feedback and correction (f=6), students being able to take role/model (f=5), being more suitable for using different methods and techniques (f=3) and having the opportunity to socialize (f=3) (Table 3).

Table 3. Instructors' experiences on the benefits and limitations of face-to-face and distance education

| Theme | Code | Face-to-Face Education | Distance Education |
		f	f
Benefits	Ease of involving the learner in the process	15	0
	Validity-reliability	13	0
	Interaction	13	0
	Ease of classroom management	9	3
	Feedback/Correction	6	0
	Role/Modeling	5	0
	Different method-techniques	3	0
	Socialization	3	0
	Technology use	0	11
	Spatial independence	0	8
	Ease of time management	0	7
	Digital literacy	0	2
	Flexibility	0	2
Limitations	interaction/communication	0	18
	Insufficient technological infrastructure	0	14
	Measurement and evaluation	0	14
	Applied courses	0	7
	Inequality of technological opportunity	0	3

Instructors believe that face-to-face education has no limitations. The benefits of distance education are; increased use of technology by stakeholders (f=11) and accordingly an increase in their digital literacy (f=2), the formation of a learning environment independent of space (f=8), easy time management (f=7), easy classroom management (f=3) and providing flexibility to stakeholders (f=2). Instructors emphasized the limitations of distance education as lack of interaction-communication between stakeholders (f=18), inadequacy of technology infrastructure (f=14), measurement and evaluation not reflecting the reality (f=14), not suitable for applied courses (f=7) and creating technological inequality of opportunity (f=3).

The explanations of the lecturer coded A9, who stated that face-to-face education is beneficial in terms of providing ease of including the student in the process, providing more accurate results in terms of validity and reliability, providing interaction, easy classroom management, providing feedback and correction and taking the student as a role model, are as follows; *"When we look at face-to-face education, there is inevitably student-student interaction in classroom interaction, so we can include the student in the process... All exams should be face-to-face in terms of validity and reliability.... In face-to-face education, for example, classroom management was easier because we could see the student. Again, in face-to-face education, I can give feedback to students about homework assignments, but we could not do this in distance education... In face-to-face education, children receive not only field knowledge but also teaching knowledge. I'm not talking about vocational courses, I'm talking about teacher posture, they can understand how a teacher should be by seeing us in face-to-face education."*

The statements of the lecturer coded A10, who emphasized the benefits of distance education as providing an increase in his/her own technology usage skills, providing an education opportunity independent from space, being economical in terms of time management, providing flexibility and gaining digital literacy, are as follows: *"In distance education, you can plan your time better. Because you know that you have a time limit, but in face-to-face education you can extend it a little longer. In distance education, you evaluate time management well... We had to use technology and we learned technology by doing and experiencing. Our digital literacy has actually improved in distance education... Being independent of space, I taught my lessons without going out of my comfort zone..."*

Instructors who thought that face-to-face education had no limitations mentioned many limitations of distance education. The instructor coded A11 expressed the limitations of distance education as follows; *"In distance education, it was not possible to do anything, especially in applied courses, in our laboratory-related courses. The application areas of education that require practice*

and skills were incomplete... We could not perform formative evaluation much in distance education*." The lecturer coded A1 expressed the limitations of distance education as follows; "I think the biggest limitation of distance education is that we cannot know whether the student is fully participating in the process or not... We received many e-mails from students saying that they could not enter the system, they could not attend the lesson, they could not take the exam, they could not take the exam, our internet connection was not good, and so on. For example, one of my students told me that I don't have a computer, my father brings his friend's computer and that's how I listen to the lessons...now we can't say anything to these students, they don't have technological means, what can we do.... In face-to-face education, when you are doing assessment and evaluation, you are there with the student at that moment, maybe you are more sure of what the student does, what he/she does with his/her own knowledge, but you cannot be sure in distance education...*"

Findings on the difficulties experienced by instructors in distance education

Instructors were asked to explain the difficulties experienced in distance education. The most emphasized challenges are summarized in Table 4. These are; lack of interaction (f=12), difficult classroom management (f=9), technical problems (f=9), difficulty in getting used to the university's distance education system (portal) (f=6), lack of technological infrastructure (f=6), lack of technological opportunities for students (f=5), The following factors were mentioned: lack of technological knowledge and skills in stakeholders (f=4), insufficient portal (f=4), screen fatigue (f=4), home-work environment being the same (f=3), pedagogical difficulties (f=2) and adaptation to the process (f=2).

Table 4. Instructors' statements about the difficulties experienced in distance education

Theme Frequency	Code	f
	Lack of interaction	12
	Classroom management	9
	Technical problems	9
	Not recognizing the program	6
Challenges in distance education	Technological infrastructure	6
	Technological possibilities of the student	5
	Lack of technological knowledge and skills	4
	Portal inefficiency	4
	Screen fatigue	4
	Home-work environment	3
	Pedagogical	2
	Adaptation to the process	2

Explaining the difficulties experienced in distance education with difficulties in classroom management, inability to establish effective interaction and pedagogical difficulties, the statements of the lecturer coded A3 are as follows: *"For example, there is something we call classroom management. Pedagogically, we need to enter into a teacher-student interaction with children. There was no such event in distance education, I had a lot of difficulty pedagogically*." While the lecturer coded A11 stated as follows; *"The basic logic of the interactive course is to provide student-teacher interaction. In distance education, we could not ask questions to students and create discussions."* The statements of the lecturer coded A15, who explained the difficulty he experienced in distance education with the lack of technological infrastructure, are as follows: *"If there was a very strong infrastructure or if my internet was very strong, maybe I would not have difficulty in distance education."* The lecturer coded A9 expressed the difficulty he experienced in distance education as screen fatigue as follows; *"The screen was very tiring. It is constantly lecture, screen, homework, screen..."*

Findings on instructors' self-evaluation in face-to-face and distance education experience

When the instructors were asked to make a self-evaluation based on their face-to-face and distance education experiences, all instructors (f=18) found themselves more successful in face-to-face education. In addition, four instructors also evaluated themselves as successful in distance education. When the same table is continued to be analyzed, most of the lecturers evaluated themselves as partially successful in distance education (f=11), while three lecturers evaluated themselves as unsuccessful in distance education.

Table 5. Self-evaluations of instructors' experiences with face-to-face and distance education

		Face-to-Face Education	Distance Education
Theme	**Code**	**f**	**f**
Self-Assessment	Successful	18	4
	Partially Successful	0	11
	Failed	0	3

The statements of the lecturer coded A7, who found himself more successful in face-to-face education based on his experience of face-to-face education and distance education process and explained the reason for this situation with his inadequate technology use and skills, are as follows; *"I am more successful in face-to-face education and I enjoy it and I think I learn more and teach more. I told you that I am not good at using technology."* The lecturer coded A16 explained the reason why he characterized his self-evaluation as partially successful in distance education by justifying it as follows; *"I cannot say that I am successful in measurement and evaluation in distance education, I can summarize distance education as follows; the student did not stay away from education and training for a year. We tried to keep them in the environment in one way or another. Let's not say we succeeded, but let's say we tried. I did my best, I can neither call it successful nor unsuccessful."*

When Table 5 is analyzed, it is seen that four instructors characterized their self-evaluations as successful in distance education as they were in face-to-face education. The lecturer coded A5 justified his self-assessment as successful in the distance education process as follows; *"If I need to evaluate myself in general, I found myself successful, I was a prepared lecturer. I am a person who can use technology and has technology knowledge because of my field."* Within the scope of all these processes, the statements of the lecturer coded A14, who characterized himself as unsuccessful especially in distance education, are as follows; *"When I evaluate myself in distance education, I can consider myself unsuccessful, I can say this clearly."*

DISCUSSION AND CONCLUSION

With the Covid-19 pandemic, the importance of distance education has once again emerged in order not to interrupt education and training activities. This research, which was conducted in order to reveal the thoughts of the lecturers about this education model due to the fact that they have experienced distance education and gained an experience, as well as to make some suggestions about this education model, examined the advantages and disadvantages of distance education, distance education model and face-to-face education models from the eyes of the participants from different perspectives. In this context, the general teaching of the course in face-to-face education and distance education, the benefits and limitations of both education models, the difficulties experienced in distance education and the self-evaluations of the participants within the scope of all these processes were determined based on the explanations and descriptions of the participants as the themes of the research.

In face-to-face education, the general teaching of a course is mostly carried out by lecturers with the presentation strategy, and the most commonly used method-techniques are the lecture method, question-answer and discussion techniques. In this context, it can be said that instructors do not prefer different constructivist-based strategies. In their research, Kurnaz and Serçemeli (2020) concluded that the lecturers in face-to-face education use the classical method of using the board and slides to teach their lessons, and accordingly, they mostly prefer the presentation strategy. In this context, it is in parallel with the findings of this study. When the findings in the same theme continued to be analyzed, it was concluded that the time allocated for a lesson in face-to-face education was between 45-90 minutes, and that both the instructor and the student were active in this process. Based on the explanations of the participants, the reasons for the student's being active in the course can be explained by the fact that the course content is suitable for the student's activity and the necessity of the student's active participation in applied courses. It was observed that instructors had difficulty in completing the course content they planned in face-to-face education until the end of the semester.

With the transition to distance education, there have been significant changes in the general teaching of a course, which was the first theme of the study. These changes were seen in the strategies-methods-techniques used, the time used, stakeholder activism and the completion of the course content. One of the most striking findings of the study was that the planned course content could not be completed in face-to-face education while it was completed in distance education. The reason for this is thought to be that instructors cannot involve students in distance education as much as in face-to-face education model, instructors are more active in the course process than in face-to-face education, and interaction and effective communication cannot be provided by stakeholders.

In this study, the biggest advantage of face-to-face education for lecturers is explained by the fact that it is easier to involve students in the process of education and training activities. This can be explained by the fact that the interaction in face-to-face education model is reciprocal and thus communication between stakeholders is easier, eye contact can be established and feedback/correction can be given to stakeholders. Institutions where face-to-face education activities are carried out are an

environment where students can participate effectively and provide a discussion environment, and where students can develop personal competencies such as empathy, love, respect and self-confidence (Zins et al. 2007). Another noteworthy result of the study is that the measurement and evaluation conducted for the course is thought to give more accurate results in face-to-face education. The reason why lecturers think this way can be explained by cheating in exams conducted in distance education. The negative evaluation of measurement and evaluation in distance education is associated with the fact that it is easier to cheat in online exams, inadequate or complicated distance education system software of universities, and the inadequacy of instructors and students in using information communication technologies (Kınalıoğlu & Güven, 2011). In this study, lecturers were of the opinion that face-to-face education has no limitations.

Based on the findings of the research, the advantages of distance education are that it provides an increase in the technology usage skills of individuals due to the fact that individuals are more exposed to technology, that education can be done anywhere and anytime by providing a space-independent education and training opportunity, and that it is economical in terms of time. Instructors who think that face-to-face education has no limitations think that distance education has many limitations. These limitations are as follows: interaction and communication cannot be carried out mutually, lack of or inadequate technological and technical infrastructure, inefficiency of distance education for applied courses, and inequality of technological opportunities especially among students. The limitations of distance education are encountered in both national and international literature. The fact that distance education is more efficient for theoretical courses and the lack of technological infrastructure are the biggest limitations (Djalilova, 2020; Gao & Zhang, 2020; Atmojo & Nugroho, 2020; Christoforou, 2021). Aras and Karakaya (2020) concluded in their research that distance education eliminates time and space problems, but there may be problems in effective communication and interaction. From this point of view, the results of this study and the results obtained from the findings of this study are similar.

The biggest difficulty experienced in distance education is that the interaction between student-student or instructor-student cannot be carried out mutually. The reasons for this situation can be explained by the shorter duration of the course compared to face-to-face education, the inability of the instructors to involve the student in the process in order to complete the planned course content until the end of the semester, the lack of technological facilities or lack of technological infrastructure of the students, and the students' lack of desire to participate interactively in the course since they are in a certain comfort zone. Similar findings were also found in the studies of Tuncer and Tanaş (2011), Gürer et al. (2016), Moorhouse and Kohnke (2021) and they stated that the instructors were not satisfied with the limited interaction, which is one of the biggest limitations of distance education. One of the most striking difficulties experienced in distance education is the limited technological equipment possibilities of the students and the technical infrastructure problems (problems in internet connection, difficulties in the distance education system provided by the university, etc.) encountered by both students and instructors. In their study, Karadağ and Yücel (2020) found that 63% of the students had internet connection at home and 66% had computers and tablets. Therefore, they concluded that 64% of the students continued distance education with computers or tablets, 32% with smartphones, and 23% could not continue distance education in any way. In their study, Simamora et al. (2020) emphasized the need for the widespread use of distance education in terms of providing more materials, although instructors have problems such as insufficient internet access.

Within the scope of this research, another difficulty experienced by the instructors in distance education was the inability to provide classroom management. Within the scope of this research, it is possible to say that the lecturers do not see classroom management as a discipline because they think that classroom management can be achieved through mutual communication and interaction as well as eye contact. In the study conducted by Fakazlı, İlhan and Yılmaz (2021), lecturers stated that classroom management is easier in distance education. This can be explained by the fact that instructors see classroom management as a discipline.

In the distance education process, instructors characterized their self-evaluation as partially successful. The reason for this situation was explained in different ways by the participants; the most emphasized point is that the instructors explained their technology usage skills as intermediate level; they need a certain amount of time to reach the level of technology knowledge-skills-usage of today's conditions. In this context, it is thought that when instructors are given enough time and technological opportunities, they can adapt to the distance education system more. When the related literature is examined, the positive self-evaluation of the lecturers is associated with their ability to achieve the purpose of their courses (Ustabulut, 2021).

RECOMMENDATIONS

Based on the above, some suggestions were made for the distance education system to be more efficient with the results of this research and for future research.

1. This research was conducted only with instructors. In another research, the views and experiences of distance education model from the perspective of both stakeholders can be revealed by including students in the research.

2. The opinions of lecturers in seven regions of Turkey on distance education can be revealed.

3. Even though we were caught unprepared for distance education, it is possible to say that the instructors adapted to the distance education system at the end of a semester. In this context, the ground for a more successful education and training

process can be created by eliminating the technological-instrument deficiencies and technological infrastructure deficiencies of both instructors and students.

4. In addition to providing in-service training to the lecturers, it will be possible for them to find themselves at least as successful in the distance education system as in face-to-face education by giving them a certain amount of time for the development of their technological knowledge-skill competencies.

5. The limitations of distance education can be minimized by equipping universities with the necessary technological equipment and infrastructure.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, author-ship, and/or publication of this article

Statements of publication ethics

I/We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Examples of author contribution statements

The study was conducted and reported with equal collaboration of the researchers.

Researchers' contribution rate

The study was conducted and reported with equal collaboration of the researchers.

Ethics Committee Approval Information

For the master's thesis "The View of the Lecturers to Distance Education in the Covid-19 Pandemic", was discussed by the Kastamonu University Social and Human Sciences Research and Publication Ethics, at the meeting dated 4.01.2022 unanimously approved.

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| Araştırma Makalesi / Research Article |

Investigation of The Performance Anxiety of Music Teacher Candidates in Context of Various Variables (Example of Ankara Music and Fine Arts University)

Müzik Öğretmeni Adaylarının Performans Kaygısı Düzeylerinin Çeşitli Değişkenler Bağlamında İncelenmesi (Ankara Müzik ve Güzel Sanatlar Üniversitesi Örneği)

Feride Deniz ÖZDAMAR[1]

Abstract

Purpose: aim: The aim of this research is to determine whether the performance anxiety levels of students studying at Ankara Music and Fine Arts University, Faculty of Music and Fine Arts Education, Music Education department differ according to gender, grade level, individual instrument type and individual instrument success level.

Design/Methodology: . Correlational survey model was used to describe the current situation in the research. The study group consists of 67 music teacher candidates who continue their education in the 1st, 2nd and 3rd grades of Ankara Music and Fine Arts University, Faculty of Music and Fine Arts Education, Department of Music Education in the fall semester of the 2022-2023 academic year. Kenny Music Performance Anxiety Inventory "K-MPAI" developed by Kenny, Davis, and Oates (2004) and adapted into Turkish by Özevin-Tokinan (2013) was used as a data collection tool in the study.

Findings: The findings showed that teacher candidates have moderate performance anxiety. In the study, it was concluded that gender, individual instrument type and level of success were variables that caused a difference in the performance anxiety levels of teacher candidates, but the grade level was the variable that did not cause a difference in anxiety scores.

Öz

Çalışmanın amacı: Bu araştırmanın amacı, Ankara Müzik ve Güzel Sanatlar Üniversitesi, Müzik ve Güzel Sanatlar Eğitim Fakültesi, Müzik Eğitimi bölümü öğrencilerinin performans kaygısı düzeylerinin cinsiyete, öğrenim görülen sınıf düzeyine, bireysel çalgı türüne ve bireysel çalgı başarısı düzeyine göre farklılaşıp farklılaşmadığını saptamaktır.

Materyal ve Yöntem: Araştırmada var olan durumu betimlemek amacıyla ilişkisel tarama modeli kullanılmıştır. Çalışma grubunu 2022-2023 öğretim yılı güz döneminde Ankara Müzik ve Güzel Sanatlar Üniversitesi, Müzik ve Güzel Sanatlar Eğitim Fakültesi, Müzik Eğitimi bölümü 1., 2. ve 3. sınıfta öğrenimini sürdüren 67 müzik öğretmeni adayı oluşturmaktadır. Çalışmada veri toplama aracı olarak, Kenny, Davis ve Oates (2004) tarafından geliştirilen ve Özevin-Tokinan (2013) tarafından Türkçe uyarlaması yapılan Kenny Müzik Performans Kaygısı Envanteri "K-MPKE" kullanılmıştır.

Bulgular: Elde edilen bulgular öğretmen adaylarının orta düzeyde performans kaygısına sahip olduklarını göstermiştir. Araştırmada cinsiyetin, bireysel çalgı türünün ve başarı düzeyinin öğretmen adaylarının performans kaygısı düzeylerinde farklılaşmaya yol açan değişkenler olduğu ancak sınıf düzeylerinin kaygı puanlamalarında farklılaşmaya yol açmayan değişken olduğu sonucu elde edilmiştir.

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INTRODUCTION

Anxiety is an emotional reaction such as threat, risk, worry, fear that a person may face throughout his life. However, anxiety, which is a stimulant, is a stimulus that affects one's learning. In this context, the effect of anxiety on learning differs according to the developmental qualities of individuals. When the definitions in the literature are examined, it is understood that anxiety is a state of fear that the person feels unexpectedly or constantly without knowing about the problem (Çiçek, 2020, p.28). Anxiety is most commonly described as fear, risk, misfortune or discomfort. However, according to the framework in which it is defined and the area of use, the content of the term anxiety is also quite wide and differs within itself, without disturbing its theoretical structure (Uzun, 2016, p.9).

"Anxiety" is derived from the root "difficulty breathing", which has its origin in Latin. Anxiety was used frequently in the field of literature after the second half of the 19th century in the history of humanity. It has been one of the most common words in western literature, fine arts, especially in music, science, philosophy, religion, and politics. Starting from the other half of the twentieth century, psychology has been emphasized and many studies have been carried out. The concept of anxiety was first defined by Freud and its causes were investigated" (Freud, 1926 as cited in Erözkan, 2020, p.13).

Anxiety can be defined as a state of worry and tension felt under a risk (Büyüköztürk, 1997).

Anxiety is an emotional state in which the individual perceives and interprets his/her internal or external sensations as a risky situation and can watch continuously (Bilici, 2020, p.23). When we look at the common components of the definitions, we can understand that the person is automatically stimulated in the physiological, psychological and behavioral context.

It can also be stated that anxiety has positive effects in terms of preparing oneself against negative situations that may arise and taking precautions. Anxiety is an emotional state that sometimes leads the person to positive behaviors in daily life, and sometimes prevents positive behaviors and causes uneasiness in general (Başarır, 1990, p.1 quoted by Çiçek, 2020, p.28). According to Demir (2020), cognitive, behavioral, psychological and physiological reactions experienced by the individual during anxiety may occur. Table 1 includes these components and their common features.

Table 1. Common Characteristics of Anxiety

Psychological Symptoms
" (1) Rapid heartbeat, palpitations; (2) shortness of breath, rapid breathing; (3) chest pain or pressure; (4) feeling of suffocation; (5) dizziness, lightheadedness; (6) sweating, hot flashes, chills; (7) nausea, upset stomach, diarrhea; (8) sway; (9) tingling or numbness in the arms, legs; (10) weakness, indecision, fainting; (11) tense muscles, inflexibility; (12) dry mouth"
Cognitive Symptoms
"(1) fear of losing control, not being able to cope; (2) fear of physical injury or death; (3) fear of going crazy; (4) fear of negative evaluation by others; (5) frightening thoughts, images, or memories; (6) perceptions of unreality or detachment from reality; (7) poor concentration, confusion, may be distracted; (8) limitation of attention, hypersensitivity to threat; (9) poor memory; (10) difficulty in reasoning, loss of objectivity"
Behavioral Symptoms
"(1) avoidance of threatening signs or situations; (2) escape, salvation; (3) seeking security, trying to alleviate anxiety; (4) restlessness, excitement, stepping; (5) rapid breathing; (6) freezing, immobility; (7) difficulty speaking Emotional Symptoms (1) being nervous, tense (2) scared, terrified; (3) restless, timid, irritable; (4) impatient, don't be disappointed"
Emotional Symptoms
"(1) nervous, (2) frightened, (3) restless, fearfull, irritable; (4) impatient, disappointed"

(Demir. 2020, s. 11).

An individual may experience anxiety in different areas of life, and performing in front of a crowd for any reason may cause anxiety in this context. When considered in terms of instrument training, the ability to perform the target of a piece in front of an ensemble is considered as a musical performance. Performance anxiety is one of the important factors affecting the quality of life of a person. Although the state of anxiety is quite common in people who perform music, the high level of anxiety can negatively affect the performance of the person.

"Performance manifests itself in all aspects of daily life, in all situations involving interaction with other people. Performance, as we use it in daily life, is expressed as "the effort spent in reaching a goal" (Ergun 2008, p.50)

There are many definitions of performance anxiety in the literature. According to Kruger (1993), concert organist and recording artist, who is known as a psychotherapist and international musician, performance anxiety or stage fright is basically the fear of life. This problem can mean a depressive strain or numbness of the nerves. Except in some abnormal situations, it is a normal reaction to a dangerous situation and this is because one can take risks because of the anxiety of failing to express oneself (Krüger, 1993, p.17 as cited in Sarıkaya, 2018, p.19).

Performance anxiety, which is a natural feature of the performance environment, can be considered a problem if it limits one's ability and personal potential. In this context, negative self-influence of the person in cognitive, affective and behavioral dimensions may cause performance anxiety to continue (Sarıcan, 2013, p.33).

"Performance anxiety has often been the case, especially for areas that require performance, such as on-stage arts or sports activities. It can be emphasized that this type of anxiety can be effective in different structures such as readiness, the environment in which the performance is performed or the audience. However, coping with anxiety is an element of the exam for the musician to perform fully and achieve success" (Erözkan, 2020, p.23).

Music performance anxiety, which is an area in which anxiety states are specialized, is a common condition that appears to those who receive music education and perform it in front of the public, regardless of amateur or professional. Music performance anxiety covers not only the stage moment, but also the pre-performance preparation and post-performance evaluation process. In addition to this, the performance of the instrument is a basic criterion in order to evaluate the stage performance, that is, to evaluate the success of the instrument. In addition, it is important for a performance artist to be able to overcome situations such as stress, anxiety and anxiety, to be successful in his instrument in technical, musical and artistic terms.

It can be stated that music performance anxiety is a combination of unsatisfactory emotional state, reaction and experienced qualities and related physiological differences apart from stress, anxiety, fear etc. Music Performance Anxiety is a reaction that occurs due to the nature of the person. It is a kind of arousal that occurs in order to motivate the body and mind to improve performance and to adapt when faced with a situation that the person perceives as a threat or to adapt to a difficult situation (Aydın, 2017, p.16).

The number of studies on music performance anxiety is increasing every year. When the literature is examined, it has been observed that some of the researchers' studies have shown that the performance anxiety of musicians affects their musical performance (Fehm, L., & Schmidt, K. 2006; Thomas, J.P., & Nettelbeck, T. 2014; Spahn, C., Echternach, M., Zander F.M., Voltmer, E., Richter, B. 2010; Nussek, M. Zander, M., & Spahn, C. 2015; Steptoe, A., Fidler, H. 1987; Ryan, C. 2005). Others have examined the performance anxiety of musicians in the context of the gender variable (Wesner, R.B., Noyes, R. Jr.& Davis, T.L. 1990), and studies have also been conducted on therapy methods used in the treatment of musical performance anxiety (Juncos, D.G., Markman E. J. 2016; Jungos, G.D., Heinrichs A.G., Towle, P., Duffy K., Grand, M.S., Morgan, C. M., Smith, D.J. and Kalkus, E. 2017; Shaw, T.A., Jungos, G.D., Winter, D. 2020).

It can be stated that Music Performance Anxiety, unlike negative emotional states, is a match state of the qualities related to the experience and the physiologically felt differentiations related to it (Bilici, 2020, p.26).

The ability of a performer to perform a musical performance is much more than just hitting the right notes, and the fact that he will perform a work that requires attention in front of an audience increases the risks of making mistakes, forgetting and losing control. It can be stated that this situation will increase the pressure, stress and anxiety on the person who will perform (Uzun, 2016, p.20)

Music teachers, due to their profession, perform with their instruments both in front of their students and in social activities such as ceremonies and commemorations. In this context, the fact that teacher candidates experience performance anxiety throughout their education life has not been defined, the reasons and not knowing how to deal with anxiety may cause problems in their professional lives. These difficulties they will experience in their professional life may negatively affect the quality of education and leave a negative impression on students (Tokinan, 2014, p.89)

The aim of this study, which was carried out in the light of the explanations above, was to determine the performance anxiety levels of music teacher candidates and to determine their differentiation levels in the context of various variables. For this purpose, answers to the following questions were sought:

1) What are the performance anxiety levels of the music teacher candidates?

2) The performance anxiety levels of the music teacher candidates

a) Does it differ according to gender?

b) Does it differ according to the grade levels?

c) Does it differ according to the individual instrument type?

d) Does it differ according to the instrument's level of success?

METHOD/MATERIALS

Research Model

In this study, a correlational survey model based on due diligence was structured in order to determine the performance anxiety of teacher candidates and to determine whether their anxiety levels differ according to various variables such as instrument performance, gender, grade level, etc. "In research in the field of education, the most common descriptive method is survey, researchers summarize characteristics (skills, preferences, behaviors, etc.) of individuals, groups or physical environments. Studies aimed at collecting data to determine certain characteristics of a group are called survey research" (Büyüköztürk, 2014, p.22).

"General survey models are survey arrangements made over the whole population or a group, sample or sample to be taken from the universe in order to make a general judgment about the universe in a universe consisting of many elements. Singular or relational survey can be made with general survey models. The correlational survey model is a research model that aims to determine the existence and/or degree of co-variance between two or more variables" (Karasar, 2002, p. 79-81).

Working Group

This research group consists of 67 teacher candidates who continue their education in Ankara Music and Fine Arts University, Faculty of Music and Fine Arts Education Department. 38 of the teacher candidates in the study group (56%) were female and 29 (44%) were male. The study group consisted of 27 (40%) from the 1st grade, 26 (39%) from the 2nd grade, 17 (21%) from the 3rd grade teacher candidates in the Ankara Music and Fine Arts University, Faculty of Music and Fine Arts, Music Education Department.

Data Collection Tools

Data in the research were collected through the "Personal Information Form" created by the researcher and the Kenny Music Performance Anxiety Inventory "K-MPAI" developed by Kenny in 2004 and adapted into Turkish by Özevin-Tokinan (2013).

Personal Information Form

The "Personal Information Form" created by the researchers was used to examine the variables (gender, grade level, individual instrument type and individual instrument success) that may be related to the performance anxiety levels of music teacher candidates.

Kenny Musical Performance Anxiety Inventory (KMPAI)

"Developed by Kenny in 2004, the K-MPAI was developed to measure pre-performance experiences and underlying psychological vulnerabilities, to better conceptualize the condition to help artists suffering from performance anxiety, and to take a step towards focusing on more appropriate, comprehensive treatments" (Tokinan, 2013, p.56).

When we look at the relationship between the components of the emotion-based anxiety theory put forward by Barlow and *K-MPAI*, the anxiety state (lack of control, unpredictability, negative effect, situational symptoms, etc.); attention shift (eg focusing on task or self-evaluation, fear of negative evaluation, etc.), physiological arousal and memory bias are included. Kenny's Music Performance Anxiety Inventory consists of 25 items and 5 sub-factors. These sub-factors are "Negative Performance Perception (items 1-14)", "Psychological Vulnerability (items 15-22)", "Somatic Anxiety (item 23)", "Personal Control (item 24)"" and "Physiological Vulnerability (item 25)". In the 7-point Likert-type inventory, items are scored as 1, 2, 3, 4, 5, 6, 7 from "strongly disagree" to "strongly agree". The Cronbach's Alpha coefficient of the inventory for this study group was found to be .727.

Table 2. Kenny Musical Performance Anxiety Inventory (K-MPAI)

1) I never know if my performance will be good before a concert.
2) My mouth is dry before and during the performance.
3) I feel nauseous or dizzy before or during a performance.
4) I often worry about getting a negative reaction from the audience.
5) I remember when I first started my music education, I was worried about going on stage.
6) I worry that one bad performance could ruin my career.
7) Before or during a performance, my heart beats faster and my heart is pounding in my chest.
8) I give up performance opportunities worth doing because of anxiety.
9) Anxiety and nervousness about my performance affect my focus and concentration.
10) Often, as I prepare for a concert, I expect disaster and fear.
11) I worry so much before a performance that I lose sleep.
12) I experience shaking, trembling or chills before or during a performance.
13) I worry about being scrutinized by others.
14) I worry about my own judgment of how I will perform.
15) I often find it difficult to find the strength to do something.
16) I often think that life doesn't have much to offer me.
17) Even if I work hard in preparation for a performance, it is possible for me to make mistakes.
18) I often think that I am not a valuable person.

19) During performance, I find myself unsure whether I can complete my performance.

20) Thinking about the evaluation results I will receive affects my performance.

21) Sometimes I feel anxious for no apparent reason.

22) I often think that there is nothing I can expect from life.

23) I experience feelings of panic before or during a performance.

24) After the performance, I worry if I can play well.

25) The tension in my muscles increases before or during performance.

Negative Perception of Performance: (1-14), Psychological Vulnerability: (15-22), Somatic Anxiety: (23), Personal Control: (24), Physiological Vulnerability: (25).

FINDINGS AND COMMENTS

Table 3 shows the attitude score, arithmetic mean and standard deviation values of the whole scale and its sub-factors.

Table 3. Descriptive Analysis Results of Teacher Candidates' Performance Anxiety Levels

Sub-Factors	N	Min.	Maks.	x̄	SS
Negative Perception of Performance	67	21,00	86,00	51,98	1,79
Psychological Vulnerability	67	10,00	42,00	26,02	,88
Somatic Anxiety	67	1,00	7,00	4,28	,22
Personal Control	67	1,00	7,00	4,55	,239
Physiological Vulnerability	67	1,00	7,00	4,50	,24
Total	67	**47,00**	**145,00**	**91,35**	2,61

When Table 3 is examined, the lowest score that teacher candidates can obtain from the performance anxiety scale is 25; The highest score is 175. In this context, based on the fact that the average of the anxiety scores obtained from the whole scale (91.35) is close to the middle point value, it is thought that teacher candidates' anxiety about performance is at a moderate level. T-test results are given in Table 4 in order to determine whether there is a significant difference in performance anxiety levels of teacher candidates according to genders.

Table 4. T-Test Results of Performance Anxiety Levels of Teacher candidates by Gender

Sub-Factors		N	x̄	SS	sd	t	p
Negative Perception of Performance	women	38	56,6053	15,12	65	3,137	**,003**
	man	29	45,9310	11,82			
Psychological Vulnerability	women	38	26,3947	8,14	65	,467	,642
	man	29	25,5517	6,07			
Somatic Anxiety	women	38	4,7632	1,80	65	2,515	**,014**
	man	29	3,6552	1,75			
Personal Control	women	38	4,7632	1,92	65	1,006	,318
	man	29	4,2759	2,01			
Physiological Vulnerability	women	38	4,9474	2,02	65	2,137	**,036**
	man	29	3,9310	1,79			
Total	women	38	97,4737	23,22	65	2,819	**,006**
	man	29	83,3448	15,68			

When Table 4 is examined, the performance anxiety levels of the teacher candidates have negative performance perceptions (t[65] =3,137; p<.05), Somatic Anxiety (t[65] =2,515; p<.05) and Physiological Vulnerability (t[65] =2.137; p<.05) factors seem to differ statistically significantly according to gender. This difference observed between the mean scores of male and female teacher candidates is statistically significant. The result of one-way analysis of variance, which was carried out to determine the differentiation of   teacher candidates' performance anxiety levels according to grade levels, is presented in Table 5.

Table 5. One-Way Analysis of Variance Results of Music Teacher Candidates' Performance Anxiety Levels According to Class Levels

Sub-Factors	The Source of Variance	Sum of Squares	Sd	Mean square	F	p
Negative Perception of Performance	between-groups variance	27,524	2	13,762	,062	,940
	within-group variance	14223,461	64	222,242		
	Total	14250,985	66			
Psychological Vulnerability	between-groups variance	109,188	2	54,564	1,030	,363
	within-group variance	3390,752	64	52,980		
	Total	3499,940	66			
Somatic Anxiety	between-groups variance	8,308	2	4,154	1,212	,304
	within-group variance	219,304	64	3,427		
	Total	227,612	66			
Personal Control	between-groups variance	19,062	2	9,531	2,590	,083
	within-group variance	235,506	64	3,680		
	Total	254,567	66			
Physiological Vulnerability	between-groups variance	8,646	2	4,323	1,106	,337
	within-group variance	250,100	64	3,908		
	Total	258,746	66			
Total	between-groups variance	102,492	2	51,246	,109	,897
	within-group variance	30028,911	64	469,202		
	Total	30131,403	66			

When Table 5 is examined, it is seen that there is no statistically significant difference in performance anxiety levels of teacher candidates according to grade level in the context of Negative Performance Perception, Psychological Vulnerability, Somatic Anxiety, Self-Control and Physiological Vulnerability sub-factors.

Table 6. One-Way Analysis of Variance Results of Music Teacher Candidates' Performance Anxiety Levels by Individual Instrument Type

Sub-Factors	The Source of Variance	Sum of Squares	Sd.	Mean square	F	p
Negative Perception of Performance	between-groups variance	884,435	3	294,812	1,390	,254
	within-group variance	13366,550	63	212,167		
	Total	14250,985	66			
Psychological Vulnerability	between-groups variance	109,599	3	36,533	,679	,568
	within-group variance	3390,342	63	53,815		
	Total	3499,940	66			
Somatic Anxiety	between-groups variance	27,337	3	9,112	2,866	**,044**
	within-group variance	200,275	63	3,179		
	Total	227,612	66			
Personal Control	between-groups variance	5,559	3	1,853	,469	,705
	within-group variance	249,008	63	3,953		
	Total	254,567	66			
Physiological Vulnerability	between-groups variance	34,863	3	11,621	3,270	**,027**
	within-group variance	223,883	63	3,554		
	Toplam	258,746	66			
Total	between-groups variance	2232,161	3	744,054	1,680	,180
	within-group variance	27899,424	63	442,845		
	Total	30131,403	66			

When Table 6 is examined, it is seen that there is a statistically significant difference in performance anxiety levels of teacher candidates according to individual instrument type in the context of Somatic Anxiety (F=2,866,p<.05) and Physiological Vulnerability (F=3,270, p<.05) factors. The results of the LSD test performed to determine between which groups the resulting differentiation occurred are given in Table 7.

Table 7. Results of the LSD test performed to determine between which groups the differentiation occurred according to individual instrument type in the context of somatic anxiety and physiological vulnerability in Performance Anxiety Levels of Teacher candidates

Sub-Factors		mean difference	SS	p
Somatic Anxiety	Clavier - Bow	-2,10	,74	,006
	Wind- Clavier	1,85	,78058	,021
Physiological Vulnerability	Clavier - Bow	-2,20	,78861	,007
	Bow - Strings	1,36	,57	,020

In Table 7, the data on the difference in anxiety level of teacher candidates according to individual instrument type were examined. In the context of the Somatic Anxiety factor, it is seen that the anxiety levels of those whose individual instruments are keyed (X=2.75) are statistically significantly lower than those whose individual instruments are stringed (X=4.85) and wind

instruments (X=4.60). In the context of the Physiological Vulnerability factor, it is seen that the anxiety levels of those whose individual instruments are stringed (X=5.45) are statistically significantly higher than those whose individual instruments are with keys (X=3.25) and strings (X=4.08).

Table 8. One-Way Analysis of Variance Results of Music Teacher Candidates' Performance Anxiety Levels According to Academic Achievement

Sub-Factors	The Source of Variance	Sum of Squares	Sd.	Mean square	F	p
Negative Perception of Performance	between-groups variance	2214,349	4	553,587	2,851	**,031**
	within-group variance	12036,636	62	194,139		
	Total	14250,985	66			
Psychological Vulnerability	between-groups variance	647,156	4	161,789	3,516	**,012**
	within-group variance	2852,784	62	46,013		
	Total	3499,940	66			
Somatic Anxiety	between-groups variance	45,371	4	11,343	3,859	**,007**
	within-group variance	182,241	62	2,939		
	Total	227,612	66			
Personal Control	between-groups variance	8,158	4	2,040	,513	,726
	within-group variance	246,409	62	3,974		
	Total	254,567	66			
Vulnerability	between-groups variance	21,341	4	5,335	1,393	,247
	within-group variance	237,405	62	3,829		
	Total	258,746	66			
Total	between-groups variance	5524,260	4	138,065	3,48	**,013**
	within-group variance	24607,143	62	396,889		
	Total	30131,403	66			

When Table 8 is examined, it is seen that there is a statistically significant difference in performance anxiety levels of teacher candidates according to academic achievement in the context of Negative Performance Perception (F=2,851, p<.05), Psychological Vulnerability (F=3,516, p<.05) and Somatic Anxiety (F=3,589, p<.05). The results of the LSD test performed to determine between which groups the resulting differentiation occurred are given in Table 9.

Table 9. The results of the LSD test performed to determine between which groups the differentiation occurred according to instrument performance in the context of negative performance perception, psychological vulnerability and somatic anxiety factors of performance anxiety levels of teacher candidates

Sub-Factors			mean difference	SS	p
Negatif Performans Algısı	75-84	95-100	161,181	4,87	,002
	85-94	95-100	12,272	4,87	,014
Psychological Vulnerability	55-64	85-94	9,272	3,687	,015
	55-64	95-100	10,807	3,878	,007
	65-74	85-94	7,439	3,124	,020
	65-74	95-100	8,974	3,347	,009
Somatic Anxiety	55-64	65-74	2,50	1,106	,027

	55-64	95-100	3,07	,980	,003
	75-84	95-100	1,80	,599	,004
	85-94	95-100	1,62	,599	,009
	85-94	95-100	-1,44	,684	,038
Total	55-64	95-100	28,173	11,390	,016
	65-74	95-100	20,756	9,83	,039
	85-94	95-100	17,513	6,96	,015

In Table 9, the data on the difference in anxiety level of teacher candidates according to instrument success were examined. In the context of negative performance perception, the success score of the individuals defined in the 95-100 (X=41.00) range differs significantly from those defined between 75-84 (X=57.18) and 85-94 (X=53.27) levels appear to be lower. In the context of the psychological vulnerability factor, it was observed that the anxiety levels of people whose instrument success was defined in the 85-94 (X=24.22) range were lower than those whose instrument performance was defined between 55-64 (X=33.50) and 65-74 (X=31.66) instruments. In addition, the anxiety levels of individuals defined in the range of 95-100 (X=22.69) differ significantly in favor of instrument success scores compared to those defined in the range of 55-64 (X=33.50) and 65-74 (X=31.66). In the context of somatic anxiety, the success scores of the individuals defined as 95-100 (X=2.92), 55-64 (X=4.54), 75-84 (X=4.72) and 85-94 (X=4.54) It is seen that there is a significant difference in favor of teacher candidates (significantly low in enrollment level).

CONCLUSION AND DISCUSSION

Today, the fact that music teacher candidates experience performance anxiety and have negative psychological and physical behaviors due to different variables are among the subjects examined by music education researchers. When the data obtained from this study are evaluated, it can be stated that the performance anxiety levels of the music teacher candidates are close to the average value, and teacher candidates' concerns about performance are at a moderate level.

When we look at the gender variable that affects the anxiety levels, in the context of sub-factors, it is seen that the performance anxiety levels of teacher candidates differ statistically according to gender in the context of negative performance perception, somatic anxiety and psychological vulnerability. It was concluded that the resulting differentiation was more anxious in women at the level of the whole scale and defined sub-factors.

In addition to this study, in which the data that gender is a variable that affects the performance anxiety levels of music teacher candidates, results about the gender variable were also obtained when the literature was examined. In a study conducted with the participation of musician students, it was stated that women showed higher anxiety than men (Abel&Larkin, 1990). In another study that supports this result; It has been stated that performance anxiety has a negative effect and that female students have higher anxiety scores than male students (Atay, 2018). In this context, the disadvantage of female students with high music performance anxiety due to anxiety during the performance negatively affects female students psychologically and physically.

According to the results of the research, it was concluded that the performance anxiety levels of the teacher candidates did not differ statistically significantly according to the grade level in terms of negative performance perception, psychological vulnerability, somatic anxiety, personal control and vulnerability factors. In another study in the literature, it was determined that the music performance anxiety of teacher candidates differed significantly between 1st and 2nd grades and 1st and 4th grades according to the grade level. This difference was reflected in the results as the performance anxiety of the 1st grade music teacher candidates was lower than the music performance anxiety of the 2nd and 4th grade music teacher candidates (Jelen, 2017).

According to the individual instrument type, the performance anxiety levels of teacher candidates; It was concluded that there was a statistically significant difference in the context of somatic anxiety and physiological vulnerability sub-factors. When the studies on this variable were examined, it was seen that the self-efficacy perception levels of the students regarding stage management differed significantly according to the individual instrument types (Birdal, 2021). In another study, it was concluded that there was a significant difference between the trait anxiety level of music teaching students in terms of instruments, but there was no significant difference between the anxiety level of statefulness (anxiety that occurs at a certain moment and under a certain condition) (Umuzdaş & Tök, 2020).

Music performance anxiety, which causes physical and psychological behaviors, also affects musicians' instrument success. According to another result obtained from the research, according to the academic success of the performance anxiety levels of the teacher candidates; It was concluded that there was a statistically significant difference in terms of negative performance perception, somatic anxiety and psychological vulnerability factors. When we look at the literature (Nacakcı & Dalkıran), it is stated that students with academic success scores between 41-60 in individual instrument lessons are more anxious than those with an academic success score of 81-100, and students with high academic success have lower anxiety in instrument exams. When we look at the findings of another study examining academic achievement scores, it was concluded that as the test anxiety levels of music teacher candidates decrease, instrument education success scores increase (Küçük, 2010). The findings of the studies obtained support each other.

Music teachers, who have to perform in front of an ensemble throughout their professional life, are expected to be successful in performance-oriented courses in undergraduate programs. In this context, instrument success is a basic criterion in the evaluation of students. Within the framework of this research, it was concluded that the performance of music teachers in front of the public negatively affects their anxiety levels, depending on various variables. The fact that their anxiety levels are lower can contribute positively to them in terms of successfully performing their profession and raising successful students. It is thought that this study will draw attention to the importance of music performance anxiety in the context of various variables.

RECOMMENDATIONS

Considering the results of this research;

It is thought that it is normal for people who play bow instruments to show performance anxiety compared to their keyboard instruments because they are in the music community. In this context, it is suggested that those who perform the relevant instruments should perform more frequently in the musical ensemble.

Based on the fact that high instrument performance is a variable that affects performance anxiety, educational experiences should be presented to increase the instrument success of individuals. (Çalgı eğitimi derslerinin programlardaki sürelerinin iyileştirilmesi, çalgıdaki yetkinliği destekleyen bireyin aktif katılımına fırsat veren workshopların düzenlenmesi, Bireysel öğretim yöntemlerinin kullanılması, vb.)

When evaluated within the framework of behavioral theories, it is recommended to give positive reinforcements for the individual's instrument performance in order to increase or maintain the individual's instrument success, and to remove negative stimuli (eg, Perfectionist attitude of the family, high expectations, works not suitable for the individual's readiness level, etc.).

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author received no financial support for the research, author-ship, and/or publication of this article.

Statements of publication ethics

I hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The study was conducted and reported with equal collaboration of the researchers.

Ethics Committee Approval Information

Ethics Committee Approval for this research was received from Ankara Music and Fine Arts University Ethics Committee.

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APPENDIX

CONTENT	(0) Strongly Disagree	(1)	(2)	(3)	(4)	(5)	(6) Strongly Agree
1) I never know if my performance will be good before a concert.							
2) My mouth is dry before and during the performance.							
3) I feel nauseous or dizzy before or during a performance.							
4) I often worry about getting a negative reaction from the audience.							
5) I remember when I first started my music education, I was worried about going on stage.							
6) I worry that one bad performance could ruin my career.							
7) Before or during a performance, my heart beats faster and my heart is pounding in my chest.							
8) I give up performance opportunities worth doing because of anxiety.							
9) Anxiety and nervousness about my performance affect my focus and concentration.							
10) Often, as I prepare for a concert, I expect disaster and fear.							
11) I worry so much before a performance that I lose sleep.							
12) I experience shaking, trembling or chills before or during a performance.							
13) I worry about being scrutinized by others.							
14) I worry about my own judgment of how I will perform.							
15) I often find it difficult to find the strength to do something.							
16) I often think that life doesn't have much to offer me.							
17) Even if I work hard in preparation for a performance, it is possible for me to make mistakes.							
18) I often think that I am not a valuable person.							
19) During performance, I find myself unsure whether I can complete my performance.							
20) Thinking about the evaluation results I will receive affects my performance.							
21) Sometimes I feel anxious for no apparent reason.							
22) I often think that there is nothing I can expect from life.							
23) I experience feelings of panic before or during a performance.							
24) After the performance, I worry if I can play well.							
25) The tension in my muscles increases before or during performance.							

| Research Article / Araştırma Makalesi|

Analysis of Sample Science Questions for Secondary School Exam in terms of Revised Bloom Taxonomy

Ortaöğretime Geçiş Merkezi Sınava İlişkin Fen Bilgisi Örnek Sorularının Yenilenmiş Bloom Taksonomisine Göre İncelenmesi

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Abstract

Purpose: In this research, it is aimed to examine the sample questions for the exam in high school transition system published between 2018-2022 according to the revised bloom taxonomy.

Design/Methodology/Approach: The document analysis model was used and The data source of this research is the science questions in the sample questions for the central examination for secondary education institutions to admit students by examination published on the website of the General Directorate of Measurement, Evaluation and Examination by the Ministry of National Education since October 2018. Between October 2018 and December 2022, a total of 355 science questions were published and in this study all of these questions examined according to the revised bloom taxonomy.

Findings: Most of the sample questions examined are within the scope of conceptual questions. 74% of the questions published in 2018, 75% of the questions in 2019, 66% of the questions in 2020 and 2021, and 70% of the questions in 2022 are at the level of conceptual knowledge.

Highlights: Almost all of the questions are in the conceptual knowledge class and are preferred from low-level questions, and high-level questions are the last ones. Another important finding is that all of the high-level questions (58 questions) are preferred from the category "Analyze", but not at all from the categories "Evaluate" and "Create".

Öz

Amaç: Bu araştırmada 2018-2022 yılları arasında yayınlanan lise geçiş sistemindeki sınava yönelik örnek soruların yenilenmiş Bloom taksonomisine göre incelenmesi amaçlanmıştır.

Tasarım/Yöntem/Yaklaşım: Bu araştırmada doküman incelemesi modeli kullanılmış ve bu araştırmanın veri kaynağı olarak Ölçme, Değerlendirme ve Sınav Hizmetleri Genel Müdürlüğü'nün internet sitesinde yayınlanan Millî Eğitim Bakanlığınca Liselere Geçiş Sistemi (LGS) kapsamındaki merkezi sınava yönelik hazırlanan örnek fen bilimleri sorularıdır. Ekim 2018 ile Aralık 2022 arasında toplam 355 örnek fen bilimleri sorusu yayınlanmıştır ve bu çalışmada bu soruların tamamı yenilenmiş Bloom taksonomisine göre incelenmiştir.

Bulgular: İncelenen örnek soruların çoğu kavramsal sorular kapsamındadır. 2018'de yayınlanan soruların %74'ü, 2019'daki soruların %75'i, 2020 ve 2021'deki soruların %66'sı ve 2022'deki soruların %70'i kavramsal bilgi düzeyindedir.

Öne Çıkanlar: Soruların tamamına yakını kavramsal bilgi dersinde olup alt düzey düşünme sorulardan tercih edilmekte, üst düzey düşünme soruları ise son sırada yer almaktadır. Bir diğer önemli bulgu da üst düzey soruların tamamı (58 soru) çözümleme kategorisinden tercih edilirken, "Değerlendirme" ve "Oluşturma" kategorilerinden hiç soru tercih edilmemesidir.

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INTRODUCTION

Education is a system with input, process, output and feedback mechanisms. Exams are one of the most effective ways to provide results and feedback to students, parents and the school. In order to evaluate the results of the teaching in education, both national and international exams are applied and their results are emphasized with sensitivity (İncikabı, Pektaş, & Süle, 2016). In Türkiye, central measurement and evaluation is carried out by the Ministry of National Education (MoNE) and the Student Selection and Placement Center (SSPC) to select students for secondary and higher education institutions. The Ministry of National Education has implemented five different systems in the transition to secondary education since 1997, with the claim of improving the quality of the exam, which is the transition to secondary education, eliminating the differences in education between regions, and implementing a system in line with the requirements of the age (Demir & Yılmaz, 2019). More recently a new system of transition to secondary education, called High School Transition System (HSTS), was put into practice on February 14, 2018 because the latter one was abolished on October 3, 2017, on the grounds that it is not possible to enter high schools without score and all students have to take the exam and experience exam stress. (MoNE, 2018). The exam in high school transition system was occurred on June 2018 for the first time. There are 90 questions consisting of 50 verbal and 40 numerical questions.

Since October 2018, the Ministry of National Education has published some sample questions for the exam in high school transition system. These sample questions are similar to the main exam to be held at the end of 8th grade. In this way, the students who will take the exam have an idea about which subjects and what kind of questions they will encounter. Therefore, considering that the students will be placed in secondary education with the scores they will get from this exam, it will be useful to determine the acquisitions necessary to solve these questions and to determine the cognitive process steps. Classification is made according to various taxonomies in order to determine at which cognitive process and knowledge level the exam questions are and at what level the students have acquired (Demir, 2011). Among these taxonomies, Bloom's Taxonomy is preferred (Thompson, 2008).

Taxonomy enables students to classify the goals they want to gain (Bümen, 2006). Another benefit of taxonomies is that they rank the targets from simple to complex, from concrete to abstract, as prerequisites for each other (Sönmez, 2015). Although there are more than one taxonomy in the literature, the most preferred is Bloom Taxonomy or Revised Bloom Taxonomy. Among the reasons why Bloom's taxonomy is preferred more is its effect on providing consistency by giving importance to the classification of the cognitive domain and the measurement process (Gündüz, 2009). Thinking skills in this taxonomy are of two types, lower and higher thinking skills. The titles of knowledge, comprehension and application are at the lower level, while the titles of analysis, synthesis and evaluation are at the upper level. The Bloom Taxonomy was reviewed in 2000 by Anderson and his colleagues and brought to the literature as the Revised Bloom Taxonomy (Anderson et al., 2014).

Revised Bloom Taxonomy

The original Bloom's Taxonomy was widely accepted, but it was criticized by some researchers in the following years, and as a result, a need for renewal arose (Yüksel, 2007). The first classification made was renewed in line with the criticisms and the fact that the student-centered approach did not fully measure the high-level thinking skills (Anderson et al., 2001). The expert team formed under the leadership of Anderson, a student of Krathwohl and Bloom, who also took part in the preparation of the original taxonomy, claimed that the taxonomy process was not completed (Anderson, 1999; Krathwohl, 2002). From this point of view, this team, consisting of curriculum development, assessment and learning psychologists, rearranged the original taxonomy after five years of work and published it under the editorship of Anderson and Krathwohl (Anderson, 2002). The most important difference that distinguishes the revised Bloom Taxonomy from the original is the two-dimensionalization of the cognitive domain (Krathwohl, 2002). With YBT, the classification process has changed from one-dimensional to two-dimensional. With YBT, noun and verb forms are separated from each other and become easy to understand. In the dimension of knowledge, noun cases consist of 4 categories, in the cognitive process dimension, verb cases consist of 6 steps (Arı, 2011).

Level of Knowledge

Today's education system is based on constructive, active and cognitive learning, which includes meaningful learning. It is accepted that students choose the necessary information for their own learning, away from passivity, at the center of learning. Students have become a permanent learning tool by making sense of the given information rather than being a recording device that takes the information from their teachers, parents and textbooks. In the current understanding of learning, in which the student is centered and constructivist learning predominates, what students learn and how they learn shows the importance of meaningful learning. It is accepted that students create their own meaningful learning by using the positive and negative aspects of the environment depending on their previous knowledge, cognitive and metacognitive activities and all the activities they can benefit from in the teaching environment. Students try to make sense of the information they have acquired in the new environments they enter by making use of their previous knowledge. In this context, there are cognitive processes in which students can actively use their previous knowledge in constructivist learning. Information dimension; It consists of four main groups as factual knowledge, conceptual knowledge, procedural knowledge and metacognitive knowledge and eleven subgroups (Anderson & Krathwohl, 2001).

Cognitive Process

Increasing the permanence and transfer of learned knowledge is also among the two most important aims of education. While the ability to remember a previously learned material close to the way it was learned after a certain period of time expresses the permanence of learning, the ability to search for answers to new questions, find solutions to new problems and facilitate new learning refers to the transfer of what has been learned. In the updated taxonomy, cognitive processes focus in detail on the "Comprehension, Application, Analysis, Evaluation and Creation" steps, which enable the transfer of what has been learned, rather than the "Remembering" step that provides permanence (Anderson & Krathwohl, 2001).

The Revised Bloom Taxonomy is formed as in the following Table 1.

Table 1. The Revised Blook Taxonomy

Level of Knowledge	Cognitive Processes					
	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual						
Conceptual						
Procedural						
Metacognitive						

When the relevant literature is examined, it is seen that there are studies that examine the objectives included in the curriculum for different courses according to the Revised Bloom Taxonomy (RBT). Examining the achievements of science curriculum (Aktan & Sevinç, 2018; Avcı, Öz, Cangüven & Binzet, 2017; Gökler & Arı, 2012; Güven & Aydın, 2017; Kurnaz & Yaz, 2017); analysis of science and technology course exam questions (Arı & İnci, 2015; Ayvacı & Türkdoğan, 2010); examination of secondary school chemistry curriculum outcomes (Zorluoğlu, Kızılaslan, & Sözbilir, 2016); examination of secondary school mathematics curriculum (6-8th grades) achievements (Kablan, Baran & Hazer, 2013), analysis of mathematics course exam questions (Baki & Köğce, 2009; Dursun & Parim-Aydin, 2014; Karaman & Bindak, 2017), analysis of national level exam questions (Aypay, Gökler & Arı, 2012; Baş & Beyhan, 2012; Çevik, 2010; Dursun & Parim-Aydin, 2014, Çifçi, Sönmez & Koç, 2013) studies have been carried out.

Among these studies, Köğce and Baki (2009) examined the exam questions prepared by mathematics teachers and concluded that the questions generally measure low-level thinking skills. In the study of Gündüz (2009), Science and Technology questions were examined and it was concluded that 64.65% of these questions were at the knowledge level, while 92.19% of them were low-level questions. In addition, Ayvacı and Türkdoğan (2010) examined the written questions prepared by the teachers in the Science and Technology lesson according to the new taxonomy in their study and concluded that the questions were at the level of remembering and knowing at a rate of 55%. In another study, the achievements in the 2013 Science curriculum were examined according to the renewed Bloom taxonomy and it was concluded that 69% of the gains were in the sub-cognitive level steps of the taxonomy, but when it was examined in terms of knowledge, 63% of them were in the conceptual knowledge dimension (Yaz & Kurnaz, 2013). In the study of Karaman and Bindak (2017), 72.5% of the TEOG exam questions were low-level and 27.5% were high-level; They determined that 41.3% of the exam questions prepared by the teachers were at the level of understanding and application. In the studies of Güven and Aydın (2017), when he examined the questions in the 8th grade science curriculum, it was concluded that 48.72% of the questions were at the comprehension level. In a study in which the achievements in the 2017 Science draft program were examined according to the renewed Bloom taxonomy, 8.65% of the achievements were recall, 40.79% comprehension, 16.35% application, 11.65% analysis, It has been determined that 3.95 of them are at the evaluation stage and 16.92% at the creation stage (Cangüven, Öz, Binzet, & Avcı, 2017). When Yolcu (2019) evaluated the achievements in the 3rd and 4th grade Science curriculum according to the revised taxonomy, he concluded that he addressed the comprehension level at a rate of 43%.

In general studies, instead of questions that measure low-level mental skills, question information only and are based on memorization; They emphasized the need to prepare questions that can interpret information, adapt existing information to new situations, and provide the opportunity to establish relationships with different disciplines. As can be seen, the reconstructed Bloom taxonomy is a frequent topic in the literature. In addition, when the studies examined were examined, it was determined that as the years progressed, with the development of science and technology, the steps of the questions asked to the students were generally parallel to each other, that is, they appealed to low-level mental skills. Today, sample questions of the entrance exam to high schools have been published by the Ministry of National Education in order to close this gap, and warnings have been made that these questions must be solved by the students. From this point of view, this study has been put forward to reveal which mental process the sample questions, which have been discussed for a long time and taken into account by all stakeholders, address. In addition, this study has been put forward to raise awareness about the importance of higher-order thinking skills and the need to highlight them. To summarize, in this research, it is aimed to examine the sample questions for the exam in high school transition system published between 2018-2022 according to the revised bloom taxonomy.

METHOD

Research Design

In this research, which aims to examine sample science questions for the high school entrance exam published by the Ministry of National Education, according to the cognitive steps of the revised bloom taxonomy, the document analysis model was used. Document analysis is the examination of the existing written or unwritten source of the researched subject (Büyüköztürk et al., 2018).

Research Data Source

The data source of this research is the science questions in the sample questions for the central examination for secondary education institutions to admit students by examination published on the website of the General Directorate of Measurement, Evaluation and Examination Services (URL1, 2022) by the Ministry of National Education since October 2018. Between October 2018 and December 2022, a total of 355 science questions were published and in this study all of these questions examined according to the revised bloom taxonomy.

Data Analysis

While analyzing the questions, cognitive process and knowledge dimensions of the restructured Bloom Taxonomy were taken into consideration. In order to find out which level the questions belong to in the taxonomy, firstly, the sentence structures, which are the main expressions of the questions, were focused on. A sentence is formed by combining the words noun and verb. In the question analysis, the questions were divided into two parts as noun and verb, and then the noun part of the question provided the information dimension, while the verb part provided the cognitive process dimension. In this analysis, while placing the questions in the taxonomy table consisting of horizontal and vertical dimensions, the verbs and nouns in the taxonomy table were taken into consideration. In order to explain how the questions are classified in order to establish the theoretical validity in the study, the following examples of questions regarding the determination of the cognitive levels and types of knowledge of the analyzed questions are shared.

10. Aşağıda 10 g saf K sıvısının ısıtılması sırasında termometrede okunan değerler gösterilmiştir.

Buna göre aşağıda kütleleri ve ısı-sıcaklık grafikleri verilen saf maddelerin hangisi K maddesi ile aynı cinstir?
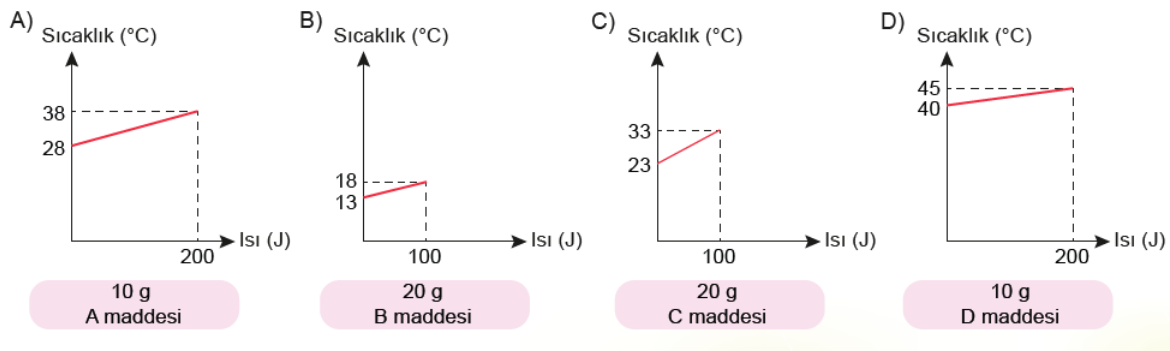

Figure 1. Sample Coding 1 – 2022 February 10th question

As this question is about the calculation of specific heat of some materials, it is classified into "procedural" as the level of knowledge and "apply" as the cognitive process.

5. 21 Aralık tarihinde birim yüzeye düşen enerji miktarı aşağıdaki görselde verilmiştir.
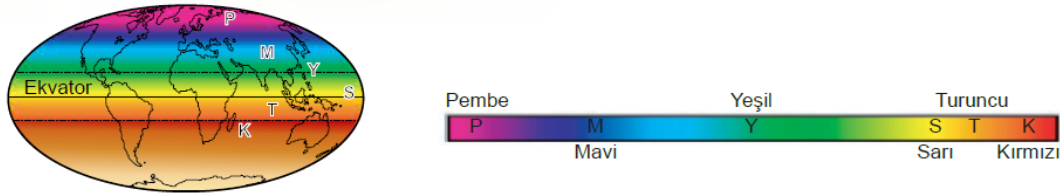
Görselde her renk birim yüzeye düşen farklı miktarlardaki Güneş enerjisini ifade etmektedir.

Buna göre verilen tarihler için,
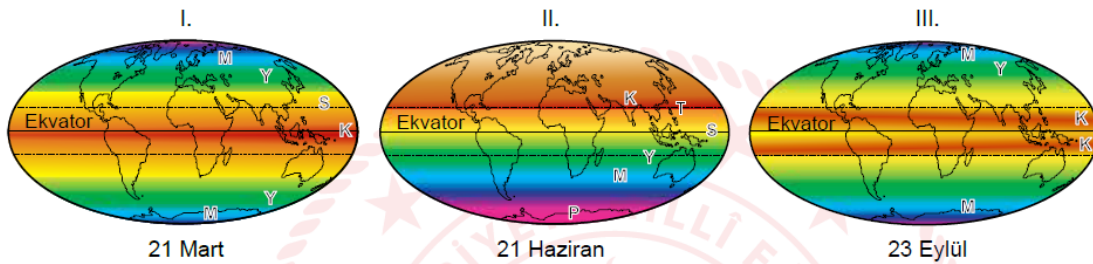
renklendirmelerinden hangileri doğrudur?

A) Yalnız I   B) I ve II   C) II ve III   D) I, II ve III

Figure 2. Sample Coding 2 – 2021 October 5ᵗʰ question

As this question is about the determination of one simple phenomena "amount of energy per unit surface" for different days of year, it is classified into "factual" as the level of knowledge and "remember" as the cognitive process

The researchers performed the analyzes separately from each other. Then, the two researchers came together and the results were compared. Disputes were reviewed and a common conclusion was reached. After these procedures were repeated several times by all questions, the researcher analyzed the questions. The answers with the same evaluation of the two researchers were accepted as consensus, and the answers with different evaluations were accepted as differences of opinion. The reliability of the research; Reliability=Consensus/(Consensus + Disagreement)*100 is calculated using the mathematical expression. Accordingly, the reliability of the research was found to be 83.33%. Finding the result above 0.70 ensures the reliability of the research (Miles & Huberman, 1994). Therefore, the classification can be expressed as reliable.

FINDINGS

In this section, the findings after the analysis of questions will firstly be given according to the year, to the level of knowledge and the cognitive process and finally according to the learning areas. In this study, 355 sample questions are published between 2018 and 2022. For each of 4 years, the following table 2 shows the distribution of questions in terms of revised bloom taxonomy categories.

As seen in table 2, most of the sample questions examined are within the scope of conceptual questions. 74% of the questions published in 2018, 75% of the questions in 2019, 66% of the questions in 2020 and 2021, and 70% of the questions in 2022 are at the level of conceptual knowledge. While no questions from the metacognitive knowledge dimension were encountered among the questions examined, the factual knowledge dimension was the least included information dimension for each year.

When the cognitive processes in Table 2 are examined, it is seen that there are no questions in the evaluation and creation dimensions. On the other hand, it is seen that the most used cognitive dimension among the remaining 4 dimensions is the understand dimension. It consists of questions in the dimension of understanding values between 48% and 74% of all questions in 4 years. At least, questions were included in the remember dimension.

Table 2. Distribution of sample questions according to the years

Year	Level of Knowledge	Cognitive Processes				
		Remember	Understand	Apply	Analyze	Total
2018	Factual	0	3	0	0	3
	Conceptual	1	16	3	6	26
	Procedural	0	1	3	2	6
	Total	1	20	6	8	35
2019	Factual	5	1	0	0	6
	Conceptual	1	37	10	12	60
	Procedural	0	0	11	3	14
	Total	6	38	21	15	80
2020	Factual	4	7	0	0	11
	Conceptual	1	46	0	6	53
	Procedural	0	6	7	3	16
	Total	5	59	7	9	80
2021	Factual	3	3	1	0	7
	Conceptual	5	40	2	6	53
	Procedural	0	6	10	4	20
	Total	8	49	13	10	80
2022	Factual	0	2	0	0	2
	Conceptual	10	37	3	6	56
	Procedural	0	4	8	10	22
	Total	10	43	11	16	80

The graph of these findings is as below.

Graph 1. Distribution of sample questions according to the years
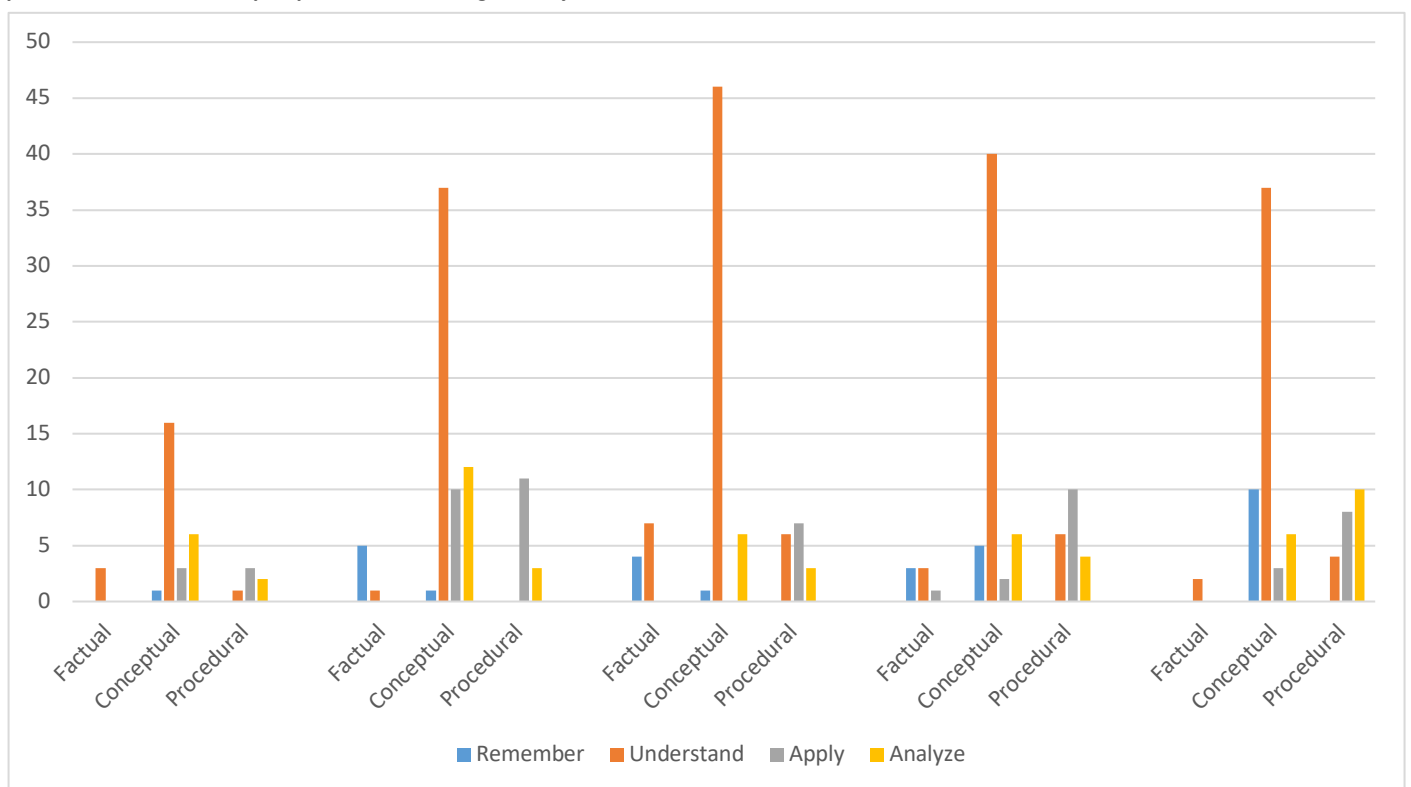
For each of 4 years, the following table 3 shows the distribution of questions in terms of learning areas.

Table 3. Distribution of sample questions in terms of learning areas according to the years

Learning Areas	Level of Knowledge	Cognitive Processes				
		Remember	Understand	Apply	Analyze	Total
Earth and Universe	Factual	5	5	0	0	10
	Conceptual	5	39	8	6	58
	Procedural	0	0	4	0	4
	Total	10	44	12	6	72
Creatures and Life	Factual	3	3	1	0	7
	Conceptual	6	57	3	13	79
	Procedural	0	6	12	8	26
	Total	9	66	16	21	112
Physical Events	Factual	3	6	0	0	9
	Conceptual	1	43	6	9	59
	Procedural	0	8	19	12	39
	Total	4	57	25	21	107
Matter and Nature	Factual	1	2	0	0	3
	Conceptual	6	37	1	8	52
	Procedural	0	3	4	2	9
	Total	7	42	5	10	64

When Table 3 is examined, it is seen that the 355 questions analyzed are almost equally distributed according to science learning areas. 112 of the sample questions examined are in the "Creatures and Life" learning area, 107 in the "Physical Events", 72 in the "Earth and the Universe" and 64 in the "Matter and Nature" learning area. Similar to the table 2, most of the questions belong to the conceptual level of knowledge and to the understand level as the cognitive process. As seen in Table 3, 57 questions in the "Creatures and Life" learning area have the highest frequency in the "Conceptual - Understanding" category.

DISCUSSION

When looking at the results obtained from this study conducted for the purpose of analyzing sample questions for the exam in high school transition system published between 2018-2022 according to the revised bloom taxonomy, almost all of the questions are in the conceptual knowledge class and are preferred from low-level questions, and high-level questions are the last ones (58 question – Analyze). Another important finding is that all of the high-level questions (58 questions) are preferred from the category "Analyze", but not at all from the categories "Evaluate" and "Create". It should be known that the possibility of applying the "Create" category in multiple choice exams is almost impossible. For this reason, it is not something to be criticized for not asking questions suitable for this category. Despite this, not asking enough questions in accordance with the "Apply" and "Evaluate" categories should be considered as an important deficiency. When many studies on this subject are examined, it is seen that similar results have been reached (Arı & İnci, 2015; Ayvacı & Türkdoğan, 2010;Baş & Beyhan, 2012; Çevik, 2010; Dursun & Parim-Aydın, 2014, Gökler, Aypay & Arı, 2012; Sönmez, Koç & Çifçi, 2013). The results of these cited studies also revealed the fact that the questions in the national exams and science course exams were from low-level questions.

In the current study, it has been observed that science questions mostly measure low-level thinking skills and concentrate especially on the comprehension level. The fact that the questions are mostly at the comprehension level may not be sufficient to develop high-level thinking skills, while making a contribution to the students' understanding of the subject (Güven & Aydın, 2017). In the study, while the questions measuring high-level thinking skills were at a low rate in the analysis and evaluation step, no questions were found in the creation step. Although the distribution of science questions in high school entrance exams is not balanced, the increase in the number of questions prepared for high-level thinking skills draws attention in recent years. The reason for this is that it is an exam that requires students to relate their existing knowledge to daily life and interpret it from different perspectives. It is thought that this situation will contribute to the permanence of knowledge in students and that each student gains these skills in order to solve the situations they encounter in their daily lives by using their problem-solving skills (Sönmez, Koç & Çifçi, 2013). It is clear that it is a highly selective exam, as the science questions in the high school entrance exams do not only include reading comprehension questions, but require interpretation of many information. These results are similar to other studies in the literature (Ayvacı & Türkdoğan, 2010;Baş & Beyhan, 2012). It has been determined that the taxonomic distribution of the examined questions is not homogeneous, and there is a discordance in terms of proportion. In the literature, similar studies were found in which science questions in central exams were examined according to the revised Bloom's taxonomy.

Central exams are made with multiple choice questions. Since these questions are generally used in the measurement of behaviors at the level of remembering, understanding and application and do not allow students to create the answers personally, they lead them to rote thinking (Gökler, Aypay & Arı, 2012). For this reason, it is necessary to use open-ended questions in order to measure individuals' high-level thinking skills (problem solving, critical thinking, etc.). These types of questions provide an opportunity for individuals to reflect and also to personally create answers. It is unlikely that the test questions in the central exams administered in Turkey, in which many students participate, will be distributed conveniently and to a similar extent across all levels of the revised Bloom's taxonomy.

RECOMMENDATIONS

Suggestions developed within the framework of the results obtained from the findings of the research can be listed as follows;

- The questions in the transition exams from basic education to secondary education should not be stacked on the renewed Bloom taxonomy table, but should be distributed homogeneously in the cells. It should not be aimed at certain knowledge and cognitive process dimensions, but should be in a quality that will enable all knowledge and cognitive process dimensions to be used.
- The questions and achievements are located in the lower level cognitive steps. High-level thinking skills of students should be increased by increasing the number of questions and achievements in high-level cognitive steps. For this, the type of questions in the central exams should be changed, open-ended questions should be included in addition to multiple-choice questions, or high-level cognitive skills should be measured with multiple-choice questions.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Statements of publication ethics

I/We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The study was conducted and reported with equal collaboration of the researchers.

Ethics Committee Approval Information

As this study is of the document analysis method, the Ethics Committee Approval Document is not needed.

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| Research Article / Araştırma Makalesi|

A Review of Pragmatics Studies Focusing on English Language Teaching in the Turkish Context

Türkiye Bağlamında İngiliz Dili Eğitimi Alanında Yapılan Edimsel Araştırmalar

Mehmet KANIK[1]

Abstract

Purpose: This paper reviews the studies in English language teaching focusing on pragmatics in the Turkish context in terms of their methodological choices.

Design/Methodology/Approach: For this purpose, 57 studies published between 2001 and 2022 were identified and coded for different methodological choices. They were then analyzed to map their methods in terms of aims, research design, sample size, research setting, participants, the type of data, data collection instruments, the methods of data analysis, pragmatic aspects investigated and the findings.

Findings: The results of the analysis indicate that there was an overreliance on some data collection and analysis methods. Studies commonly used elicitation tasks such as discourse completion tasks to collect elicited data and analyzed them using descriptive methodologies. Furthermore, studies that are in the university context populate the list of articles and few studies were conducted in primary and secondary school settings with younger learners.

Highlights: The findings indicate that there are several research gaps in pragmatic studies in the field of English language teaching in the Turkish context.

Öz

Çalışmanın amacı: Bu çalışma, yöntemsel tercihleri açısından Türkiye bağlamında edimbilime odaklanan İngiliz dili öğretimindeki çalışmaları gözden geçirmektedir.

Materyal ve Yöntem: Bu amaçla 2001-2022 yılları arasında yayınlanmış 57 çalışma belirlenmiş ve farklı yöntem tercihleri açısından kodlanmıştır. Daha sonra amaçları, araştırma tasarımı, örneklem büyüklüğü, araştırma ortamı, katılımcılar, veri türü, veri toplama araçları, veri çözümleme yöntemleri, araştırılan pragmatik yönler ve bulgular açısından incelenmiştir.

Bulgular: Sonuçlar, bazı veri toplama ve çözümleme yöntemlerinin sık kullanıldığını göstermektedir. Çalışmalar, ortaya çıkarılan verileri toplamak için söylem tamamlama testi gibi söyletimli yöntemlerin yaygın olarak kullandığını ve bunları betimleyici yöntemler kullanarak analiz ettiklerini göstermektedir. Ayrıca, çalışmaların çoğu üniversite bağlamında yapılmış ve ilk ve orta okul ortamlarında daha genç öğrencilerle çok az çalışma yapılmıştır.

Önemli Vurgular: Bulgular, Türkiye bağlamınde İngiliz dili eğitimi alanında edimbilisel çalışmalarda çeşitli araştırma açıklığı olduğuna işaret etmektedir.

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INTRODUCTION

While speaking a language, some knowledge of grammatical structures and a good size of vocabulary will help the second language (L2) speakers to a great extent. However, there will be moments where grammatical and lexical knowledge at a linguistic level will fail the L2 learners/users. Those are the moments where they cannot only depend on their linguistic knowledge since the use and interpretation may be specifically influenced by contextual factors, for example, when an L2 speaker needs to understand if what is said is what is meant, which could potentially cause challenges for second language learners and users. The linguistic field that studies this aspect of language is pragmatics, which is defined as the study of meaning in context (O'Keeffe et al., 2011). Yule (1996) emphasizes four aspects in his definition. He asserts that pragmatics deals with "speaker meaning … contextual meaning … how more gets communicated than is said … the expression of relative distance" (p. 3). The field developed on theoretical grounds in the 60s, 70s, and 80s with the works of scholars such as Austin (1975), Searle (1969), Grice (1975), and Brown and Levinson (1987). They established that in communication people express certain meanings indirectly and context plays an important role in interpreting utterances.

Starting from the early 80's, studies in applied pragmatics have emerged, especially those that focus on cross-cultural pragmatics. As the studies developed methodological practices in terms of data collection and analysis, more studies followed through. Some of the coding schemes (e.g. Beebe et al., 1990; Blum-Kulka, et al., 1989; Hudson, et al., 1995; Trosborg, 1995), for example, have been commonly used in later studies. This gave subsequent studies in applied pragmatics a descriptive orientation in which data were collected through elicitation tasks such as discourse completion tasks and then qualitatively analyzed for strategies employed. Then they frequently quantified the analyzed data and presented them in descriptive statistics.

Later, interest in the learning of pragmatics has emerged with new research perspectives such as interlanguage pragmatics, which "examines second language (L2) learners' knowledge, use, and development in performing sociocultural functions. L2 learners need linguistic forms and skills to perform everyday social functions in the target language" (Taguchi, 2017, p. 153). One can expect a developmental perspective in studies in interlanguage development, yet "the study of use (rather than learning) dominates interlanguage pragmatics" (Bardovi-Harlig, 2013, p. 69). Kasper (1992) pointed this out three decades ago when she stated that interlanguage studies were not acquisitional, but cross-cultural, comparing learner data with native speaker data with respect to some pragmatic aspects and attributed this to the methodological practices used in earlier studies of cross-cultural pragmatics. Referring to Kasper (1992), Bardovi-Harlig (1999) expresses similar sentiments and sets out a roadmap for research in interlanguage pragmatics and suggests that future interlanguage pragmatics research should focus on beginning-level learners, and include developmental studies focusing on learners proficiency as well as other longitudinal studies. In a more recent article, Bardovi-Harlig (2013) calls for investigations of task features to collect speech data and to reveal explicit and implicit knowledge, assessment, the relationship between linguistic and pragmatic knowledge, and the environmental effects on the development of pragmatics.

Another research perspective in pragmatics was instructional pragmatics and conducted mostly in experimental conditions. In this line of research, participants are provided different instructional treatments of various forms of explicit and implicit teaching such as consciousness-raising, input enhancement, feedback and the like (see Jeon & Kaya (2006) and Taguchi (2015) for reviews on the issue). In the studies reviewed by Taguchi (2015), researchers used a variety of outcome measures including but not limited to metapragmatic awareness questionnaire, multiple choice questionnaire, judgment task, different versions of discourse completion tasks, interview, role plays, online communication and emails and writing tasks. Similarly, in a review of data collection methods in L2 pragmatics, Nguyen (2019) categorizes data collection instruments into pragmatic production, pragmatic comprehension and perception, and pragmatic decision-making tasks. He lists the following methods employed by researchers in L2 pragmatics: naturally occurring data (like field notes, audio and video recording, synchronous and asynchronous computer mediated communication), conversation tasks, (closed and open) role plays, written discourse completion tests (with or without multiple turns), multiple choice questionnaire, judgment tasks (MCQ and scaled-response questionnaire), retrospective and introspective verbal report. He also lists methods of data analysis such as identifying occurrences of particular speech act strategies, conversation analytic techniques, descriptive and inferential statistics as well as thematic content analysis. These reviews document descriptive and experimental research methodologies and various forms of data collection and analysis tools and techniques employed by studies implemented in the field of pragmatics.

In Turkey, interest in pragmatics began in 1990's as evident in a few articles, theses and dissertations (e.g Demirezen, 1991; Erçetin, 1995; İstifçi, 1998; Tunçel, 1999) published during this period. In a bibliography of second language pragmatics research in Turkey, Ural and Asutay (2021) highlight that there are only a limited number of studies before the year 2000 and more studies have been published in recent years although they acknowledge that some of the studies that were published before 2000 may not be indexed by databases and not digitally available in any form to access. In any case, there are more studies focusing on pragmatics in language teaching, yet investigating the kind of research that has been conducted in foreign language teaching, especially in the field of teaching English, can draw a picture of the general tendency in research on pragmatics in Turkey. To what extent they used the methodological options available that have been employed in the field and whether they followed the research direction to fulfill the gaps in L2 pragmatics previously highlighted (e.g. Bardovi-Harlig, 1999, 2013) is important in identifying the focus of pragmatics research in the context of English language teaching in Turkey and in revealing the existing gap

within the context. For this purpose, this paper reviews articles on pragmatics with a focus on English language teaching for their methodological choices. The review includes studies between the years 2001 and 2022.

METHOD

In this mapping review, firstly, I conducted an online search by entering keywords such as pragmatics, speech acts, etc. in Turkish and English over databases in Turkey and Google Scholar. I also searched by combining some words and phrases such as pragmatics and Turkish learners of English. After identifying the articles, I initially reviewed them to see if they fit into the following inclusion criteria.

- Related to pragmatics
- Related to teaching English as a foreign language
- Conducted in Turkey
- Published in peer-reviewed journals
- Data collected from human subjects

In this respect, theses, book chapters, and conference papers (except those later published in journals) are not included as they do not usually go through the type of peer-review process exercised by academic journals. I wanted to include research that went through peer-review process of academic journals. In addition, studies with a textual focus, such as specific discourse markers, were excluded from the corpus. In addition, studies that deal with the teaching of pragmatics yet in languages such as Turkish and French are not included in this review. On the other hand, studies that focus on research methods in pragmatics but do so in the context of teaching English were evaluated. Finally, since the universities in Turkish-speaking Northern Cyprus are highly integrated into the university system in Turkey, and because a significant number of students from Turkey enroll in Northern Cyprus universities through the central university placement system of Turkey, the studies conducted in the context of universities in Northern Cyprus are included in the corpus provided that they meet the other criteria.

As a result of the search and the first review, 82 articles were examined. During the detailed analysis process, 25 articles were excluded from the review because they did not meet all the conditions. As a result, 57 articles were methodically analyzed and coded in terms of context, research question, research focus, pragmatic focus, research design, participants, number of participants, age, gender, language proficiency, data type, data collection methods, data analysis methods, comparison groups, and findings. Since the focus of this review is on the methods employed, these features, as methodological choices, were deemed relevant for the purpose of the study.

FINDINGS

Studies on pragmatics focusing on English language teaching in Turkey have increased in frequency in recent years. The number of studies identified that were published between 2000 and 2010 was eight whereas this number is 49 for the period between 2011 and 2022. There seems to be an increase in interest in pragmatics in the field of English language teaching in this context.

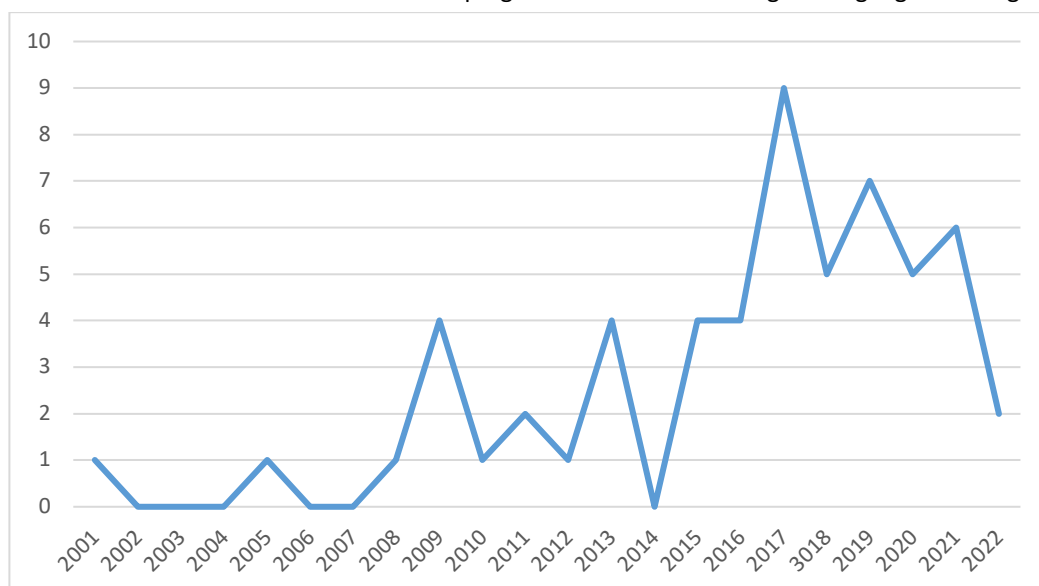**Figure 1. Number of Studies Published Between 2001 and 2022 Included in the Review**

In these studies, the focus was mainly on interlanguage and cross-cultural pragmatics, instructional pragmatics, some specific pedagogical aspects and research methods. More specifically, when the research questions and aims of the studies are scrutinized, it seems that the studies sought to answer research questions with respect to:

• Speech act strategies employed by Turkish EFL learners/users in English (and Turkish) and the factors influencing them such as sociopragmatic factors and transfer from L1.

• Differences between various EFL learners (Turkish and others) in using speech acts.

• Differences between native speakers and Turkish EFL teachers/learners in comprehension and production of pragmatic features such as speech acts and implicatures.

• EFL learners' speech act production perceived by native speakers.

• The effect of individual and contextual factors on using speech acts and implicatures such as gender, level of English, type of school, seniority in school, length of stay, and sociocultural context.

• The effect of instruction and different instructional models on awareness, comprehension, and production of pragmatic features in L1 and L2.

• Learners', lecturers', EFL teachers', and teacher trainees' awareness, perceptions, and production of pragmatic features.

• Difference between data collection instruments in assessing the performance of EFL learners.

The studies included in the review were looked into to see which of the basic research paradigms they fit into. This examination shows that the majority of the studies used both qualitative and quantitative research methods during the data collection and/or data analysis phase (Dörnyei, 2007), and in this respect, they preferred the mixed methods paradigm. A significant part of these studies collected qualitative data and coded the pragmatic strategies by analyzing the data with the content analysis method. Then, they analyzed these coded strategies using descriptive or inferential statistics. While 45 of the 57 studies included in the review used mixed methods, eight studies used quantitative methods and four studies used qualitative methods alone. These results are summarized in Table 1.

Table 1. Research Design of Choice in Studies

Research paradigm	# of studies	Research method	# of studies
Quantitative	8 (14%)	Experimental	8 (14%)
Qualitative	4 (7%)	Descriptive	49 (86%)
Mixed (data collection or analysis)	45 (79%)		

A related finding is that eight of the 57 studies included in the review used experimental methods. In fact, these studies are all quasi-experimental studies as they do not apply random sampling required by the true experimental design. Furthermore, single-sample designs without a control group were also included in the experimental methods here, as they applied pretest-posttest and experimental intervention. The majority of the studies (86%) preferred non-experimental designs.

Table 2. The Number of Studies Employing Multiple Groups

Includes Multiple Groups			
Experimental		Descriptive	
Yes	No	Yes	No
5 (9%)	3 (5%)	25 (44%)	24 (42%)

Of the 57 studies, 30 included multiple groups (53%) while 27 did not include them (47%). In the eight studies that implemented experimental methods, five had control groups. These studies are in instructional pragmatics where the researchers tested the influence of instruction such as film-based, corpus-based, explicit instruction. In these studies, the experimental group received the target instructional method while the control group did not. In descriptive studies, on the other hand, 25 had multiple groups. In some of them, learner data were compared to native speaker data. Others compared different learner groups such as Turkish, Arabic, Chinese, Persian, and Kurdish.

Another aspect of research related to this corpus of studies is sample size. In these studies, the average number of participants is 94 with a range of 3 and 604. Besides, the average number of participants in groups where there are multiple groups is 48 with a range of 5 and 554 as seen in Table 3. It seems that overall the studies recruited a good number of participants given that the majority of the studies collected qualitative data.

Table 3. Sample Size in Studies

	Average	Range	Group average	Group Range
Sample size	94	3-604	48	5-554

Regarding the research setting, there is a clear preference for university setting as the large majority of the studies were conducted in university settings as could be seen in Table 4. Only seven of the 57 studies included settings other than universities, namely primary schools, high schools, and private language institutions. The reason for this is possibly the overreliance on the convenience sampling methods where the faculty members chose to recruit students from their institutions. Yet, 17 studies were able to recruit students from universities in other countries mostly to establish native speaker baseline data although there were cases to compare Turkish EFL data with EFL data obtained from universities in other countries. Since the university setting is the main context in these studies, naturally the participants were mostly university students in 45 studies although EFL teachers and faculty members at universities were also recruited. Sixteen studies included native speakers among their participants to compare with the EFL data. The reason why there seems to be a discrepancy in the numbers in the table between the setting and participants is the overlap between them. For example, a study worked with college students in a university setting, yet included some high school students as well. Since the setting was coded as a university, a difference between the figures ensued. When it comes to the proficiency levels of the participants, 36 studies did not specify the participants' proficiency levels. There was no study that worked with participants at the beginning level, yet other levels were represented in the other studies that reported them. Although the language level is not specified, since those studies were mostly conducted with English teachers, English language teaching students and faculty members, it would not be wrong to think that they are at upper-intermediate and higher levels.

Table 4. The Setting of the Studies

Setting	Number of studies	Participants	Number of studies	Language proficiency	Number of studies
Primary School	3	Primary school students	3	Unspecified	36
High School	2	High school students	4	Intermediate	8
Universities	50	University students	45	Lower-intermediate	7
Private language institutions	2	Turkish EFL students (not specified)	8	Advanced	6
		Other EFL students	3	Upper-intermediate	6
		Teachers/faculty members (NESTS & NNESTS)	8	Elementary	3
		English native speakers	16	Self-reported	1
		Turkish native speakers	3		
		TFL students	1		

Another aspect of participants is their age. Figure 2 demonstrates the age range reported by the studies. Since some studies did not include enough descriptions of age, only those that provide age range are included in this graph. As it can be seen, the studies mostly recruited young adults and usually college students. Those that include native speaker data sometimes included participants with higher age groups. Nevertheless, the target learner groups were usually college students in the majority of the studies. There seems to be a need for research that investigates the learning of pragmatics by younger learners.
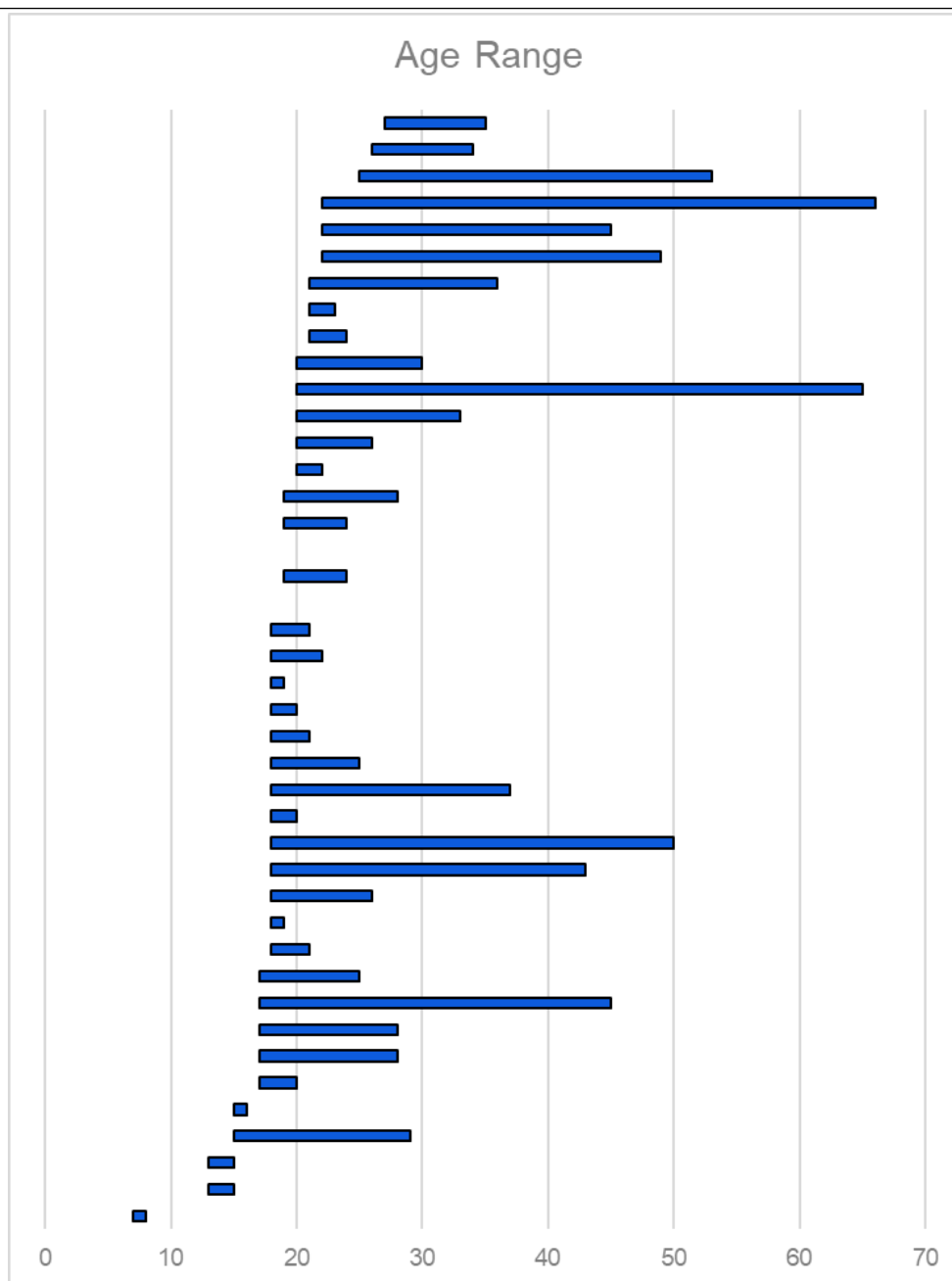
Figure 2. Age range of the participants in the studies that reported it

These outline the choice of setting, sample and participant characteristics. The review also focuses on the data collection and analysis done in these studies. It is apparent that there was an overwhelming tendency to collect elicited data (96%) as seen in Table 5. Natural data were collected in one study (Burgucu-Tazegül, Han & Engin, 2016). In this particular study, the researchers compiled a corpus of authentic emails they received over two months from their students that included requests. In another study (Takkaç-Tulgar, 2018), elicited data were collected, yet natural(istic) data could be said to have been collected as well through classroom observation that focused on the exposure to pragmatic features. In all other studies, data were collected through tasks and techniques that produce elicited data.

Table 5. The Type of Data Collected in the Studies

Data type	Number (%)
Elicited data	55 (96%)
Natural data	1 (2%)
Both	1 (2%)

To collect the data, the majority of the studies employed different forms of discourse completion tasks. To be exact, 47 studies (accounting for the 82% of the studies included in this review) used these tools. Although the studies resorted to 22 different types

of data collection methods, 14 of them were used only once. To triangulate the production tasks, some studies included interviews. Overall, participants were interviewed in 9 studies (16%). Among the production tasks, role-plays were also among the most frequent although they were implemented in seven studies (12%). Survey/questionnaire, class observation, rating scale, and reflective writing were uncommon, yet they were utilized in more than one study. Furthermore, the majority of the data collection methods employed in the studies were used to collect qualitative data in the form of mostly elicited speech data. Table 6 outlines the data collection methods used in the studies reviewed.

Table 6. Data Collection Instruments Used in the Studies

Data collection instruments	The number of studies
Written discourse completion task	34
Multiple choice discourse completion task	10
Interview	9
Role-play	7
Survey/Questionnaire	5
Class observation	3
Rating scale	3
Reflective writing	2
Discourse evaluation task	1
Authentic e-mails	1
Elicited emails	1
Oral discourse completion task	1
Reverse discourse completion task	1
Judgment task	1
Scenario-based communication task	1
Self-report	1
Language proficiency test components	1
Retrospective verbal report	1
Self-assessment questionnaire	1
Field note	1
Lesson plan	1
Reflective comment	1

Thirty-three studies used a single data collection instrument while 14 studies employed two instruments. Of the remaining seven studies, five employed three instruments, one employed four, and another five different instruments. Figure 2 depicts this finding.
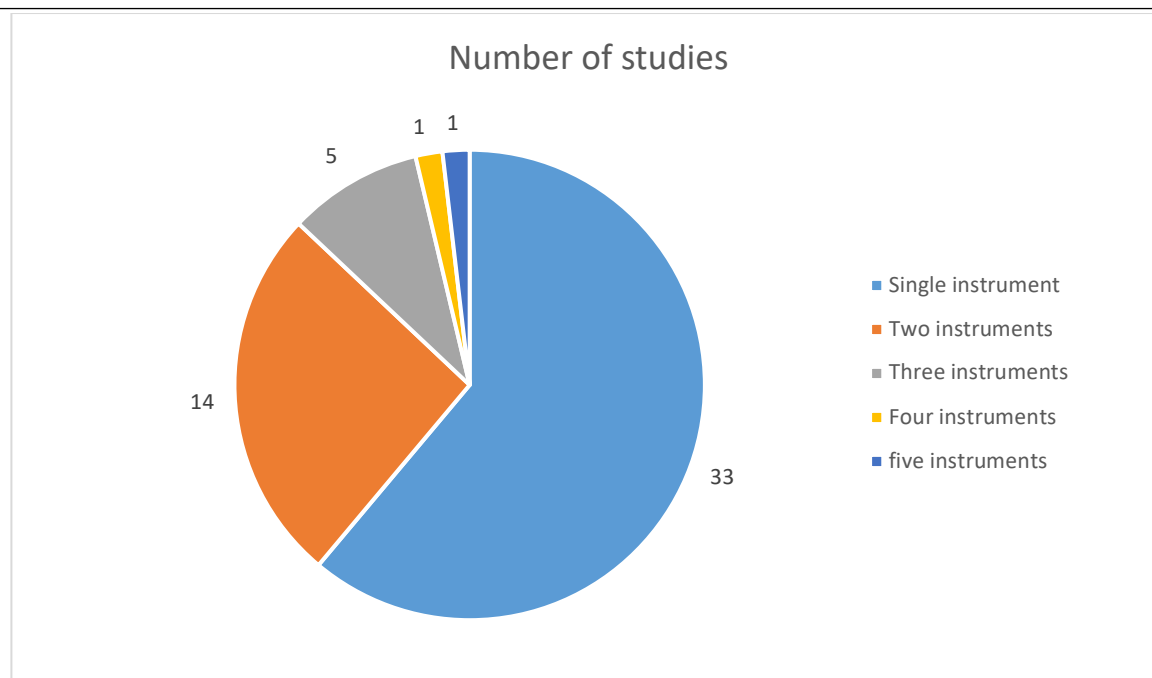
Figure 2. The Number of Data Collection Methods Employed in Studies

Furthermore, in these studies, there was a tendency to use both qualitative and quantitative analysis. The general trend in the studies is that the speech data were collected through elicitation techniques such as discourse completion tasks and then the researchers analyzed them and coded them into strategies and moves. Following this procedure, they quantified these data and implemented statistical analyses. In this respect, qualitative analysis was employed in 48 studies (84%) whereas quantitative analysis was used in 53 studies (93%). Nearly 80% of studies implemented both types of analysis. Of the statistical analyses, descriptive type reporting frequencies and percentages was the choice in 23 studies (40%) while the inferential type was preferred by the researchers in 30 studies (53%).

Table 7. Data Analysis Methods Employed in Studies

Type	Number (%)
Qualitative	48 (84%)
Quantitative	53 (93%)
Descriptive	23 (40%)
Inferential	30 (53%)
T-test	16 (28%)
Chi-square	10 (17.5%)
ANOVA	5 (9%)
Mann Whitney U	3 (5%)
Kruskal Wallis	2 (3.5%)
Wilcoxon signed-rank test	1 (2%)
Correlation	1 (2%)

There were several inferential statistical tests that were used, the t-test being the most common choice. Researchers preferred to use paired-samples or independent-samples t-tests depending on their groping while they compared frequencies of speech act strategies. Studies that included more than two groups used ANOVA. When they were interested in the categorical distribution of strategies, they implemented the non-parametric test chi-square. A few studies tested the normality of the distribution and in line with the result of this test, they ran non-parametric tests such as Mann-Whitney U, Kruskal Wallis, and Wilcoxon signed-rank test. Finally, only one study implemented correlation as could be seen in Table 7.

In the studies reviewed, 18 different pragmatic aspects were investigated. This may seem to be an important variety, yet nine of them were only investigated once. In contrast, requests, refusals, and apologies were the most commonly investigated speech acts, accounting for more than half of the investigations. One-third of the studies investigated requests and a quarter examined the use of refusals. Four studies did not focus on a specific speech act or pragmatic feature. Rather, they were interested in perception and awareness without a link to any pragmatic aspects. Table 8 outlines this finding.

Table 8. Pragmatics Aspects the Studies Focus on

Pragmatic aspect	The number of studies
Request	19 (33%)
Refusal	14 (25%)
Apology	8 (14%)
Complaint	5 (9%)
Implicature	5 (9%)
Compliment response	4 (7%)
Compliment	3 (5%)
None (pragmatic development/perception and awareness)	3 (5%)
Suggestion	2 (4%)
Clarification	2 (4%)
Others (gratitude, agreement, disagreement, assertion, question, order, acceptance, response, advice investigated once)	9 (16%)

Finally, the findings of the studies are scrutinized. Several of them highlight the speech act realization patterns of EFL learners/users as they have a use perspective more so than a pragmatic development perspective. Some studies investigated the effect of different instructional models on learning pragmatics. They found positive instructional effects although the results of two studies were not quite conclusive. Also, in a couple of studies, positive attitudes to pragmatics teaching were identified. A number of other studies compared EFL learners/users with native speakers. Nearly all of them found differences. In general, the utterances of EFL learners/users were not native-like. A related result came from studies that examined the transfer effect. Overall, these studies documented transfer effects, mostly negative transfer, and one study found a reverse transfer effect. Furthermore, studies that compared different EFL learners found differences between them. These findings, together, likely point to the effect of the L1 background. Some studies investigated the effect of individual and contextual characteristics. Those that were interested in the effect of language proficiency found that it influenced pragmatic performance positively, that is, the higher the language proficiency the better performance the participants demonstrated. The effect of other characteristics was inconclusive. For example, about half of the studies that investigated gender found an effect whereas the others did not. Similarly, age and year in the program did not lead to conclusive results. On the other hand, among the situational features, the status of the interlocutor was found to be affecting utterances.

DISCUSSION

This review of studies in the Turkish context points to some research gap. For instance, in this context, a great majority of the studies focused on adults and specifically college students either in preparatory programs or in English language teaching programs. Overall, 91% of the studies worked with adults (including college students) while only 9% worked with teenagers (other than college students) and children. In fact, only one study recruited 7-8-year-old children. Similarly, few studies were conducted at the primary and secondary levels. Thus, more studies may be needed to understand the teaching and learning of pragmatics at different educational settings and levels. Besides, 36 studies do not mention proficiency levels, yet 21 studies had ELT students, EFL teachers, and faculty members as their participants, which implies that they had upper-intermediate level and proficient users of English as their participants. Still, 15 studies do not list proficiency levels. As the findings of some of the studies included in this review and others (e.g. Taguchi, 2011) demonstrate that language proficiency may influence pragmatic comprehension and performance, in studies that deal with pragmatic competence in some way, the proficiency level is likely to be an important variable to report, yet this was not always the case in this corpus of studies.

Furthermore, of the studies included in this review, the majority employed descriptive methods (86%). Only eight studies (14%) had a design that included some kind of intervention. Yet, they were all quasi-experimental studies either lacking comparison groups or random selection. Since the focus of this review is the pragmatics research in English language teaching, true

experimental studies may shed light on the effectiveness of different methods on pragmatic awareness or development of learners in the said context. Another research gap related to methodological design in the context is the need for longitudinal studies. Bardovi-Harlig (1999) proposed a research direction that focused on beginning-level learners and longitudinal and cross-sectional studies that demonstrate interlanguage development. It seems that in this corpus, research focusing on these areas has not been conducted commonly. In the corpus, there is only one study that is longitudinal in nature comparing college students' pragmatic awareness in the freshmen and senior years and there are five cross-sectional studies comparing students at different proficiency levels. Furthermore, no study recruited beginning-level learners and only three studies were conducted with elementary-level learners. As mentioned earlier, Bardovi-Harlig (2013), in another article, calls for investigations of task features to collect speech data and to reveal explicit and implicit knowledge, assessment, the relationship between linguistic and pragmatic knowledge, and the environmental effects on the development of pragmatics. Again, only a few studies have addressed these issues. In this respect, the research gap identified by Bardovi-Harlig (1999; 2013) has yet to be addressed in the Turkish context. In her article, Bardovi-Harlig (2013, p. 69) highlights that "the study of use (rather than learning) dominates interlanguage pragmatics" (p. 69). This seems to be the case in this context. The majority of the studies did not have a developmental perspective. They followed rather the methodological practices of cross-cultural pragmatics. In general, they identified EFL learners' use of speech acts, compared different EFL learners, or compared them with native speakers. In this respect, studies that approach the learning of pragmatics with developmental perspectives may contribute to interlanguage pragmatics research in the context through longitudinal and cross-sectional designs. In this way, pragmatic development of students in the Turkish context may be further explored.

Another finding about methodological choices is on data collection methods. Kasper and Dahl (1991) and Nguyen (2019) identify several data collection tools in their review of research methods in pragmatics. In the current review, the majority of studies relied on pragmatic production in the form of different versions of discourse completion tasks and role plays. Naturally occurring data were used in only two studies. Conversation tasks were not employed. Pragmatic decision-making tasks were also not common. In fact, only one study used a retrospective verbal report. Pragmatic comprehension and perception tasks were employed by some studies but were not common. A judgment task was reported in only one study. This indicates that in this context the data collection methods are not varied. Also, the majority of the studies relied on a single data collection method. In addition, there was an overreliance on elicited data and a research gap exists with respect to authentic speech data and variety in data collection instruments in this context. Since choices in data collection methods may potentially influence the data (see for example, Bataller & Shively, 2011; Economidou-Kogetsidis, 2013; Félix-Brasdefer, 2007; Golato, 2003; Kanık, 2016, 2017b), variety in data collection methods and data triangulation may strengthen the research in the context. Nguyen (2019) suggests data collection on the real-life interactions of L2 learners, investigation of pragmatic comprehension and perception of L2 learners, validation of research instruments through verbal reports and data triangulation in L2 pragmatics studies in his review of data collection methods. Thus, the findings in this study also point to these research directions in this context.

In data analysis, there seem to be some mistakes in statistical choices in a few studies. For example, the paired-samples t-test was used in a study comparing two independent groups, or the independent samples t-test was used in a study involving a single group. Also, one study mentions the use of t-tests and factor analysis while reporting the results of only descriptive statistics. Besides, some studies mention a significant difference when using descriptive statistics. This indicates that some researchers in the context may benefit from further training on research methods. Another methodological issue is related to studies that include multiple groups. In some of these studies, participant profiles were not tightly matched. For instance, data obtained from college students may be compared with native English-speaking professionals who are older, have more experience, and are in different social settings. Since such variables may influence data, the validity of these studies may be negatively impacted.

Finally, there was not enough variety in pragmatic features addressed in the studies. Just three speech acts, namely request, refusal and apology, account for more than 50% of the pragmatic features investigated. Although 18 different features were pinpointed, the majority of them were minimally studied in this corpus. Thus, there is a need for more studies that address different pragmatic features to establish a knowledge base with respect to their teaching in the context.

CONCLUSION AND RECOMMENDATIONS

This study focuses on the studies conducted in the Turkish context on second language pragmatics. The review of the studies identifies an increase in interest in pragmatics research in English language teaching in this context, yet there still exist research gaps that have yet to be addressed. Although descriptive research that addresses Turkish EFL learners' pragmatic choices in simulated conditions adds to the growing body of research in the context, there is a need for studies that investigate what Turkish EFL learners really do through investigations of authentic data. Furthermore, the research designs should deviate from the methodology of traditional cross-cultural pragmatics and explore the learning of pragmatics from a developmental perspective and good practice in teaching pragmatics to EFL students in context. Yet, the interest in pragmatics research has increased in recent years and it is a positive sign for research potential in the context with a variety of methodological choices in years to come.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, author-ship, and/or publication of this article.

Statements of publication ethics

I hereby declare that the study does not have unethical issues and that research and publication ethics have been observed carefully.

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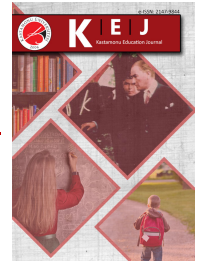
| Research Article / Araştırma Makalesi|

Examining the Impact of Interdisciplinary Practices on Secondary School Students' Awareness of Sustainable Living

Disiplinler Arası Uygulamaların Ortaokul Öğrencilerinin Sürdürülebilir Yaşama Yönelik Farkındalıkları Üzerindeki Etkisinin İncelenmesi

Mustafa Kemal Yüzbaşıoğlu[1]

Abstract

Purpose: This study aimed to determine the effect of the practices carried out according to an interdisciplinary approach on students' awareness of sustainable living.

Methodology: In the present study, one group pre-test post-test experimental design, one of the quasi-experimental methods, was used. A total of 46 activities were carried out in 33 weeks of the academic year within the scope of 11 different courses and social club practices with 37 secondary school students who participated in the study. The study data were collected using the Sustainable Living Awareness Scale.

Findings: As a result of the activities carried out, students' awareness of sustainable living increased significantly on an overall scale and in the social, economic, and environmental sub-dimensions of the scale.

Highlights: The present study concluded that the activities carried out over a long period with an interdisciplinary approach reflected positively on the awareness of the students. It is recommended to take steps to make teacher candidates and teachers aware of the concept of sustainable development and for the development of teacher candidates and teachers on sustainable development.

Öz

Çalışmanın amacı: Araştırmada disiplinler arası bir yaklaşıma göre yürütülen uygulamaların öğrencilerin sürdürülebilir yaşama yönelik farkındalıklarına olan etkisinin belirlenmesi amaçlanmıştır.

Yöntem: Mevcut araştırmada yarı deneysel yöntemlerden biri olan tek grup ön test son test deneysel desen kullanılmıştır. Çalışmaya katılan 37 ortaokul öğrencisi ile 11 farklı ders ve sosyal kulüp uygulamaları kapsamında eğitim öğretim yılının 33 haftasında toplamda 46 etkinlik yürütülmüştür. Araştırmada veriler Sürdürülebilir Yaşama Yönelik Farkındalık Ölçeği ile toplanmıştır.

Bulgular: Yürütülen faaliyetler sonucunda öğrencilerin sürdürülebilir yaşama yönelik farkındalıkları ölçeğin hem toplum, ekonomi ve çevre boyutlarında hem de tamamında anlamlı olarak artış göstermiştir.

Önemli Vurgular: Araştırma sonucunda disiplinler arası bir yaklaşım ile uzun zaman diliminde yürütülen faaliyetlerin öğrencilerin farkındalıklarına olumlu yansıdığı sonucuna ulaşılmıştır. Aynı zamanda öğretmen adayları ve öğretmenlerin sürdürülebilir kalkınma kavramından haberdar olmaları ve bu konudaki gelişimlerine yönelik adımlar atılması önerilmiştir.

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INTRODUCTION

In the song titled "Who's Gonna End?" launched by the United Nations Development Programme (UNDP) Turkey Office, some important questions were being addressed about our world and humanity at its core. These questions included who would end poverty, who would end gender discrimination, who would fight climate change, and who would keep water clean. Although the questions were listed in this way, there was only one answer, and that was as Sertab Erener expressed in the song: "*Why can't we see. It's not just you, it's not just me, it's all of us.*" (UNDP, 2023).

As expressed in the World Wide Fund for Nature's (WWF) 2022 Living Planet Report, we will face serious problems due to humanity's unconscious use of the Earth. To save our planet from its current state, we all have responsibilities, and the necessary steps must be taken together as soon as possible. The necessary steps to be taken for the present and future of the planet have paved the way for the concept of sustainable development. The concept of sustainable development is defined in its simplest form as meeting the needs of humanity today while maintaining the ability of future generations to meet their needs (WCED, 1987). Therefore, all individuals should act with the awareness that others will use the world after them (Tietenberg, 2006). The natural resources used by humanity today are legacies that have been passed down from the past to the present, and they need to be transferred to the future as well. Therefore, individuals should fulfill their responsibilities and use natural resources sustainably for the preservation of both the present and the future of the Earth. The concept of sustainable development has three dimensions: environmental, social, and economic, which are directly interacting with each other (Harris, 2000; Soubbotina, 2004). People need to consider these three dimensions of sustainable development as a whole, regardless of the circumstances. A disruption in one of these three dimensions affects the overlooked dimensions over time (Strange & Bayley, 2008).

Although different perspectives have been put forward in every period on issues such as the definition, objectives, and indicators of sustainable development, the idea that Education for Sustainable Development (ESD) plays a significant role in achieving sustainable development is widely accepted by societies (Bonnett, 1999; Foster, 2001). The Earth's natural resources might seem limitless, but at a certain point, they will be insufficient to meet people's needs (Raven & Berg, 2006). To prevent such a scenario and avoid potential catastrophes, individuals should be educated from a young age about the sustainable use of resources (Hofman-Bergholm, 2018; Yüzbaşıoğlu & Kurnaz, 2022). ESD encourages individuals to have competencies such as thinking critically, imagining possible scenarios that may be encountered in the future, and collaboratively taking steps (UNESCO, 2014). Through teaching practices, individuals can be provided with the necessary knowledge for a sustainable world (Stratton et al., 2015). In this way, responsible individuals who are concerned about the planet's future can be raised, and sustainable development can be promoted (Eilks et al., 2014).

ESD aims to educate individuals so that they can make sustainable decisions in the future (Walls, 2011). Educators have important responsibilities in terms of raising individuals who are aware of the concept of sustainable development and take steps towards the realization of sustainable development goals in their daily lives (Anyolo et al., 2018; Hungerford, 2010; Wals, 2011; Yüzbaşıoğlu & Kurnaz, 2021). In teaching environments, educators may experience difficulties or disruptions related to ESD. One of the main points where educators have difficulty is the lack of educational materials (Kahriman, 2016). To prevent these deficiencies from reflecting on students and to eliminate them, educators and policymakers have important duties. Teachers need to start their profession well-trained in sustainable development (Hofman-Bergholm, 2018) and to keep their knowledge up-to-date (Salite, 2015). Thus, they can allocate more space in their lessons for instructional activities that can prepare students for possible situations they may encounter in their daily lives.

Although the concept of sustainable development is discussed at certain rates in different courses, students think that the concept of sustainable development is a subject that should be learned within the scope of science courses because it is mostly included in science lessons. Research emphasizes that the concept of sustainable development should be addressed in all courses with an interdisciplinary understanding rather than a specific course (Colucci-Gray et al., 2013; Jabareen, 2011). The presence of different dimensions of sustainable development such as environmental, social, and economic aspects necessitates the use of an interdisciplinary approach in ESD (Jabareen, 2011; Parker, 2010). With the activities carried out based on an interdisciplinary approach, it will be possible to address ESD more comprehensively (Yüzbaşıoğlu & Kurnaz, 2022). Current curricula have shortcomings in ensuring the active participation of students in the context of sustainable development (Holbrook, 2009; Tanrıverdi, 2009). It is stated that nature trips, drama, observation, and reading books are mainly included as teaching practices in ESD (Kahriman, 2016). Including such activities on ESD causes students to stay in more observer positions. When the literature is examined, it is determined that studies related to sustainable development are generally conducted with teachers/teacher candidates, and the analysis of the curriculum is often the focus. In these studies, the subject area and pedagogical knowledge of teachers and teacher candidates regarding sustainable development concept are identified (Corney & Reid, 2007), their conceptual understanding of sustainable development is examined (Borg et al., 2014), their views on ESD topics are determined (Nas & Çoruhlu, 2017; Spiropoulou et al., 2007), and their attitudes and awareness about ESD are revealed (Faiz & Bozdemir Yüzbaşıoğlu, 2019; Keleş, 2017; Mogren et al., 2019). In studies related to curriculum, curriculum documents have been examined in terms of ESD (Kaya & Tomal, 2011; Yüzbaşıoğlu & Kurnaz, 2022), and issues such as the lack of sufficient content and learning outcomes related to sustainable development in the curriculum (Tanrıverdi, 2009; Yüzbaşıoğlu & Kurnaz, 2022) have been criticized. It is noticeable that direct practical studies with students are limited and there are deficiencies in this area. However, environmentally-oriented practices carried out in schools allow students to use their knowledge of the environment in subjects

directly related to their daily lives and offer the opportunity for sustainable development (Bajd & Lescanec, 2011). Based on these issues, in this study, it is considered that the activities carried out by secondary school students within the scope of different courses will contribute to their awareness of sustainable development. In this regard, the present study aimed to determine the impact of interdisciplinary practices conducted on students' awareness of sustainable living.

METHOD

Research Design

In the present study, one group pre-test post-test experimental design, one of the quasi-experimental methods, was used. In single-group pre-test post-test experimental designs, the independent variable is applied to a group, and measured before and after the experiment (Cohen & Manion, 1997; Fraenkel & Wallen, 1996). In this study, the effect of interdisciplinary practices on awareness of sustainable living is examined.

Study Group

The study group consists of a total of 37 middle school students, including nine 5th graders, five 6th graders, ten 7th graders, and thirteen 8th graders, studying at a middle school in the northern region of Turkey. Convenience sampling is a non-random sampling method used in this study. The participants in the study group are selected according to certain criteria such as geographical proximity, availability at a certain time, easy accessibility, and willingness to volunteer (Dörnyei, 2007).

Teaching Practices

The students who participated in the study participated in a total of 46 activities in 33 weeks of the academic year within the scope of 11 different courses and social club activities. The courses in which the activities took place are shared in Figure 1.
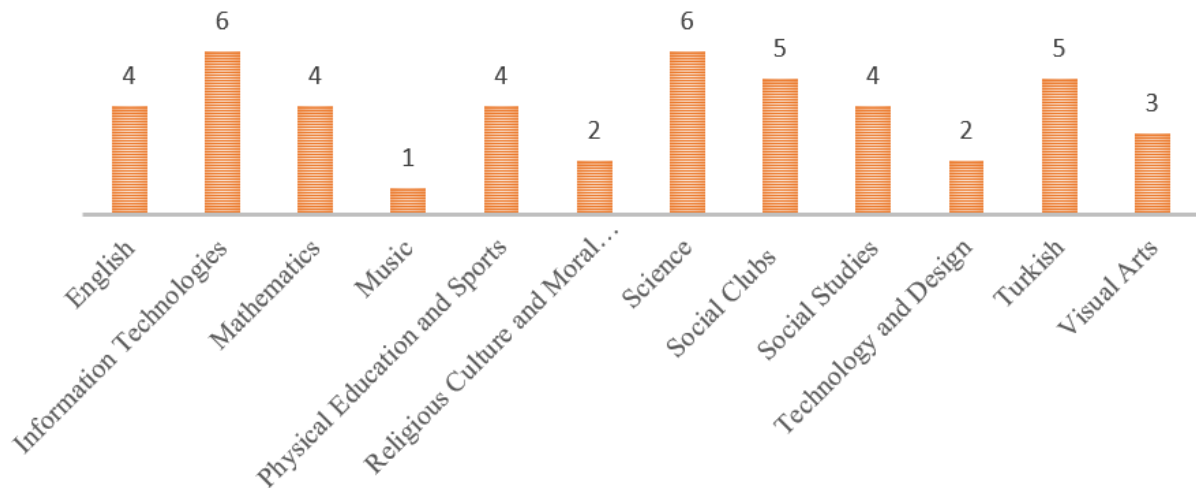
Figure 1. Courses and Number of Activities

Within the scope of the English lesson, brochures and banners on the subject of environmental awareness were prepared. A board was prepared based on the activities students conducted at school and home with the hashtag #gogreen. A word tree was designed, made from recycled materials, and placed in a suitable area in the classroom. A game was designed to find the English meanings of recycling and environmental symbols and played with students.

In the information technology course, students were given training within the scope of "Energy Saving Week". Students designed recycling buckets with Arduino. Students prepared short videos with the theme "Don't throw me away, because..." A virtual tour of compost and recycling facility was organized with the students. Using computer programs they were familiar with, students designed recycling logos and played computer games related to the environment.

In the mathematics class, sample questions were solved that were aligned with the structure of the topic and focused on the concept of waste. Bookmarks with a theme related to World Pi Day were prepared, teaching materials were designed using waste materials, and various geometric shapes were created from waste materials.

In music class, students sang by making musical instruments from waste materials.

In Physical Education class, students planted saplings as part of the National Reforestation Day, designed and played children's games using waste materials, created kites using packaging waste and plastic bags and flew them, made flowerpot designs from unused burst balls, and planted flowers in them.

In the Religious Culture and Moral Knowledge class, topics related to the importance Prophet Muhammad placed on the environment and the significance of the environment in Islam was discussed. The subjects of preventing waste and promoting saving were also addressed.

As part of the science course, students were informed about the zero-waste concept. A display board was prepared, a rainwater collection activity was conducted, and the collected rainwater was used to water class flowerpots. Seed balls were prepared from waste paper and left in nature. A dynamometer was designed using waste materials, an insect hotel was created, and eco-printing applications were carried out.

Within the scope of social clubs, students prepared a Teachers' Day bulletin board from waste paper. They organized recycling activities during World Recycle Week. They created a bulletin board for Forest Week. As part of the celebrations for April 23rd National Sovereignty and Children's Day, they made models of children from around the world using waste materials. Additionally, they prepared a bulletin board for Environmental Protection Week.

In the social studies course, the subject of Atatürk's love of trees was discussed. Students were enabled to model the historical places and artifacts around them using waste materials. Organizations operating to protect the environment in Turkey were introduced, and international environmental agreements to which Turkey is a party were introduced to the students.

Within the scope of the technology and design course, students made school logo designs from waste materials and prepared an environmentally friendly village model.

Within the scope of the Turkish language class, students were shown logos of environmental organizations and encouraged to brainstorm about their meanings. Environmental-themed haikus were prepared. Acrostic poems related to the environment were written. A creative writing activity involving environmental topics was conducted, and exercises on writing petitions were carried out to establish communication with local organizations.

In the visual arts class, origami activities were held using waste paper. A painting contest was organized for March 22, World Water Day. Waste paper was recycled and different designs were made from paper pulp.

Figure 2 shows the visuals of the activities carried out by the students.

| a | b | c | d |
| e | f | g | h |

a: Flower pot design from old balls, b: Model of local historic sites, c: Word tree, d: World pi day themed bookmark, e: National Reforestation Day sapling planting, f: Bug hotel, g: Origami, h: Eco-oriented computer game

Figure 2. Sample student activities

Data Collection and Analysis

The study data was collected using the Sustainable Living Awareness Scale (SLAS), a 3-point Likert-type scale with twenty items, developed by Akgül and Aydoğdu (2020). The SLAS consists of three dimensions "Society (8 items)", "Environment (7 items)" and "Economy (5 items)" and the internal consistency reliability coefficient is calculated as .77. For the present study, the reliability coefficient was found to be .771.

At the beginning of the academic year, the SLAS was administered to the students as a pre-test and then re-administered as a post-test after 33 weeks of activities. The study data was analyzed using SPSS software. In addition to descriptive statistics, the dependent groups' t-test was used to determine the effect of interdisciplinary activities on students' awareness of sustainable living.

FINDINGS

Within the scope of the study, the effect of interdisciplinary activities carried out by secondary school students on their awareness levels for sustainable living was examined. In this regard, SLAS was administered before and after the activities, and descriptive statistics and dependent group t-test findings related to the obtained data are presented below. Descriptive statistics for the pre-test and post-test scores of students' sustainable living awareness are presented in Figure 3.
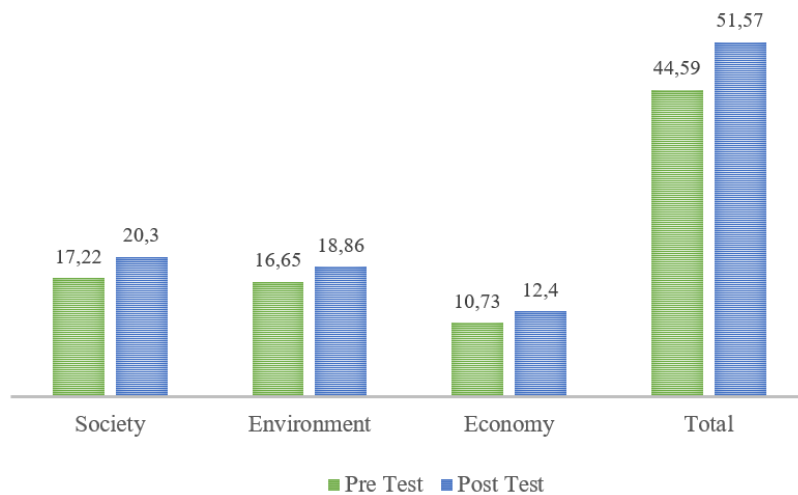
Figure 3. Descriptive statistics on students' awareness of sustainable living pre-test and post-test scores.

As can be seen in Figure 3, the mean pre-test scores for students' sustainable living awareness before the activities are as follows: social dimension $\overline{X}$=17.22, environmental dimension $\overline{X}$=16.65, economic dimension $\overline{X}$=10.73, and the total score $\overline{X}$=44.59. After a total of 46 activities carried out by the students for 33 weeks, the mean post-test scores are as follows: social dimension $\overline{X}$=20.30, environmental dimension $\overline{X}$=18.86, economy dimension $\overline{X}$=12.40, and the total $\overline{X}$=51.57. As can be seen in Figure 3, the students' awareness of sustainable living scores increased in favor of the post-test in overall scale and in all dimensions of the scale. In terms of the social dimension, the dependent group t-test results regarding the pre-test and post-test scores are presented in Table 1.

Table 1. Dependent group t-test results regarding social dimension

Measurements	N	$\overline{X}$	Sd	sd	t	p
Pre-test	37	17.22	3.19	36	6.859	.000
Post-test	37	20.30	2.12			

As can be seen in Table 1, students' awareness of sustainable living pre-test and post-test scores shows a significant difference in favor of the post-test in the social dimension. Based on this situation, it can be stated that students' awareness has increased after the activities about not making changes to the environment for their own needs, recognizing that humanity's purpose of existence is not to dominate nature, understanding that poverty and hunger are not at the same level in all countries, acknowledging the significant population growth rate on Earth, understanding that population growth affects the consumption of natural resources, and realizing that there are not enough natural resources on Earth to meet the needs of all humanity.

The dependent group t-test results for the pre-test and post-test scores of the students in terms of the environment dimension are presented in Table 2.

Table 2. Dependent group t-test results for the environment dimension

Measurements	N	$\overline{X}$	Sd	sd	t	p
Pre-test	37	16.65	3.05	36	4.170	.000
Post-test	37	18.86	1.93			

As can be seen in Table 2, the pre-test and post-test scores of the students show a significant difference in favor of the post-test in the environment dimension. After the activities carried out by the students, it can be stated that their awareness of the

decrease in forest areas due to urbanization, the rights to life of plants and animals, human-induced desertification, the decrease in biodiversity, the extinction of plant and animal species and the impact of humans on this situation, and the global effects of environmental problems have increased positively.

The dependent group t-test results for the pre-test and post-test scores in the economy dimension are presented in Table 3.

Table 3. Dependent group t-test results for the economy dimension

Measurements	N	$\overline{\text{X}}$	Sd	sd	t	p
Pre-test	37	10.73	1.68	36	4.926	.000
Post-test	37	12.40	1.75			

As can be seen in Table 3, students' pre-test and post-test scores show a significant difference in favor of the post-test in the economy dimension. The activities carried out by the students have contributed positively to their awareness of issues such as effects on world income distribution, the relationship between the country's economy and raw materials, green building applications, renewable resources, and the use of waste materials.

The dependent group t-test results for the pre-test and post-test scores of the overall scale are presented in Table 4.

Table 4. Sustainable living awareness t-test results

Measurements	N	$\overline{\text{X}}$	Sd	sd	t	p
Pre-test	37	44.59	6.14	36	7.350	.000
Post-test	37	51.57	4.35			

As can be seen in Table 4, students' overall scale pre-test and post-test scores differ significantly in favor of the post-test. In other words, it was determined that the practices carried out by the students caused a significant increase in their awareness of sustainable living.

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

Despite numerous research efforts over the years to achieve sustainable development goals, the fact that relevant issues continue to persist in the present day is a significant indicator that solutions have not been permanently effective (Yüzbaşıoğlu & Kurnaz, 2022). Therefore, conducting studies related to the concept of sustainable development with a focus on humanity would be much more beneficial (Blair, 2008). Although there are many objectives for ESD, there can be shortcomings in achieving these objectives (Yüzbaşıoğlu & Kurnaz, 2021). Many reasons such as insufficient inclusion of sustainable development in curricula, the complexity of sustainable development goals, lack of or inadequate educational tools and inadequate social participation lead to failure to reach the desired levels in ESD (McKeown et al., 2002). Although the subjects and achievements related to sustainable development are included in the secondary school level curriculum in Turkey, studies determined that the students have not heard of this concept at a sufficient level before (Demir & Atasoy, 2021). This is an indication that the concept of sustainable development is not given enough space in the courses or that the activities carried out are insufficient. To achieve sustainable development, it is essential to ensure sustainability in all three dimensions, environmental, economic, and social, by all individuals who make up the society. Theoretical knowledge alone is not enough for this to happen. In addition to theoretical knowledge, individuals should also take practical steps. In the present study, various practices were carried out focusing on students within the scope of different courses aimed at improving the awareness of secondary school students about sustainable living. At the end of these activities, it was determined that the awareness of the students toward sustainable living developed positively.

The information contained in ESD is fed by more than one discipline including science, social sciences, and humanities. Demir & Atasoy (2021) stated that students mostly learn about sustainable development concepts in science and social studies classes, while they learn much less about them in Turkish, technology design, music, visual arts, information technologies, physical education, mathematics, English, and religious culture classes. In the present study, activities were carried out taking into account the weekly class durations of the courses, ensuring that there is no significant disparity in proportions between the classes (see Figure 1). The fact that activities carried out in different courses contribute to increasing students' awareness of sustainable living can be considered as an indication that their tendency to associate the concept of sustainability primarily with science subjects could be addressed. Addressing the issue of sustainable development mainly as a single course in science may limit the adequate understanding of the comprehensive structure of the subject by students. The intensive curriculum of science courses is insufficient to address the teaching of issues related to sustainable development in detail (Gayford, 2002). In previous studies, supporting this situation, it was stated that the concept of sustainable development should be considered an interdisciplinary subject rather than teaching it with a single course (Anyolo et al., 2018; Gayford, 2002; Gustaffsson et al., 2015; Yüzbaşıoğlu & Kurnaz, 2021). For this reason, ESD should be considered interdisciplinary, not with a single course, but with more than one course. Thus, students will be able to make the necessary associations by making connections between environmental, social, and economic dimensions. In the present study, supporting this situation, the activities carried out within the scope of 11 different courses related to the environmental, social, and economic dimensions of sustainability contributed to the development of students' awareness of sustainable life.

Theoretical studies on ESD are mainly carried out on curricula, teacher candidates, and teachers. Studies on ESD for the younger age group at both international and national levels are rare. In the conducted studies, it has been stated that only a small portion of secondary school students had heard of the concept of sustainable development before (Demir & Atasoy, 2021). It was determined that the students who knew the concept of sustainable development were more interested in the environmental dimension of sustainable development and their knowledge of the economic and social dimensions was weak (Borg et al., 2014; Demir & Atasoy, 2021). When the relationship balance between the sustainable development dimensions established by Munasinghe (1993) is examined, it is revealed that each dimension has equivalent value and there is no order of significance between each other. Secondary school students stated that while they frequently encountered concepts related to the environmental dimension of sustainability in the lessons, they encountered concepts related to social and economic dimensions much less (Demir & Atasoy, 2021). When the globally determined sustainable development goals and sub-goals are examined to protect the future of the planet, it is seen that sustainability is not only about the environmental dimension. Therefore, in the activities carried out in teaching environments, the social and economic dimensions of sustainable development should be included as well as the environmental dimension (Burkaz-Ekinci, 2021). Ignoring one of the dimensions of sustainable development will undoubtedly cause problems in other dimensions in the future. In the present study, activities were carried out not only for the environmental dimension of sustainable development but also for the social and economic dimensions. In this regard, activities such as rainwater collection, communicating with local organizations, taking steps to prevent waste, taking part in social responsibility projects, and upcycling practices were carried out in different courses. After these activities, students' awareness of sustainable living has developed positively both in social and economic dimensions, as well as the overall scale.

Individuals may experience deficiencies in addressing environmental problems that they cannot directly observe in their immediate environment (Bozdemir Yüzbaşıoğlu, 2020). Within the scope of the study, all of the activities carried out by the students were selected from the subjects they had the opportunity to observe directly in their daily lives and the school environment. Within the scope of environmental education, activities carried out outside the traditionally accepted teaching environments reflect positively on students' knowledge of the environment (Carrier, 2009). In addition to directly imparting knowledge to individuals, ESD aims to provide them with the necessary skills, values, and perspectives related to sustainability (Hopkins & Mckeown, 2002). For this to be achieved, different teaching methods and techniques that prioritize student-centered approaches and interaction should be employed (Corney & Reid, 2007). It is stated that it is more appropriate to include inquiry-based teaching, discussion, field studies, case studies, and experimental activities in teaching environments during ESD compared to traditional teaching methods (Corney & Reid, 2007). Thus, the environment is prepared for students to explain and evaluate their thoughts (Hicks, 2002). The results of the present study also support this situation. A total of 46 activities carried out by the students during the 33 weeks in which they were directly involved were found to reflect positively on students' awareness of sustainable living.

When the literature is reviewed, it can be seen that in many conducted studies, the issues of not polluting and preserving the environment (Bozdemir Yüzbaşıoğlu, 2020; Uyanık, 2017; Yaşaroğlu & Akdağ, 2013) are addressed, but the social and economic dimensions of environmental protection remain superficial. The steps taken for the future of the world should encompass not only the preservation of the environment but also its economic and social dimensions, which is of utmost importance. Thus, it will be possible to build a sustainable future. In their study conducted with 646 secondary school students, Demir & Atasoy (2021) found that students encounter the environmental, social, and economic dimensions of sustainable development more frequently in extracurricular activities compared to in-school activities. Students expressed that they frequently encounter concepts related to sustainable development through extracurricular activities, social clubs, communication channels such as TV, and the Internet, and projects. Considering the importance of schools in providing students with planned behaviors and the goals of the curriculum on sustainable development (Yüzbaşıoğlu & Kurnaz, 2022), it can be stated that this situation is a significant problem in raising individuals who will build the future of our world. The present study determined that the activities carried out with an interdisciplinary approach have positive effects on the sustainable development awareness of the students. In their study, Demir and Atasoy (2021) found that students approached environmental issues globally and expressed that what other countries do to improve or harm the environment also concerns them. In the present study, it can be stated that sustainable development is perceived as a global situation based on the responses of the students to the scale. Students in similar age groups stated that people should be ready to make sacrifices if necessary to raise the living standards of people other than themselves (Demir & Atasoy, 2021). The present study determined that students at the secondary school level have an awareness of economic growth and income justice as well as protecting the environment and that this awareness can be increased even more with activities in which students can participate actively.

The awareness of the individuals who make up society directly affects their attitudes and behaviors (Vrasidas et al., 2007). For sustainable development to take place on a global scale, all individuals who make up societies should have positive attitudes toward achieving sustainable development goals and objectives. ESD aims to raise individuals with awareness of sustainable development, thereby providing societies with the opportunity to live in a healthier, more reliable, and fairer world across generations (Öztürk Demirbaş, 2015). Individuals who are highly aware of sustainable development are more aware of environmental problems and more sensitive to environmental protection (Fien, 2006). Therefore, it is stated that activities to raise students' awareness of sustainable living should be utilized in teaching environments (Azrak, 2023). As a result of the present study, it was found that the awareness of the students towards sustainable living was at a moderate level in the pre-test, and after the activities were carried out it was at a high level in the post-test. The fact that the awareness of the students has increased at

the end of the activities in which they can directly participate for about an academic year can be accepted as an indication that they can transfer the concept of sustainability to their lives.

The results of this study revealed that interdisciplinary activities within the scope of different courses had positive effects on students' awareness of sustainable living. The fact that the rate of increase in the post-test scores of the scale is close to each other in the dimensions of environment, society, and economy shows that the interdisciplinary activities carried out ensure an equal rate of improvement in all dimensions of sustainable development. To achieve sustainable development, all individuals that makeup societies need to take steps towards all dimensions of sustainable development. The fact that this has happened in the present study can be considered one of the significant results of the study. To spread this result of the study to the general, it will be useful for all branch teachers to include more activities related to sustainable development in their lessons. For this to be achieved and for the ESD to achieve its objective, all teachers must have sufficient knowledge and awareness of sustainable development. In this way, they will be able to transfer and share these awarenesses with their students in educational environments. In previous studies, it is stated that the university education of teachers who are actively involved in ESD should be reorganized by considering the needs of students and teachers (Spiropoulou et al., 2007), and in-service training should be provided to provide an opportunity for current teachers to make ESD more effective (Tilbury, 2011). Therefore, based on the field literature and the results of the present study, it will be a significant step to provide training to increase the competencies of teachers for ESD during their undergraduate education. Teachers who are on duty should be given the necessary information through in-service training. Additionally, curriculum developers need to create and share more examples of activities and teaching materials related to sustainable development.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author received no financial support for the research, author-ship, and/or publication of this article.

Statements of publication ethics

I hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The study was conducted and reported by the researcher.

Ethics Committee Approval Information

This study received ethics approval from the Kastamonu University Social and Human Sciences Research and Publication Ethics Board (Dated 09.06.2022 and numbered 2022/6/18).

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| Research Article / Araştırma Makalesi|

The Relationship Between Readability and Text Design in Educational Websites[1]

Eğitsel İçerikli Web Sitelerinde Okunabilirlik ve Metin Tasarımı Arasındaki İlişki

Fatma Keskinkılıç[2], **Serçin Karataş**[3]

Abstract

Purpose: Purpose of this study is to investigate the readability levels of the websites that have educational contents.

Design/Methodology/Approach: Web-site readability is generally examined through the structural properties of the texts, or their physical properties. This research performs readability measurements are performed by employing both of the above-mentioned methods.

Findings: The findings illustrate that half of the websites are at the medium difficulty level, 20% of the remaining websites are easy, and 30% of them are difficult in terms of readability. It is concluded that readability and text design levels of the investigated websites are consistent with each other.

Highlights: The most important features in terms of text design elements in educational websites are the tonal value of the text that makes it easier to read, the balanced use of the spaces between the letters, attention to the text integrity in the text, the listing levels not exceeding two levels, and the clickability of the links. It has been seen that the least considered features in terms of text design elements in educational websites are glossary and bibliography arrangement, not including scroll bars, explaining links with texts, distinguishing visited links, inverted pyramid technique, using in-page links. It has been seen that the texts on the educational websites are at a medium difficulty level according to the text design elements scale. According to the result obtained from the readability formula of the texts on the educational websites, it was seen that the readability levels were at the medium difficulty level.

Öz

Çalışmanın amacı: Bu çalışmanın amacı, eğitsel içerikli web sitelerinin okunabilirlik düzeylerinin araştırılmasıdır.

Materyal ve Yöntem: Web sitesi okunabilirliği genellikle metinlerin yapısal özellikleri veya fiziksel özellikleri üzerinden incelenir. Bu araştırma, yukarıda belirtilen yöntemlerin her ikisi de kullanılarak okunabilirlik ölçümleri gerçekleştirir.

Bulgular: Elde edilen bulgular okunabilirlik açısından web sitelerinin yarısının orta zorluk seviyesinde, kalan web sitelerinin %20'sinin kolay ve %30'unun zor olduğunu göstermektedir. İncelenen web sitelerinin okunabilirlik ve metin tasarım düzeylerinin birbiriyle uyumlu olduğu sonucuna varılmıştır.

Önemli Hususlar: Eğitsel web sitelerinde metin tasarım öğeleri açısından en önemli özellikler metnin okumayı kolaylaştıran ton değeri, harfler arasındaki boşlukların dengeli kullanımı, metinde metin bütünlüğüne dikkat edilmesi, listeleme düzeylerinin iki düzeyi geçmemesi ve bağlantılara tıklanabilirlik hissinin verilmesi olarak karşımıza çıkmaktadır. Eğitsel web sitelerinde metin tasarım öğeleri açısından en az dikkate alınan özellikler ise sözlük ve kaynakça düzenlemesi, kaydırma çubuklarına yer verilmemesi, bağlantıların metinler ile açıklanması, ziyaret edilmiş bağlantıların ayırt edilmesi, ters piramit tekniği, sayfa içi bağlantıların kullanılması olduğu görülmüştür. Eğitsel içerikli web sitelerinde yer alan metinlerin, metin tasarım unsurları ölçeğine göre orta güçlük düzeyinde olduğu görülmüştür. Eğitsel içerikli web sitelerinde yer alan metinlerin okunabilirlik formülünden alınan sonuca göre okunabilirlik düzeylerinin orta güçlük düzeyinde olduğu görülmüştür.

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INTRODUCTION

Communication environments present information and a rich communication environment with the tools appealing to multiple senses. Wroblewski (2002) attributes the web as a communication medium to the fact that millions of people and institutions come together in this medium. The exact number of people communicating on the web can vary greatly depending on the time frame, platform, and region. It's important to note that this number is constantly changing due to global internet penetration rates, technological advancements, and other factors. He states that when communicating through the web, it is necessary to know your audience, what and how to say; thus, effective web design leads to effective communication.

The web has revealed some deficiencies and problems in effective communication. People communicate with each other through many different channels such as the internet, face-to-face conversations, phone calls, text messages, e-mails, social media platforms, video conferencing, instant messaging applications and websites. Social media and the web have a huge impact on accessing and sharing information today. Thanks to the web, people can access a wide range of information quickly. Social media platforms also accelerate the dissemination of this information. Social media can provide quick access to current events and news. However, this speed can sometimes lead to problems with accuracy and detail. In terms of obtaining information, the web provides access to a wide range of reliable sources, official sites, and information providers such as university libraries. It offers the chance to access in-depth and reliable information on various subjects. You have the opportunity to verify information by examining the sources of the websites. Sources such as academic sources, official documents, and reliable news sites are generally more reliable. The websites enable the masses communicate their messages by reaching wider dimensions. A communication environment with its content and features is easy to use, economical, and flexible in terms of place and time. It succeeds in reaching the targeted audience better than the other communication channels. Websites allow any desired subject to be presented and shared as preferred (Pektaş, 2001). Due to its nature of flexibility, this environment might present some unreliable information or might cause miscommunication.

On the web, the message is transmitted by the source through coding in various forms such as text, image and sound. This function of multimedia attracted computer users to create web pages, and this has caused some visual pollution without realizing it (Pektaş, 2001). But it should not be forgotten that the text forms most of a narrative (Bochkay, Brown, Leone, & Tucker, 2023).

As the internet is available to everyone without restrictions, it allows its users to create any kind of content. The web designers should avoid misusing their freedom over the design of the content, thereby restricting the users' ability to distinguish the given information. These adverse situations might cause the site visitors, who are as free as the site designers, to leave the site. If the aim is to have the users perceive the transmitted message easily, accurately and without requiring much time; having a background in design, mastering the content and characteristics of the audience necessitate.

Most visitors to websites have a specific goal; some aim to get information about a product, some to learn about a topic. Though the goals seem different, in essence, the visits aim to get the information (Doğan, 2006). This emphasizes the critical role that web content plays in catering to diverse user intentions and delivering the necessary information effectively. According to the 2007 Household Information Technologies Usage Survey carried out by the Turkish Statistical Institute (TUIK, 2021), 90% of household members use the internet to search for information, 80 % to communicate, 52% to engage in educational activities, 26% to contact the public organizations/ institutions. The same survey results from 2021 show that the rate of households with internet access increased to 92%. 2021 survey illustrates that the rate of the internet usage is 82% in the 16-74 age group; 80% of this age group use the internet regularly- everyday or a few times a week. These results show that there is a high rate of internet use among individuals who benefit from information services. In today's conditions, the rate of internet usage is not only for individuals who benefit from information services; It has become an indispensable part of the daily life of all people in general, especially after the global COVID-19 pandemic. During the pandemic period, all educational institutions had to move their services online; therefore, the number of people seeking information online from all fields has increased significantly. As learning from in web-based environments is being used increasingly, it has become more important to determine how to visually design digital text to support student learning (Jin, 2013). In parallel, information design in online environments continues to attract more attention. A good planning is the basis of any design; When the collected information is properly organized, classified and presented effectively, it offers ease of perception for the receiver. Irregular text and picture elements prevent perception and communication and may cause misunderstandings (Pektaş, 2001).Studies on usability report that users briefly visit websites to obtain information and leave the website immediately after they get the information. Hence, providing a web design with proper interaction enables users to access the information easily (Üstündağ, 2002). It is vital that building an effective communication with the user ensures an accurate online interaction.

The web has gained popularity in transferring information from one place to another (Ojha et al., 2021). Doğan (2006) identifies online communication mainly as text based. Nielsen (2015) points out the importance of tone of voice and content for online communication; however, their effectiveness relies on reaching the users. If users do not read the text, the goal cannot be achieved. Considering the significance of text/content, web designers need to focus on the most effective and fast ways of conveying the meaning. According to Doğan (2006), web content differs from traditional text as web users prefer to browse and filter instead of reading the whole text. In Nielsen's (1997), study on reading preferences of users, 79% of the users are found to scan and browse the webpage while only 16% read the text on the page. Based on these findings, Nielsen emphasizes the need for easy-to-scan texts while designing the text of web pages. Moreover, Moran (2020) states that people rarely read the text word-

by-word online; they are more likely to scan the content. This fact of online information-seeking behavior has remained the same for many years and has had significant implications for digital content creation. As seen in Nielsen's work, for effective message transmission, the website's feature of easy scanning is a prerequisite. To do so, the visual balance between text and images needs to be well established; colors, formatting and organization of web elements need to be balanced with attention getting features. The eye should be able to follow the movement on the page with ease to catch the information flow. Communicative meaning of writing/text need to be performed to achieve the purpose (Pektaş, 2001). In this context, web designers should pay attention to not only the physical characteristics of the textual information but also the content itself. Given the popularity of web content, analysis of its readability deserves more attention (Antunes & Lopes, 2019). For effective web design, the text design elements that include readability, ease of scanning and physical properties of texts need further examination.

Research on online texts mainly focuses on the concept of readability and physical properties of texts such as color, size, and font. The literature focuses on the readability of websites, and readability formulas developed and tested for printed materials such as books, magazines and newspaper. The results of the readability formula attempt to provide guidance to the designers about which age group or education level their websites appeal in terms of text difficulty level. Some researchers perceived web readability as typographic features such as the color and size of the text and evaluated the texts on the websites according to these features. Researchers differ in their approach to the readability of websites. Some researchers consider readability formulas based on the quantitative features of the text, such as the number of syllables and the number of words, while some base their decision on the physical characteristics of the online texts. Choosing one of these approaches might create confusion for the evaluators while evaluating a website in terms of readability. This study analyses this confusion as the problem of research.

Various evaluation methods have been utilized to evaluate the readability of text and web content. Since low readability directly affects the intelligibility of the content, the use of these evaluation methods for evaluation processes has been actively researched (Ojha et al., 2021). This research underlines the need to consider text design elements while evaluating the readability of the websites. Within this scope, this research aims to reveal a possible relationship between the measurements of readability of the texts on the educational websites based on Flesch's readability formula, and of text design features based on the scale developed for this research. In line with this purpose, the research seeks answers to the following questions:

1. What are the difficulty levels of the texts on educational websites according to the text design elements scale?
2. What is the readability level of the texts on educational websites according to the results from the readability formula?
3. Is there a significant relationship between the readability level determined by the readability formula and those determined by the text design elements scale?

A drastic increase has been observed in the number of online education services and in the development of online educational content. These websites are generally examined in terms of their visual design. Ease of perception and understanding of the message presented on the websites carry utmost importance for online learners. This fact necessitates the analysis of text readability and legibility for the information transfer. In addition to applying the available readability formulas, this study contributes to the literature in showing the relationship between the two measurements by examining the physical properties of the texts using the text design elements scale.

Literature

It is necessary for the information on the web pages to reach a wider audience, to be easy to read and understood, and for the webpages to be universally accessible (Ojha et al., 2021). Ali et al. (2013) report the tendency of readers to prefer online materials rather than in print media, and web designers should take this into account. Although there is no written list of design rules that educational websites must comply with; many agreed upon and recommended design principles and guidelines are available. Web designers choose whether to abide by these principles and guidelines. Nevertheless, the designers need to consider these principles and guidelines to attract more audience.

Miniukovich et al. (2017) states that readability is an under-researched aspect of user experience and that very few websites are designed for high readability. They point out the issues with the available readability guidelines. For this reason, as an outcome of their workshops with design and dyslexia experts; they have developed a satisfactory readability directive to be kept in mind during the designing process.

Although many formulas (such as Flesch Reading Ease Formula, Flesch-Kincaid Grade Level Formula, Gunning Fog Index, Coleman-Liau Index, SMOG Index etc.) have been developed and studies have been carried out for the readability evaluation of traditional texts, web readability still arouses the curiosity of researchers. Research has concentrated on the accessibility, readability and site ranking of websites using different accessibility and readability assessment tools (Ismail et al., 2019; Ismail & Kuppusamy, 2016; Ojha et al., 2018). Additional features have been taken into account for readability classification. For instance, Bennör (2005) and Newbold et. al. (2010) created new readability formulas for this purpose (Vajjala & Meurers, 2013). Vajjala and Meurers (2013) investigated how these readability models perform on web texts with newly added features. They applied their readability models to web search results and identified a relatively high level of online reading.

Ojha et al. (2021) presents an analysis of various readability measurement techniques in their study. They set four goals to analyze, compare and define the attributes of readability indices especially when accessed by people with disabilities. As a result,

they offer useful suggestions that the effectiveness could be enhanced if they are considered while developing the readability formulas.

In the study of Antunes and Lopez (2019) the readability of web pages is analyzed according to the related topics and their position in the search result. Having collected the first twenty Google search results on twenty topics, they tested the results using the readability criteria. The analysis shows that content provided by institutions such as universities, and health-related content have lower readability values. In another research, Bilal and Huang (2019) analyzed the readability and word complexity of two different search engine result pages; and found a significant difference between the results of search engines in terms of page readability and word complexity. The readability of search engine results is significantly higher than the associated web pages. In addition, readability of Google search results is found to be much higher than that of Bing search results.

Martin and Gottron (2012) analyze how to reliably measure the readability of web documents. They explore web-based corpus statistics as an alternative to measure readability independent from the language and indicate that corpus statistics can further be exploited for readability. It is seen that the distribution of terms into frequency classes accurately generates the perceived difficulty of text categories. In another study, Hall and Hanna (2004) examine the effect of web page text/background color combination on readability, memorability, aesthetics, and behavioral intent. 136 participants evaluated two websites, one with educational content and one with commercial content, based on the four color combination conditions. The results display that colors with higher contrast ratios are generally more readable; and, color combination significantly affects permanence. Further, it is reported that preferred colors lead to higher scores on aesthetic quality and intent of purchase; and aesthetic quality ratings significantly relate to the intent of purchase.

Hussain et al. (2011) explore ways of presenting the websites according to the different age groups in terms of readability and usefulness. The study focused on eight readability factors such as color contrast, white space, line spacing, font style, font size, text width, headings, graphics, and animation. By modifying these eight factors, the reaction of different age groups was compared. Readability for each group was influenced by different factors including color contrast, white space, font style and size, text width and title, graphics and animation, intelligibility of content, vocabulary, and text congestion. The study by Kadayat and Eika (2020) investigate the effect of sentence length on the readability of web texts accessed using screen readers such as those used by the the visually impaired. It is concluded that web content providers should prefer 16-20 word sentence lengths to maximize readability.

The literature presents suggestions and solutions to enhance the readability of online content. Yu and Miller (2010) propose a format called Jenga to increase the readability of web pages. Their study with 30 Asian users with intermediate English fluency aim to evaluate the Jenga Format and show that the proposed conversion method improved reading comprehension without any adverse effect on the reading speed.

Web content has been read in a variety of domains. Significantly, patients and caregivers are increasingly referring to the internet as a source of medical information. Internet stands out as one of the primary sources that people consult in any health-related issue. However, poor health literacy often limits the patient's understanding of the health care information literature (Sharma et al., 2014). Print and web-based materials are widely used to support patient education due to their ease of distribution, accessibility, and low cost; however, their effectiveness may be limited if they cannot be read or comprehended (Tian et al., 2014). For this reason, numerous studies have focused on the readability of websites used in the field of medicine (D'Alessandro et al., 2001; Friedman & Hoffman-Goetz, 2006; Georgsson & Carlsson, 2020; Hanley et al., 2019; Klonaris et al., 2020; Lim et al., 2021; Sabharwal et al., 2008; Tian et al., 2014). These studies clearly illustrate the significant role and function of readability in websites and call for designer to consider.

METHOD

This study aims to examine educational websites in terms of their text design and readability and uses the scanning model. The purpose of survey research is to describe by holistically analyzing an existing situation related to the research subject. In addition, survey type studies allow examining the relationships between the variables measured (Büyüköztürk et al., 20019).

The study population of this research consists of websites with educational content for primary school students, published in Turkish. The educational websites were listed using Google search engine as a popular and reliable search engine utilizing advanced techniques (Gürdağ & Özturan, 2002). The search results were ordered using an algorithm called PageRank (Brin & Page, 1998). As a result of the keyword searches such as "educational content websites, educational sites, lectures, online courses, course sites, distance education, teacher sites, online learning, children's sites" a variety of websites were accessed. The researchers aimed to reach a wide universe by branching the search with connections. Among the sites accessed, 10 sites that convey an educational content or a topic to users were included in the research and formed the sample of the research. Among the sites accessed with keyword search, sites that do not offer any educational content and lectures or correspond to the courses taught in primary and secondary education, although they are education related, were excluded from the research.

Data Collection

For data collection purposes, the formula that Ateşman (1997) had adapted from Flesch Kincaid's readability formula into Turkish was used to determine the readability level of the texts on the websites.

In the scale development process, first, the types of forms the texts are found on the webpages were determined. The texts on the web pages were grouped as headings, lists, links, and content. While determining the scale items, the physical features of the text such as headings, lists, links, typographic elements of the content, design principles were considered. The scale developed by Alpan (2004) significantly guided the "Website Text Design Elements Evaluation Scale" developed within the research. The scale items from Alpan's (2004) study are mostly related to the typographical features of the text. The Website Text Design Elements Evaluation Scale was prepared in the form of a 5-point rating scale. Items in the scale were scored as (5) Completely appropriate, (4) Appropriate, (3) Undecided, (2) Not suitable, (1) Not at all suitable.

In the Turkish version of the Flesch readability formula, adapted to Turkish by Ateşman, the following readability formula and classification, which is based on word and sentence length and can be applied in a section of one hundred words selected from the text, has been developed:

Readability Count= 198,825 – 40,175 x1 – 2,610 x2

x1 = Average word length in terms of syllables

x2 = Average sentence length in terms of words

The formula score is evaluated according to the Turkish readability ranges. These ranges are defined as "Very Easy" for 90-100 points, "Easy" for 70-89, "Average" for 50-69, "Difficult" for 30-49, "Very Difficult" for 1-29 points.

Analysis of Data

In the evaluation of educational websites in terms of text design; the correlation between the scores given by the experts for each site was examined. Having determined the correlation between the expert ratings as high, the scores given by the two experts for the sites were averaged.

During the expert evaluation, if the items such as tables, lists, and text boxes, which were evaluated in the scale items, were not found on the site; the scale item was excluded, and the score was calculated according to the number of items examined. After the scoring was completed, the scores given to each item of the scale were summed up and averaged. The scores obtained from the scale were calculated as a percentage to develop a common scoring in sites with varying number of items evaluated. The scores obtained as a result of the scale are evaluated out of 100.

Table 1. Text Design Legibility Range

Level	Readability Score
Very easy	90-100
Easy	70-89
Average	50-69
Difficult	30-49
Very difficult	1-29

The scores of educational websites from the scale were evaluated according to the Text Design Legibility Range (see Table 1). To determine the readability level of educational websites within the sample, the length of words and sentences was calculated in a 100-word section selected from a text on the site. These values were substituted in the readability formula (Readability number = 198,825 – (40.175x1 – 2,610x2)) and multiplied by the coefficients to calculate the readability values of the site. In the selection of online text, items containing text such as lists, poems, tables were excluded from the scope of the research. The t test was used to analyze whether there was a significant difference between the value from the scale evaluation of the sites and the readability value obtained from the readability formula.

FINDINGS

Descriptive results from the scales and procedural results regarding the research questions are presented respectively. Table 2 demonstrates the average scores of each item from the observer evaluation according to the text design elements of the websites.

$\overline{X}$n: The item average score for each site.

$\overline{\overline{X}}$: The average of the average scores the items received from the sites.

$$\overline{\overline{X}} = \frac{\overline{X_1} + \overline{X_2} + \overline{X_3} + \cdots + \overline{X_n}}{n}$$

Table 2. Mean Scores of Scale Items from Observers

Scale items Number	$\overline{X}1$	$\overline{X}2$	$\overline{X}3$	$\overline{X}4$	$\overline{X}5$	$\overline{X}6$	$\overline{X}7$	$\overline{X}8$	$\overline{X}9$	$\overline{X}10$	$\overline{\overline{x}}$
1	4,0	2,0	1,0	2,0	2,0	2,5	4,0	3,5	3,5	3,5	2,80
2	5,0	5,0	5,0	2,0	1,0	4,0	4,5	2,0	3,5	2,5	3,45
3	5,0	1,0	5,0	4,0	3,0	5,0	3,5	3,5	3,5	3,5	3,70
4	5,0	5,0	2,0	2,0	2,5	4,0	4,0	5,0	2,5	2,0	3,40
5	5,0	2,0	5,0	5,0	2,5	4,0	4,5	4,5	3,0	4,0	3,95
6	5,0	4,0	5,0	5,0	3,5	5,0	4,5	4,5	5,0	4,0	4,55
7	5,0	5,0	4,0	5,0	2,0	4,0	4,5	5,0	2,5	4,0	4,10
8	-	4,0	4,0	2,5	1,0	5,0	-	1,0	5,0	2,5	3,12
9	4,0	5,0	5,0	5,0	4,0	4,0	4,5	4,0	3,5	3,5	4,25
11	5,0	5,0	5,0	5,0	4,5	5,0	4,5	4,5	4,0	4,5	4,70
12	5,0	5,0	5,0	4,5	4,0	4,0	5,0	4,0	4,5	5,0	4,60
13	-	5,0	5,0	4,0	5,0	5,0	3,0	1,5	4,5	2,0	3,88
14	1,0	5,0	1,0	1,0	1,0	1,0	2,0	1,0	1,0	1,0	1,50
15	-	4,0	-	-	-	-	1,0	-	-	-	2,50
16	1,0	1,0	1,0	1,0	1,0	1,0	2,5	1,0	1,0	1,0	1,15
17	1,5	1,0	1,0	1,0	1,0	1,0	2,0	2,0	1,0	1,0	1,25
18	4,0	4,0	5,0	5,0	5,0	5,0	5,0	4,0	2,0	2,5	4,15
19	5,0	5,0	4,0	5,0	4,0	5,0	5,0	5,0	3,0	3,5	4,45
20	5,0	2,0	4,0	2,5	4,5	5,0	3,5	3,5	1,5	1,0	3,25
21	5,0	4,0	5,0	4,5	3,5	5,0	5,0	5,0	5,0	4,0	4,60
22	2,0	1,5	4,0	1,5	2,0	5,0	4,0	2,5	3,5	4,5	3,05
23	4,0	4,0	4,0	-	4,5	5,0	5,0	4,5	2,5	4,5	4,22
24	-	-	5,0	-	1,0	5,0	-	-	-	-	3,66
25	5,0	2,0	5,0	4,0	4,5	5,0	5,0	5,0	4,5	4,0	4,40
26	2,0	2,0	5,0	4,0	4,0	5,0	5,0	4,5	1,0	1,0	3,35
27	5,0	2,0	5,0	1,0	3,5	5,0	4,0	5,0	1,5	2,5	3,45
28	4,5	2,0	5,0	1,0	5,0	5,0	4,5	5,0	2,0	1,0	3,50
29	5,0	4,0	5,0	1,0	3,5	5,0	5,0	5,0	4,5	5,0	4,30
30	5,0	4,0	5,0	5,0	5,0	2,5	5,0	5,0	4,0	5,0	4,55
31	4,0	1,0	2,0	5,0	3,5	1,5	4,0	1,0	2,0	1,0	2,50
32	4,5	1,0	2,0	3,0	2,0	3,5	4,0	4,5	4,5	3,5	3,25
33	5,0	5,0	4,0	4,5	4,5	5,0	5,0	4,5	5,0	4,0	4,65
34	1,0	1,0	1,0	1,0	1,0	1,0	5,0	2,5	1,0	1,0	1,55
35	4,0	5,0	5,0	5,0	3,5	5,0	5,0	5,0	5,0	4,0	4,65
36	2,0	5,0	5,0	5,0	4,5	5,0	5,0	5,0	5,0	5,0	4,65
37	1,5	1,0	1,0	4,0	1,0	5,0	5,0	2,5	2,5	1,5	2,50
38	-	-	5,0	-	-	1,0	1,0	-	-	-	2,33
39	1,0	4,0	5,0	1,0	4,5	1,0	5,0	5,0	4,5	1,0	3,20
40	4,5	5,0	1,0	5,0	2,0	5,0	5,0	4,0	2,0	1,5	3,50
41	5,0	5,0	5,0	3,5	4,5	5,0	5,0	4,5	1,0	1,5	4,00
42	5,0	5,0	1,0	5,0	2,0	5,0	5,0	5,0	1,0	4,0	3,80
43	5,0	5,0	1,0	1,0	1,0	1,0	2,0	1,0	1,0	1,0	1,90
44	2,0	5,0	-	-	1,0	-	5,0	4,5	1,0	-	3,08
45	4,0	2,0	5,0	5,0	5,0	4,0	5,0	4,0	5,0	4,5	4,35
46	5,0	4,0	5,0	4,5	4,0	5,0	5,0	5,0	5,0	4,0	4,65
47	5,0	1,0	5,0	2,0	3,5	4,5	5,0	4,0	5,0	3,5	3,85
48	1,0	1,0	1,0	1,0	1,0	2,0	1,0	1,0	1,0	1,0	1,10
49	5,0	4,0	5,0	4,0	5,0	5,0	5,0	5,0	5,0	5,0	4,80
50	5,0	2,0	4,0	2,0	1,5	3,5	5,0	4,0	4,0	4,5	3,55
51	5,0	5,0	5,0	4,0	4,0	4,0	5,0	2,5	1,5	4,0	4,00
52	4,5	2,0	4,0	4,0	3,5	2,5	5,0	4,5	4,0	5,0	3,90
53	4,5	5,0	5,0	2,0	5,0	5,0	5,0	5,0	5,0	1,0	4,25
54	1,0	1,0	1,0	1,0	1,0	5,0	5,0	1,0	1,0	1,0	1,80
55	5,0	2,0	2,0	1,0	1,0	1,0	4,0	4,0	1,0	1,0	2,20

The 6, 11, 12, 18, 19, 21, 23, 25, 29, 30, 33, 35, 36, 41, 45, 46, 49, 51, and 53rd items of the scale items on the websites were evaluated according to Table 2. Overall, it scored more than 4.0 points (items with a score above 4 are indicated in bold). It can be said that the text design elements in these items were considered in the websites. For example, the average score of items 49 from the scale as a result of expert evaluation is 4.80. Hence, it can be interpreted that the criterion of "A topic or idea is mentioned in each paragraph" mentioned in item 49 on the websites is mostly complied with in all websites. According to Table 2, items 14, 15, 16, 17, 31, 34, 37, 38, 43, 48, 54 and 55 were scored below 2.5 points (in the table, items scored below are in italics). In the websites, text design elements in these items seem to be the least considered features. Table, 2 demonstrates that the item with the lowest score is item 48. It can be concluded that the criterion of "putting the result at the beginning (Inverted Pyramid)" mentioned in item 48 in the websites is an overlooked criterion.

Findings of Research Question 1:

"What are the difficulty levels of the texts on educational websites according to the scale of text design elements?"

The correlation between the scores of the websites on the text design elements evaluation scale and the expert scores was tabulated, evaluated, and interpreted in a comparative way. Table 3 presents the number of items included in the evaluation of each site.

Table 3. The Scores of the Websites for Text Design as a Result of the Text Design Scale

Site Number	r	P	Item number	Score	Scale Level
1	,969	,00	50	79,00	Easy
2	,997	,00	53	66,98	Average
3	,997	,00	52	75,19	Average
4	,957	,00	50	66,00	Average
5	,905	,00	53	60,18	Difficult
6	,973	,00	53	77,16	Average
7	,855	,00	53	85,28	Easy
8	,882	,00	52	73,20	Average
9	,916	,00	52	61,73	Difficult
10	,924	,00	51	58,82	Difficult

Table 3 shows a high level and significant relationship between the results of the evaluations made by the observers according to the developed scale.

Findings of Research Question 2:

"What are the readability levels of the texts on educational websites according to the result obtained from the readability formula?"

To determine the readability levels of the texts on the sites, Ateşman's (1997) readability formula was applied to the texts and the data on the readability are given in Table 4.

The results obtained from Ateşman's (1997) readability formula were interpreted according to Table 4. It is found that only the texts in the first and seventh websites are easily readable, 4 sites are of average difficulty, 2 sites are difficult, and the texts in 1 site are very difficult in terms of readability.

Table 4. Educational Websites Readability Level

Site Number	Readability Formula Score	Readability Level
1	73,89	Easy readable
2	55,09	Average readable
3	60,12	Average readable
4	48,47	Difficult readable
5	43,86	Difficult readable
6	49,82	Average readable
7	70,66	Easy readable
8	21,91	Very difficult readable
9	53,41	Average readable
10	8,18	Very difficult readable

Findings of Research Question 3:

"Is there a significant relationship between the readability level determined by the readability formulas of the websites and the levels determined by the text design elements scale?"

Table 5. Scale values and readability formula values

Site Number	Scale Score	Scale Level	Readability Formula Score	Readability Level
1	79,00	Easy	73,89	Easy readable
2	66,98	Medium	55,09	Average readable
3	75,19	Medium	60,12	Average readable
4	66,00	Medium	48,47	Difficult readable
5	60,18	Difficult	43,86	Difficult readable
6	77,16	Medium	49,82	Average readable
7	85,28	Easy	70,66	Easy readable
8	73,20	Medium	21,91	Very difficult readable
9	61,73	Difficult	53,41	Average readable
10	58,82	Difficult	8,18	Very difficult readable

After the scale evaluation and readability formula evaluation of the websites, the readability levels were determined according to the results of two evaluations. Table 5 shows the scores and levels of the sites from the text design scale and the readability formula.

As a result of the scores obtained from the scale and the readability formula, the text design levels, and readability levels of the sites were identified, and comparative data is presented in Table 5. According to the results of the evaluations, the scores from the scale and the determined levels of the sites, and the scores and readability levels from the readability formula are similar. The difference in the readability level and the levels corresponding to the score from the scale in some sites might be because of the evaluation of scale on a 3-point rating and the evaluation of readability level on a 5-point rating. However, when the levels of the sites are compared, a site that is identified as very difficult is not easy in the text design scale or easy in the formula, but not difficult in the text design scale. According to the data, the frequencies and percentages of the sites identified as Easy, Average or Difficult in terms of readability are given in Table 6.

Table 6. Frequency and percentage of readability and text design levels of websites

Level	f	%
Easy	2	20
Average	5	50
Difficult	3	30

Data in Table 6 present significant information on the readability and text design levels of the websites published in Turkey. Among the 10 sites evaluated, 20% (n=2) of the sites can be described as easy, 50% (n=5) of the sites as average level, and 30% (n=3) as difficult to read. These frequencies and the data might be generalized as 20% of the websites published in Turkey can be described as easy in terms of readability, 50% as medium difficulty and 30% as difficult.

DISCUSSION

Given the high usage of web content, it is important to analyze its readability (Antunes & Lopez, 2019). The Internet has emerged as a widely used and significant platform for conveying information between various locations. In order to ensure information is available to everyone, it's crucial to assess both its accessibility and readability score (Ojha et al., 2021). This study aims to reveal the relationship between the text design elements of educational websites and their readability levels, the data on the text design elements scale and readability levels of the texts on the educational websites. The conclusions reached based on these findings are as follows:

The most important features in terms of text design elements in the educational websites are found as the tone value of the text that makes it easier to read, the balanced use of the spaces between the letters, the attention to the integrity of the text on the page, the listing levels not exceeding two levels, and the clickability of the links. It is important for web-based instructional designers to choose the appropriate font for especially long text blocks to enhance students' readability levels (Ali et al., 2013). The least considered features in terms of text design elements in the educational web sites are seen as arrangement of glossary and bibliography, exclusion of scroll bars, explanation of links with texts, identification of visited links, inverted pyramid technique, and the use of in-page hyperlinks. The texts on the educational websites are identified at a medium difficulty level according to the text design elements scale. According to the result from the readability formula, the readability levels are observed at the medium difficulty level. Similarly, in their study conducted in the field of health, McCarthy & Flavin (2021) categorized 16.6% of the websites they evaluated in terms of readability as "easily readable" and most of them as "difficult to read." assess both accessibility and readability of online educational materials. At the same time, in a study conducted by Schreidah, Fahmy, Lapolla, Gordon, Kwinta, and Geskin (2023) evaluating the accessibility and readability of online educational materials, it was found that the readability levels of academic web pages were higher compared to non-academic web pages.

CONCLUSION AND RECOMMENDATIONS

Based on these findings a similarity between the readability level of the websites and the levels identified through the evaluation of the text design elements. Accordingly, the design elements of the text, namely the physical properties, the quantitative features such as the number of words and syllables need consideration while evaluating the readability of websites. The readability of a webpage is not limited to either the physical properties of the text or the quantitative formulas; both of these features need a close analysis.

Within the framework of the results, the suggestions for future studies on the website design and evaluation are as follows:

• The values from the readability formulas give information about the quantitative properties of the texts, but not about their qualities. While investigating the readability level of a website; a joint evaluation with two measurements, comments about the readability referring to the readability formulas, and a scale for identifying the qualitative features of the text necessitate.

• The readability levels were identified by analyzing the first 100 words on a page on the website. Future studies are recommended to increase the number of words or analyze the whole web content.

• This study was limited to the websites for primary and secondary school students. The research can be extended to educational websites for tertiary level education.

• Teachers can benefit from the text design scale and the readability formula in the selection of appropriate sites when recommending or using sites as an additional resource for their students.

• In addition to researchers, website designers can evaluate the texts by using the scale and readability formulas developed within the scope of this research.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, author-ship, and/or publication of this article.

Statements of publication ethics

We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Examples of author contribution statements

We confirm that this work is original and has not been published elsewhere, nor is it currently under consideration for publication elsewhere. The authors confirm contribution to the paper as follows: study conception and design: Fatma Keskinkılıç and Serçin Karataş. Data collection, analysis and interpretation of results: Fatma Keskinkılıç. Draft manuscript preparation: Fatma Keskinkılıç. Serçin Karataş encouraged Fatma Keskinkılıç to supervised the findings of this work. All authors discussed the results and contributed to the final manuscript.

Researchers' contribution rate

The study was conducted and reported with equal collaboration of the researchers.

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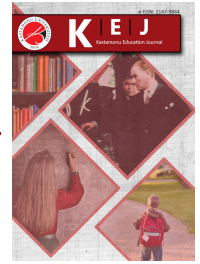
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A Phenomenographic Research On The Covid-19 Pandemic Process

Covid-19 Pandemi Sürecine Yönelik Fenomenografik Bir Araştırma

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Abstract

Purpose: In this study, it is aimed to evaluate the opinions of administrators and teachers about the reflections of the pandemic process on learning processes by making SWOT analysis.

Design/Methodology/Approach: In this context, the study was carried out with the phenomenographic research method. The study group of the research consists of 568 administrators and teachers in Trabzon in the 2020-2021 academic year. The data for the SWOT analysis were obtained by applying the structured forms prepared by the researchers to the participants.

Findings: The obtained data were analyzed by content analysis. In strengths; It has been determined that out-of-school learning opportunities have increased and students' technology use competencies have improved. On weak points; it has been revealed that it is inadequate in the lessons that require practice and there is a face-to-face communication problem. In opportunities; increasing the time spent with the family and providing fast and easy access to information came to the fore. In threats; infrastructure problems were the identified themes.

Highlights: It has been concluded that teachers should receive in-service training on methods and techniques that they can use in distance education. During the pandemic process, students were encouraged to take more responsibility for learning, and equal opportunities were provided for introverted students. The need for more objective approaches in measurement and evaluation has come to the fore. It is recommended to support applied courses with appropriate content so that they can be adapted to the distance education process.

Öz

Çalışmanın amacı: Bu çalışmada pandemi sürecinin öğrenme süreçlerine yansımaları ile ilgili idareci ve öğretmenlerinin görüşlerinin swot analizi yapılarak değerlendirilmesi amaçlanmıştır.

Materyal ve Yöntem: Bu bağlamda çalışma fenomenografik araştırma yöntemi ile yürütülmüştür. Araştırmanın çalışma grubunu 2020-2021 eğitim öğretim yılında Trabzon ilinde bulunan toplamda 568 yönetici ve öğretmen oluşturmaktadır. Swot analizi için veriler araştırmacılar tarafından hazırlanmış yapılandırılmış formların katılımcılara uygulanmasıyla elde edilmiştir.

Bulgular: Elde edilen veriler içerik analizi ile çözümlenmiştir. Güçlü yönlerde; okul dışı öğrenme imkânlarının arttığı ve öğrencilerin teknoloji kullanım yeterliliklerinin geliştiği, zayıf yönlerde; uygulama gerektiren derslerde yetersiz kalışı ve yüz yüze iletişim problemi yaşandığı, fırsatlarda; aile ile geçirilen zamanın artması ve bilgiye hızlı ve kolay erişim sağlanması, tehditlerde; alt yapı sorunları ön plana çıkan temalar olmuştur.

Önemli Vurgular: Öğretmenlerin uzaktan eğitimde kullanabilecekleri yöntem ve teknikler konusunda hizmet içi eğitimler almaları gerektiği sonucuna ulaşılmıştır. Pandemi sürecinde öğrencilerin öğrenme sorumluluğunu daha fazla almaları teşvik edilmiş, içe kapanık öğrenciler için fırsat eşitliği sağlanmıştır. Ölçme ve değerlendirmede daha objektif yaklaşımlara olan ihtiyaç ön plana çıkmıştır. Uygulamalı derslerin uzaktan eğitim sürecine adapte edilebilmesi için uygun içeriklerle desteklenmesi önerilmektedir.

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INTRODUCTION

Social change stands for the static characteristics of society being experienced in an active development process. In this sense, social change involves changes in the social and spiritual components of society. Areas such as family, consumption, production, management, human relations, science, technology and education are affected by this process of change (Şişman, 2010). The covid-19 epidemic, which affected the whole world and led to changes in all areas of social life, caused significant changes in social life (Zimmerman, 2020). Considering the formal and non-formal education process, one of the most important public fields affected by the epidemic can be said that to be the education field (Agnoletto & Queiroz, 2020). Thus, the use of digital technologies has become a basic requirement all over the world and there has been an urgent transition to distance education studies (Lau et al., 2020).

The concept of distance education refers to the process of delivering learning environments to students on a web-based basis with the help of constantly developing internet technologies and computers (Newby et al., 2006). Learning situations where the internet is at the center are called e-learning. E-learning environment includes a process where students participate in learning processes over the internet synchronously or asynchronously, away from other students and teachers (Gökdaş & Kayri, 2005). Looking at the situation of the distance education process in Turkey, it is seen that many universities have infrastructure for distance education and this infrastructure is used. In this context, a sound infrastructure can be mentioned for Turkey for distance education at the higher education level (Bozkurt, 2017). Nonetheles, it is known that a learning environment called "emergency distance education" and in return new solutions were needed during the pandemic. Emergency structured distance education is the education to be given in the face-to-face learning process completely through the distance education process when the crisis situation is over (Hodges et al., 2020). Before the epidemic, they included the digital devices, online resources, social media technology and e-learning activities educators used voluntarily in the learning process (Mulenga & Marban, 2020). In this sense, it can be stated that the epidemic process allowed to ground an active distance education process (Ferdig et al., 2020). The most important gain of this grounding is seen as the experience gained in the process (Keskin & Özer- Kaya, 2020). The gains of the distance education process, which are considered as experience can be exemplified as flexible shaping of educational materials in electronic environment, updating them when necessary, and using different technologies continuously (Yamamoto & Altun, 2020).

Another contribution of this learning process is that it forces educators, parents and students to take more responsibility. At the same time, it provides gains of using thinking skills such as critical thinking, problem solving, being creative and establishing communication and cooperation (Anderson, 2009). In addition to the gains of the distance education process, it can be stated that it involves situations which can be described as negative. That the process mostly appeals to adult learners (Bozkurt, 2020) and students, teachers and parents experience adaptation problems as a result of a rapid transition to the process, problems in the context of assessment and evaluation, and inadequate access infrastructure can be given as examples to the negative situations mentioned (Eren, 2020). In line with reducing the impact of these negative situations, according to Bozkurt (2020), students should be supported in the distance education process and adequate guidance studies should be carried out for students. According to Telli and Altun (2020), due to the sudden and rapid transition to distance education, no evaluation could be made on the requirements of distance education and possible precautions. According to Costello, Brown, Donlon, and Girme (2020), lessons should be learned from the epidemic process and new policies should be developed regarding the distance education process. According to Can (2020), in particular, the subject of assessment and evaluation should be dealt with as a priority.

From Canpolat and Yıldırım's point of view (2021), determining to what extent the courses and programs carried out in the distance education process serve the purpose, determining the thoughts of teachers and students about the process, and monitoring the distance education process continuously is necessary. It is important for the measures to be taken and the strategies to be developed to reveal the positive and negative effects of students and teachers, who are the stakeholders of distance education, which became widespread in the education process after the COVID-19 epidemic. When we look at the literature, there are many current studies examining the experience, perception and attitudes towards distance education according to teachers and administrators (Bakioğlu & Çevik, 2020; Burke & Dempsey, 2020; Çağlar & Kılınç, 2020; Görgülü Arı & Hayır Kanat, 2020; Karakuş et al., 2020; Külekçi et al., 2020; Mulenga & Marban, 2020; Roy, 2020; Taşkın & Aksoy, 2021). However, no study has been found that deals with the applications carried out for the distance education process with a SWOT analysis approach according to the views of teachers and administrators. Conducting this study with SWOT analysis enabled it to be used as a comprehensive tool that guides the strategic planning process with threats and opportunities factors by identifying the weak and strong aspects of the distance education process. It is thought that this study will make an important contribution to the field of improvement and development of the distance education process with the results of the analysis.

Based on this gap in the literature, this study, aims to evaluate the opinions of administrators and teachers about the reflections of the distance education process on the learning processes by making a SWOT analysis. For this purpose, answers were sought for the following sub-problems;

1) What are the strengths of the distance education process?
2) What are the weaknesses of the distance education process?

3) What are the opportunities intended for the distance education process?
4) What are the threats to the distance education process?

METHOD

This research was carried out in order to reveal the perceptions of the participants about the reflections of the covid-19 epidemic process on the educational environments. In this context, the study was carried out with the phenomenographic research method. With phenomenographic research, the relationship between the individual and what he or she is trying to understand or learn is tried to be investigated and explained. If the results of these studies are well understood, important steps can be taken in matters related to individual learning (Çepni, 2007). Because the more aware of the learning process related to a particular phenomenon, the more effective the implementing school stakeholders will be in the development and good structuring of the process (Marton, 1986). In this respect, it is obvious that the SWOT analysis, which was carried out on the basis of phenomenographic research, with the views of teachers and administrators, who are stakeholders in education, shows purposeful integrity.

Working Group

Purposeful sampling method was used to determine the study group. The study group of the research consists of 568 administrators and teachers in Trabzon city during the 2020-2021 academic year. Demographic data of the participants are given in Table 1.

Table 1. Participant profile

Role in the institution	Teacher	472
	Administrators	96
Gender	Female	300
	Male	268
Level of education	Undergraduate	480
	Graduate	88
School grade	Primary school	248
	Middle School	220
	High school	100
Age range	22-30	86
	31-40	219
	41-50	179
	51-60	75
	60+	9

According to Table 1, it is seen that the number of teacher participants is higher according to the type of task. According to the gender variable, it is seen that the number of female participants is higher than the number of male participants. According to the school level, it is seen that the least participation is in the high school type, and according to the age variable, the least number of participants is 60 years old and over.

Data Collection

The data for the SWOT analysis were obtained by applying the structured forms prepared by the researchers to the participants. The 4-item data collection tool was transformed into an online form using the google form. The use of the online form in the research provided the participants with the convenience of filling out the data collection tool any time. In the first part of the form, there is a text about the importance of the participation of teachers and administrators in the research mentioning their personal information is not requested and that the data obtained will only be used for scientific purposes.

Analysis of Data

Before analyzing the data of the research, preliminary preparations were made. With this regard, first of all, the data of each participant was read and checked. In these controls, it was detected that two participants filled out the form twice and the forms were removed from the data set. As a result, analyzes were made with the remaining 568 data. The obtained data were analyzed by content analysis. While performing content analysis, the data is organized in a meaningful way and categories are created in line with the relationships that best explain the data. While analyzing, similar data are integrated with certain concepts and themes. In this way, reaching concepts and relationships that can explain the data is aimed (Yıldırım and Simsek, 2011). The data obtained in this research are grouped as strengths, weaknesses, opportunities and threats. The consistency between the codes and categories created by the two experts was calculated using the formula of Miles and Huberman (1994) [Consensus/

(Disagreement + Consensus) X 100], and the consistency between the coders was determined as 90 %. Accordingly, the analyzes were found to be consistent. In addition, codes with a frequency of one in the data analysis were not included in the categories.

Validity and Reliability

In order to ensure the validity of the research, the data collection process and how the researchers reached the results were explained in detail and direct quotations from the participants' views were given (Yıldırım & Şimşek, 2011). In order to ensure internal validity in the research, researcher triangulation was performed and data collection and data analysis processes were carried out by more than one researcher (Merriam, 2013). To ensure the reliability of the study, Miles and Huberman's (1994) formula was used and the consistency between coders was calculated as 90%. In the relevant literature, it is recommended that the consistency between the coding of the researchers should be at least 80 % (Patton, 2002; Yıldırım & Şimşek, 2011).

FINDINGS

The findings emerged out of the analysis of the data during the research process were described as four categories. These categories are presented under the headings of strengths, weaknesses, opportunities and threats.

Strengths:

Strengths category consists of the opinions of the participants about the strengths of the distance education process. The frequency of repetition of teacher opinions reached in the strengths category is shown in Table 2.

Table 2. Strengths identified in line with teachers' opinions

	Category	f
1	Increasing out-of-school learning opportunities	119
2	Flexibility in time and space	98
3	Supporting student autonomy	90
4	The development of students' technology use proficiency	71
5	Improvement of teachers' technology use proficiency	68
6	No risk of contamination	61
7	No internet speed problems experienced at school	61
8	Improvement of technology use competence of parents	56
9	Improvement of teachers' proficiency in using digital materials	54
10	To have a better idea about the student's home environment	52
11	The student's taking responsibility for learning	51
12	Ability to record and reuse audio and written materials used in the learning process	50
13	Providing advantage in individual learning	49
14	More active participation of parents in the learning process	45
15	Increasing need for visual material production	45
16	Creating an advantage for introverted (shy) students	44
17	Having the opportunity to reach the student outside of school	42
18	Ensuring continuity in communication with the student outside the school	36

As seen in Table 2; the views most repeated by the participating teachers in this category are determined as; flexibility in time and space, increasing opportunities for out-of-school learning, no risk of contamination, improvement of teachers' proficiency in using digital materials, improvement of parents' proficiency in technology use, improvement of teachers' proficiency in technology use, development of technology use proficiency of students, no internet speed problems experienced at school, student's taking responsibility for learning, having a better idea about the household environment of the student, ensuring the participation of those who have a disability to come to school, the ability to record and reuse the audio and written materials used in the learning process, supporting student autonomy. The frequency of repetition of the opinions of the administrators reached in the strengths category is shown in Table 3.

Table 3. Strengths determined in line with the opinions of the administrators

	Category	f
1	Development of students' technology use proficiency	51
2	Development of technology use competence of parents	50
3	3The development of teachers' technology use proficiency	44
4	No loss of time in transportation	42
5	No risk of contamination	36
6	Supporting student autonomy	33

As seen in Table 3, the most repeated opinions of the administrators in this category are determined as; no loss of time in transportation, no risk of contamination, the development of technology use proficiency of teachers and students, the development of technology use proficiency of parents, and support for student autonomy.

Weaknesses:

Weaknesses category consists of the opinions of the participants about the weaknesses of the distance education process. The frequency of repetition of teacher opinions reached in this category is shown in Table 4.

Table 4. Weaknesses identified in line with teachers' opinions

	Category	f
1	Inadequacy for the lessons that require practice	112
2	Failure to make objective measurement and evaluation	93
3	Communication problems (eye contact-touch)	84
4	Failure to attend the lesson	76
5	Inability to carry out student-centered, individual studies	61
6	Limited opportunity for immediate feedback correction	59
7	Inability to provide classroom management	55
8	The flexible environment in the home environment creates a disadvantage in terms of discipline	55
9	Decreased peer relations between students and disadvantage in terms of socialization	54
10	Students' lack of sense of responsibility	49
11	The difference between students with and without family interest is greater than that of face-to-face education	45
12	Limited use of methods, techniques and materials in some courses	41
13	Inadequate class hours and duration	39

As seen in Table 4, the most repeated opinions of teachers in this category are determined as; inadequacy for the lessons that require practice, communication problems (eye contact-touch), not being able to participate in the lesson, not being able to do student-centered individual studies, lack of objective measurement and evaluation. The frequency of repetition of the opinions of the administrators reached in the category of weaknesses is shown in table 5.

Table 5.Weaknesses determined in line with the opinions of the administrators

	Category	f
1	Communication problem (eye contact-touch)	41
2	Lack of objective measurement and evaluation	39
3	The difference between students with and without family interest is greater than that of face-to-face education	36
4	Inadequacy for the courses that require practice	33
5	Inability to provide classroom management	28
6	Students get ahead of teachers in the use of technology	26
7	Limited opportunity for immediate feedback correction	24
8	Increasing the workload of the teacher	17
9	Students have a disadvantage in terms of decreasing peer relations with each other and socialization	16

As seen in Table 5, the most repeated opinions of the administrators in this category are determined as; communication problems (eye contact-touch), inadequacy for the lessons that require practice, lack of objective measurement and evaluation, inability to provide classroom management, and the increase in difference between students with and without family support compared to face-to-face education.

Opportunities:

Opportunities category consists of the opinions of the participants about the opportunities provided by the distance education process. The frequency of repetition of teacher opinions reached in this category is shown in Table 6.

Table 6. Opportunities determined in line with teachers' opinions

	Category	f
1	Increased time spent with family	101
2	Availability of technology	87
3	Bringing the positive aspects of technology use to the forefront for students	79
4	Internet and tablet support	65
5	Creating a new vision of the learning process	65
6	Parents should also be involved in the education process in terms of technology	56
7	To create a sustainable communication between the teacher and the student.	48
8	Accelerating the production and use of technology-supported materials	41

As seen in Table 6, the most repeated opinions of teachers in this category are determined as; availability to technology, internet and tablet support, the positive aspects of technology use for students coming to the fore, creating a new vision of the learning process and the increase in time spent with the family. The frequency of repetition of the opinions of the administrators reached in the category of opportunities is shown in Table 7.

Table 7. Opportunities determined in line with the opinions of the administrators

	Category	f
1	Quick and easy access to information	53
2	Formation of an alternative process in case schools interrupt face-to-face education for any reason (epidemic, flood, fire, etc.)	49
3	Internet and tablet support	41
4	Availability of technology	37
5	Equality of opportunity for students living in rural areas or unable to attend school for any other reason.	33

As seen in Table 7, the most repeated opinions of the managers in this category are determined as; internet and tablet support, quick and easy access to information and forming an alternative process in case of schools interruption of face-to-face education for any reason (epidemic, flood, fire, etc.).

Threats:

The threats category consists of the opinions of the participants about the threats to the distance education process. The frequency of repetition of the opinions reached in this category is shown in Table 8.

Table 8. Threats identified in line with teachers' opinions

	Category	f
1	Infrastructure problems (power outage, internet access, etc.)	118
2	Participation difficulties of students whose home environment is not suitable	80
3	Creating screen addiction	64
4	Conflicts in entering live classes in families with multiple children	59
5	There are distracting stimuli on the internet while in a live class	55
6	Some course contents are not suitable for the distance education process.	54
7	The weakening of the bond between the student and the school due to the distance from the school culture	53
8	Health problems caused by being in front of the screen	51
9	Creating a non-social environment	51
10	Parents' effort to control the teacher	48

11	Internet related security problems	42
12	Access problems for students living in rural areas	42
13	The failure of working parents to show interest in their children	33
14	Parents who are not interested in the distance education process	32

As seen in Table 8, the most repeated opinions of teachers in this category are determined as; infrastructure problems (power outage, internet access, etc.), difficulty in participation of students whose home environment is not suitable, screen addiction, conflicts in entering live classes in families with multiple children and weakening of the bond between the student and the school due to the distance from the school culture. The frequency of repetition of the opinions of the administrators reached in the category of threats is shown in Table 9.

Table 9. Threats determined in line with the opinions of the administrators

	Category	f
1	Infrastructure problems (power outage, internet access, etc.)	41
2	Access problems for students living in rural areas	38
3	Internet related security problems	32
4	The weakening of the bond between the student and the school due to the distance from the school culture	31
5	Educators who are not open to innovation and change	24

As seen in Table 9, the most repeated opinions of the participants in this category are determined as; infrastructure problems (power outage, internet access, etc.), internet-related security problems and access problems for students living in rural areas.

DISCUSSION

As a result of the SWOT analysis carried out to investigate the effect of the distance education process on the learning processes, the themes determined in line with the opinions of the teachers and administrators were examined under separate headings.

Strengths

In distance education applications, all stakeholders of the learning process (parent-teacher-student) had to be equipped with technology. Considering that one of the most important elements of the online learning environment is technology usage skills, it seems normal in the study findings that this situation emerges as the most important advantage of the relevant process. When the studies in the literature are examined, it is seen that similar results have been reached. In the research conducted by Özgöl, Sarikaya and Öztürk (2017), it was concluded that distance education contributes to the development of technological skills. In regard to the common opinions of administrators and teachers about the process in question; the themes of supporting student autonomy, giving students the opportunity to reach outside of school and no risk of contamination emerged. Flexible planning of working conditions in the distance education environment supported the formation of autonomy in students. Similar findings were also found in studies conducted in the literature (Elitaş, 2017; Fidan, 2021). Since the students do not leave the house during the distance education process, the risk of contamination decreases, communication is established with the student outside the school, and parents can also participate in the learning process at home. Thus, the learning process is not affected by the risk of disease and the parents, who are an important element of the education process, can be included in the learning process obligatorily. At the same time, more information is obtained about the student's home environment and the student is better known. Two of the findings of Fidan (2021) in his study are that the distance education process keeps the students away from the risk of contamination and that the parents are more involved in the educational processes. With the transfer of all educational processes to the house, reaching the student outside the school has been possible, thus, a continuous communication with the student about the educational processes has been ensured. According to Almaghaslah and Alsayari (2020), distance education has an important advantage in terms of meeting the educational needs and establishing a relationship with the student outside of school.

Unlike teachers the administrators have been determined to emphasize the theme of reducing the loss of time in transportation. The fact that the student is at home in distance education has created an advantage in terms of time spent in transportation, especially in big cities (Seyhan, 2021).

Unlike administrators the teachers have been revealed to focus on themes that are directly related to the learning processes (advantage in individual learning, the student's taking responsibility for learning, the necessity of producing visual materials, the ability to save and reuse learning materials, creating an advantage for introverted students). In the learning environment organized with distance education; students are involved in a learning process at their own pace and where they need to take more responsibility. Thus, students can live their lives in line with their own needs, interests and wishes. Başaran, Doğan, Karaoğlu and

Şahin (2020) in their research concluded that distance education contributes to the individual development of the student and to the introverted students. There are other studies supporting these findings (Cerezo et al., 2010; Fidan, 2021).

The other topics mentioned by the teachers were that the process provides flexibility in terms of time and place, that parents are more involved in the process, that internet problems experienced at school are not experienced in this process, and that they have more ideas about the home environment of students. In their study, Horspol and Lange (2012) identified the advantageous aspects of distance education as providing spatial convenience, saving time in terms of going to and coming back from school, and establishing an effective interaction with online platforms. It is seen that the same results have been achieved in similar studies (Koçyiğit & Uşun, 2020). According to Kırmızıgül (2020), the communication of families with their children and teachers with their students has had a positive effect in the distance education process. On this occasion, the participation of the parents of the students in the education was indirectly ensured. Supporting distance education with visuals, videos and animations affects teachers and students positively, increases permanence and motivation (Hartnett et al., 2011; Vasu & Öztürk, 2009). It can be said that this situation is a source of inspiration for teachers to produce visual materials.

Weaknesses

The themes expressed by the administrators and teachers in terms of the weaknesses of the distance education process are determined as; communication problems (eye contact-touch), students' disadvantage in terms of socialization due to the decrease in peer relations with each other, inadequacy for lessons that require practice, inability to make objective assessment and evaluation, limited opportunity for immediate feedback, correction and classroom management, the increase in difference between students with and without family support compared to face-to-face education.

In the distance education process, the learning environment cannot be enriched with gestures, mimics and social interaction as in face-to-face education, and a more formal interaction is established between the student and the teacher. Keskin and Özer-Kaya (2020) in their study to evaluate distance education concluded that students have problems in communicating (Koç, 2020; Serçemeli & Kurnaz, 2020). Horspol and Lange (2012) concluded that insufficient socialization opportunities are a significant disadvantage as a result of their research on the disadvantages of the distance education process (Uçkaç, 2020). Immediate feedback, correction and assessment-evaluation process focuses on learning results and gives notification about what and to what extent the student has learned and where he or she made a mistake. In this way, the correct achievements of the students are reinforced, and the wrong achievements are corrected. Hamutoğlu, Sezen Gültekin, and Savaşçı (2019) emphasized in their studies that there is a problem in receiving feedback from the instructor during the distance education process and this is a disadvantage (Erfidan, 2019; Hamutoğlu et al., 2019; Tuncer & Taşpınar, 2008). It is important that the assessment and evaluation are carried out in a healthy way in the processes where resources such as the internet and computers that provide distance education are used. The distance education process generally takes place in the houses of the students, and the indispensable component of the process is the families. There is a significant difference between the children of families who follow the student's process closely and those of families who leave the student alone, and a state of readiness emerges outside the teacher's field of intervention (Aziz & Dicle, 2017; Eygü & Karaman, 2013; OECD 2020). The inability of teachers to control the variables in the house environment at the same time is seen as an important weakness of this process. According to Kabapınar, Kanyılmaz, Koçhan, and Atik (2021), the fact that families do not show the necessary interest in live lessons, do not attach importance or do not support students in attending live lessons also causes a decrease in student motivation.

The themes that the administrators expressed differently from the teachers have been determined as; students' getting ahead of teachers in using technology and increase the workload of the teacher. The basis of the distance education process is based on the active use of information technologies. However, it can be said that students are more practical than parents and teachers in the use of information and communication technologies (Bayrak et al., 2017). Teachers can become passive with the increase in the dominance of students who have more relevant and practical use of information and communication technologies in online courses. Thus, it can be said that the workload of the teacher can increase in order to improve oneself. In a study by Burke and Dempsey (2020), it was determined that teachers do not have sufficient technological knowledge.

Themes expressed by the teachers, different from the administrators are stated as; the lack of participation in the lesson, the sense of responsibility of the students creating problems especially in participation in the lesson, the lack of attention, the lack of student-centered or group work, the use of a limited number of methods and the insufficient lesson hours. The course of the epidemic in the distance education process has resulted in students being completely away from the school environment, all learning processes continuing online, students falling into complacency after a while and decreasing attendance to classes. The fact that teachers have problems in attending online classes on time may be due to the fact that online classes create flexibility in students' discipline and participation in the lesson. In his study, Arık (2020) stated that despite all the work done by the Ministry of National Education, there is a problem in participating in distance education (De Oliveira et al., 2018; Karadağ & Yücel, 2020). The support of parents, who effectively guide children's education life, becomes even more important when it is considered especially for students who cannot take responsibility for their own learning and who do not have the habit of working individually and independently. The indifferent attitudes of parents and students in the learning process cause students not to develop the sense of responsibility (Çakın & Külekçi-Akyavuz, 2020; Eygü & Karaman, 2013).

During the epidemic process, the situation of conducting applied courses with distance education were faced with, and there were problems in the conduct of such courses. Limited methods and techniques that can be used may have been effective in the emergence of this situation. According to Eygü and Karaman (2013), although distance education is effective in gaining behaviors in the cognitive domain, it is not effective in gaining affective and psycho-motor behaviors and in practical disciplines (courses). According to Kör, Aksoy, and Erbay (2014), the use and exchange of teaching materials in the online environment is not as easy as in the classroom environment. According to Doğan and Paydar (2019), the distance education learning environment is limited in terms of teaching methods. In the distance education process, external stimuli in the house environment affect the learning processes of the students. While there is no decrease in motivation for bright students who can generate intrinsic motivation, the decrease in motivation for students who cannot generate this, causes the gap to widen. As a result of the research conducted by Doğan and Paydar (2019), among the disadvantages of open and distance education, it was concluded that it is difficult to generate motivation for the lesson (Fırat et al., 2018; Hobson & Puruhito, 2018).

Opportunities

The themes expressed by the administrators and teachers in common are determined as; accessibility to technology, internet and tablet support, acceleration of technology-supported material production and use, and the emergence of an alternative process. Due to the nature of distance education, instant access to technology is required and the internet infrastructure must support the process. At the same time, it is seen as an important requirement in the context of the execution of the process that the instructors produce technology-supported materials.

Unlike teachers, administrators expressed their views as providing easy and fast access to information and creating equal opportunities in education. In the distance education process in our country, the ministry has worked on the tablet and internet needs of students and internet infrastructure. By establishing EBA support points, the ministry provided support to students who were technologically inadequate during the epidemic. Thus, it is aimed to support students in accessing information and to increase their competence in using technology. In the research conducted by Özgöl, Sarikaya, and Öztürk (2017), it was concluded that students' opportunities for access to technology increased and technology-supported materials were actively used (Andoh et al., 2020). According to Hilli (2020), seeking solutions via distance education for schools closed due to covid-19 ensures the continuity of educational processes and creates equality of opportunity between students in rural areas and students in the center (Koçyiğit & Uşun, 2020). According to Çakmak and Uzunpolat (2021), that the education needs can be met within some limitations is an important advantage of distance education.

The themes that emerged as a result of the analysis of teachers' opinions are determined as; the increase in the time spent with the family, the fact that students and parents have to stay in the education process in terms of technology, and the emergence of a sustainable communication between the teacher and the student. In the distance education activities, which were passed quickly during the Covid-19 epidemic process, families were necessarily included in the learning processes. In this regard, it is known that families are more active and spend more time with their children in the digitalized education and distance education process compared to the face-to-face education process (Kırmızıgül, 2020). According to Ak, Şahin, Çiçekler and Ertürk (2020), families have a key importance in the distance education process and trainings should be organized for families on distance education at home. According to Durišic and Bunijevac (2017), the energetic activities, technical infrastructure and motivation of the parents in the education process positively affect the academic success of the students. According to Gewin (2020), teachers and students had to be in constant communication due to requirements such as inviting students to participate in the lesson, giving feedback and identifying students in difficult situations. Although the globally impactful epidemic period is thought of as a disaster, it is known to create different opportunities (El Maarouf et al., 2020). With this regard, it can be said that what happened in the world after the covid-19 epidemic created a new normal and a new paradigm. This process, which is considered as the new normal, is thought to create opportunities for the positive use of technology (Ferdig et al., 2020; Reimers & Schleicher, 2020; Shisley, 2020).

Threats

The themes expressed by the administrators and teachers in common are determined as; infrastructure problems, security problems related to the internet, access problems for students living in rural areas, failure to form a school culture. Due to the sudden transition to the distance education process, it is known that the process has a weakness for infrastructure problems. The fact that not all students, especially those living in rural areas, have access to the Internet, as well as the distraction and security problems caused by the virtual world, may be the reason why the participants expressed their opinion in this direction. When the literature is examined, it is seen that the research findings are supported. As a result of the researches Bakioğlu and Çevik (2020), Uyar (2020) conducted, it was concluded that the teachers themselves and their students have significant problems with the internet connection. There are studies supporting this (DePaepe et al., 2018; Özkul et al., 2020). During the distance education process, students were away from school and their social environments were limited to live lessons and at home. The limited communication of students with their peers has caused the relationship between school and student to weaken (Başaran et al., 2020; Durak, 2017; Horspol & Lange, 2012; Öztaş & Kılıç, 2017).

The theme of educators, who are not open to innovation and change, comes to the fore as the view that administrators put forward differently from teachers. The competencies required by the teaching profession are in a process of change and

transformation all over the world. Taking advantage of the developing technology opportunities in this transformation process is an important element of change for teachers (Mahruf & Shohel, 2012). The rapid transition to distance education during the epidemic period required a rapid adaptation to the aforementioned competencies. It is known that teachers who cannot keep up with innovation and change have difficulties in the process. According to Fidan (2021), teachers who are open to innovation and change can take on vital tasks and conduct a dynamic learning process.

Among the threats emphasized in teacher opinions; health problems caused by being in front of a screen, development of screen addiction, difficulty in attending classes for those with unsuitable home environments, course contents being not suitable for online classes, working parents having difficulty in following their children, low participation rate of children of disinterested parents, low socialization , the state of parents' control of the teacher, distraction, and the problem of participation in the lesson in families with many children. In younger age groups, students can be distracted quickly because their focus time is short. At the same time, it is known that in the distance education process, students spend an average of 3.5 hours a day with tools such as computers / tablets as an average learning process. Students continue to spend time with the same tools outside of class hours, and this creates a risk for digital game addiction. Yeliz, Yayan and Yayan (2021), in their study, concluded that children spend time in digital environments intensively during the epidemic and their game addictions are at an alarming level in recent years. At the same time, the health problems caused by sitting in front of the screen for a long time are seen as an important situation (Odabaş, 2003). It cannot be said that every student's home environment is suitable for participation in distance education in the distance education process. Especially the children of working parents were left on their own in distance education and could not find a parent who could guide them. Thus, the control of these students and their participation in the lessons did not follow a regular course.

In addition to the parents who cannot show interest in their children, a profile of parents who are biased towards the distance education process and try to control the teacher in the distance education environment has emerged. The control effort of the parents creates a problem regarding the student's relationship with the teacher. Thus, the teacher has problems in managing the process. According to Gürer, Tekinarslan, and Yavuzalp (2016), parents should provide a balance between controlling student participation in the distance education process and unnecessary intervention to the teacher. According to Avcı and Akdeniz (2021), families who do not take the necessary responsibility in the distance education process have caused problems to increase during the distance education process. The presentation of the course content that requires active participation of the students caused difficulties in the distance education process, and the active participation of all students in the live lessons could not be realized. Thus, a lack of meaningful learning has emerged in learning processes (Gewin, 2020). According to Attri (2012), it is important to create the content that students need in learning processes in order to increase the quality of distance education (Sarı, 2020). A non-social environment, the presence of distracting stimuli on the internet during live lesson, and the overlaps experienced in attending live lessons in families with many children were determined as the themes originating from the home environment.

According to Elcil and Şahiner (2014), due to the characteristics of the distance education environment, students and teachers are in separate places and feel lonely. At the same time, problems such as distracting stimuli and lack of dynamic interaction in face-to-face communication are seen as weaknesses of the process. Lee, Ward, Chang and Downing (2021), in their study, stated that students who continued their education life with distance education during the epidemic experienced a feeling of loneliness, and Munasinghe, Sperandei, Freebairn, Conroy, Jani, Marjanovic and Page (2020) similarly reported a decrease in the feeling of happiness and in physical activity due to distance from social environments. According to Moore and Kearsley (2012), "distance education process by weakening the communication between students and teachers in different environments causes a psychological gap". Distractions are an important variable that disrupts the distance education process. For this reason, it is important to control the distractions in the home environment as well as the feeling of loneliness (Strauß & Rummel, 2020). It is thought that the quality of the distance education environment can be improved when the overlapping situation in families with many children, which distracts and negatively affects the process, can be managed (Genç et al., 2020).

CONCLUSION AND RECOMMENDATIONS

The views of administrators and teachers about the process called Distance Education Process and called the new normal in the new education paradigm were evaluated under four categories called strengths and weaknesses, opportunities and threats. In strengths; increase in the opportunities for out-of-school learning and improve in the technology use competencies of the students, in weaknesses; inadequacy in lessons that require practice and face-to-face communication problems, in opportunities; increase in time spent with family and providing fast and easy access to information, and in threats; infrastructure problems have been the prominent themes. According to the results of the research, the fact that teachers' views on the distance education process focus directly on the learning-teaching processes and that the administrators focus more on the learning environment may be due to different roles and responsibilities (Kurnaz et al., 2020). Teachers are people who interact directly with students and plan lessons. In the distance education process, the opportunity of teachers to communicate with students face to face is limited. Therefore, teachers can focus on understanding the challenges faced by students, providing them with appropriate materials, and supporting their learning effectively. Teachers may also be concerned about using a variety of teaching strategies and tools to meet students' individual needs. On the other hand, administrators are usually the people responsible for the overall

operation of the school. In the distance education process, the focus of administrators may have a broader perspective, such as arranging the learning environment, providing the technology infrastructure, supporting teachers and maintaining communication with parents (Çağlar & Kılınç, 2020). These different focus points may mean that teachers care more about the individual learning experience for students, while administrators focus more on the effectiveness of the learning environment at the systematic and institutional level. However, this difference of opinion shows that both parties should work together for comprehensive management of distance education.

Although there are infrastructural deficiencies in terms of connecting to the internet in schools, state support was provided to students who could not access the internet during the distance education process. In this process, teachers learned more about their students' home environment and family structure. Notwithstanding, teachers made more efforts to prepare visual materials. It has been concluded that teachers should receive in-service training on methods and techniques that they can use in distance education. The importance of teachers being people who are always open to change and innovation has once again come to light in this process. Technology use skills of teachers, students and parents have increased, and student autonomy has been supported with this process. The idea that learning can take place outside of school has been adopted, thanks to these out-of-school learning activities have gained importance. Students saved time on their way to and from school, and the risk of contamination from school was reduced to zero, especially in the period when the mortality of the epidemic was high. Students were encouraged to take more responsibility for learning, and equal opportunities were provided for introverted students.

It is understood that strong social bonds cannot be established between student-teacher or student-student due to being in different places. On the other hand, it can be said that there is a sustainable and formal bond between the teacher and the parent so that they can closely monitor the student's participation in the lesson. The need for more objective approaches in assessment and evaluation has come to the fore. In this process, it was concluded that parents should display a more collaborative approach and be more interested in providing appropriate environments for their children in controlling the student's attendance and participation status. It is undisputable that there has been an interruption in the continuity of the school culture, yet it is also known that when children come together again, they fuse much more quickly in comparison to older people. The fact that students spent more time in front of the screen has revealed some health problems. In the post-pandemic period, it can be recommended that parents take urgent measures to eliminate these problems and direct their children to sports they are interested in.

It is recommended to support applied courses with appropriate content hence they can be adapted to the distance education process.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

Statements of publication ethics

We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The study was conducted and reported with equal collaboration of the researchers.

Ethics Committee Approval Information

Trabzon University Rectorate, Social and Human Sciences Ethics Committee, Number: E-81614018-000-226.

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| Research Article / Araştırma Makalesi|

The Effect of Peer Mentoring on Acceptance of and Intention to Use Web 2.0 Tools

Akran Mentorlüğünün Web 2.0 Araçlarının Kabul ve Kullanım Niyetine Etkisi

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Abstract

Purpose: This study seeks to shed light on the effect of peer mentoring on the acceptance of and intention to use Web 2.0 tools.

Design/Methodology/Approach: In the study, the static-group comparison pretest-posttest design, which falls into the category of weak experimental designs, was applied. The study group consisted of 165 (Experiment=76, Control=89) pre-service teachers continuing their second-year education in different departments of a public university in the 2021-2022 academic year. The implementation period of the study lasted for eight weeks and a total of 16 hours. In the study, the "unified theory of acceptance and use of technology model-2 / UTAUT2" scale was used as a data collection tool. The SPSS 26 package program was employed to analyse the data obtained in theß study. T-test, one-way analysis of variance (ANOVA), and correlational t-test were used in the analyses.

Findings: İt was concluded that the acceptance of and intention to use Web 2.0 tools among the- pre-service teachers receiving peer mentoring and teacher guidance were positively affected with a higher rate of effect for pre-service teachers receiving peer mentoring. Results based on gender revealed that the effect of peer mentoring on the acceptance of and intention to use technology among pre-service teachers was in favour of female pre-service teachers in various constructs. Results based on the ownership of a computer revealed that the effect was in favour of pre-service teachers owning computers in various constructs. And finally, results based on the department variable revealed that the effect was at a higher level for pre-service teachers in English Language Education than pre-service teachers in Elementary Mathematics Education. The results of the present study also contain some recommendations for future studies on the topic.

Highlights: The effect of different blended models can be examined in similar studies. Similar studies can be carried out with a full experimental design and mixed model methods. Studies can be re-examined with different variables.

Öz

Çalışmanın amacı: Akran mentörlüğünün web 2.0 araçlarının kabul ve kullanım niyetlerine etkisini incelemektir.

Materyal ve Yöntem: Çalışmada zayıf deneysel desenler arasında yer alan statik grup karşılaştırmalı öntest-sontest deseni kullanılmıştır. Çalışma grubu, bir devlet üniversitesinde 2021-2022 eğitim-öğretim yılında farklı bölümlerde ikinci sınıf eğitimine devam eden 165 (Deney=76, Kontrol=89) öğretmen adayından oluşmuştur. Çalışmanın uygulama süresi, sekiz hafta toplam 16 saat sürmüştür. Çalışmada "teknoloji kabul ve kullanım birleştirilmiş modeli-2 / UTAUT2" ölçeği veri toplama aracı olarak kullanılmıştır. Çalışmada elde edilen verilerin analizinde SPSS 26 paket programından yararlanılmıştır. Analizlerde t testi, tek yönlü varyans analizi (ANOVA) ve ilişkisel t testi kullanılmıştır.

Bulgular: Çalışmada hem akran mentörlüğündeki hem de öğretmen rehberliğindeki öğretmen adaylarının web 2.0 araçlarının kabul ve kullanım niyetlerini olumlu yönde etkilediği, ancak akran mentörlüğündeki öğretmen adaylarının daha fazla boyutta bir etkilenme yaşadığı sonucuna varılmıştır. Akran mentörlüğünün öğretmen adaylarının teknoloji kabul ve kullanım niyetlerine etkisinin cinsiyet değişkenine göre farklı boyutlarda kadın öğretmen adaylarının lehine, bilgisayar bulunma değişkenine göre çeşitli boyutlarda bilgisayara sahip öğretmen adaylarının lehine, bölüm değişkenine göre tek bir boyutta İngilizce öğretmenliği bölümü öğretmen adaylarının bir teknolojiyi kullanırken ilköğretim matematik öğretmenliği bölümü öğretmen adaylarına göre daha yüksek olduğu tespit edilmiştir. Çalışmada elde edilen sonuçlar ışığında gelecekte konuyla ilgili yapılabilecek araştırmalar için öneriler sunulmuştur.

Önemli Vurgular: Benzer çalışmalarda farklı harmanlanmış modellerini etkisi incelenebilir. Tam deneysel desen ve karma model yöntemleri yürütülebilir. Çalışma farklı değişkenler ile tekrardan incelenebilir.

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INTRODUCTION

The adventure of using technology in education covers a long period that gained momentum with the Second World War. There has been a great deal of change and development in educational technologies starting from that period with a focus on mass education until today. One of the underlying reasons behind the relevant change is the rapid development of Internet technologies. In particular, the advance of Web 2.0 technologies, which has resulted in the activeness of the users, has brought about a change in educational practices. Being a user-oriented structure, Web 2.0 has also catalysed an environment that allows interaction with content, acceleration of communication, information sharing, and collaborative work (Faboya & Adamu, 2017; Grosseck, 2009; O'Reilly, 2005). Web 2.0 technology is an active and open Web architecture that offers users to participate in collaborative learning activities, online video, animation, content creation, and sharing environments through social networks, blogs, and several applications (Downes, 2005; Huang, 2013). Web 2.0 tools have contributed to learning and teaching environments as well as many other fields (Kompen et al., 2019). Web 2.0 technologies in learning-teaching environments offer many opportunities for students to access and share information and collaborate in e-environments (Leh, et al., 2021). It is also possible to use Web 2.0 technologies for formative assessment purposes in learning and teaching environments (Gurel, 2021).

The integration of technology into educational environments has brought about a dynamic change (Çetin & Özdemir, 2018). It is known that pre-service teachers are very good at using technology for entertainment, communication, and information purposes (Ertmer et al., 2012; Habibi, et al., 2022; Martin, 2018). However, they have little knowledge and experience in the integration of technology into education (Habibi, Yusop, & Razak, 2020). In addition, it is reported that the way technology integration is presented and attitude towards technology is also influential in technological skills (Voogt and McKenney, 2017). The integration of technology is redesigned and adapted to the purposes as new technologies develop (Broadbent et al., 2020).

The acceptance and adoption of every emerging technology by users are among the most important research topics (Venkatesh, et al., 2003; Yilmaz, et al., 2018), a fact that lies behind the emergence of many models. A myriad of models is referenced when researching the diffusion, acceptance, and adoption of new technology or innovation. Among the examples is the Diffusion of Innovation Theory, the Theory of Reasoned Action, the Theory of Planned Behaviour, the Technology Acceptance Model, and the Unified Theory of Acceptance and Use of Technology Model 1 and 2.

In this study, considering the information in the literature, the acceptance of Web 2.0 tools and their effect on the intention to use were examined through the Unified Theory of Acceptance and Use of Technology Model-2 (UTAUT-2). UTAUT-2 is an updated and improved version of the original UTAUT theory, emphasizing that, unlike previous theories, technology acceptance and use are influenced by multiple factors. In the UTAUT-2 model, in addition to the four main factors (performance expectancy, effort expectancy, social influence, and facilitating condition), three factors were added: hedonic motivation, price value, and habit. As a result, the new structure managed to explain 74% of behavioral intention (Venkatesh, Thong, & Xu, 2012).

Performance expectancy means to what extent individuals will benefit from technology and their expectations regarding its use (Venkatesh et al., 2003). This factor is vital as it affects individuals' intention to adopt technology (Venkatesh et al., 2003; Kaplan, 2018; Kılıç and Yılmaz, 2021). Effort expectancy refers to the perception of how difficult and complex technology is to use and can negatively affect individuals' intentions to adopt technology. Ease of use and perceived benefit are positively affected if less effort is exerted when using an innovation (Usluel & Mazman, 2009). Social influence refers to the user's perception of whether others around him/her are using the technology. In another definition, it is defined as the degree to which individuals that matter to users believe that they should use the new technology (Venkatesh et al., 2003). Individuals that matter to users can be family, friends, and colleagues (Khechine, et al., 2014). Facilitating conditions are defined as the degree to which an individual believes in the existence of an organizational and technical infrastructure to support technology use (Venkatesh et al., 2003). Habit refers to the tendency of individuals to exhibit autonomous behaviour due to learning as a result of technology system learning (Venkatesh et al., 2012). Hedonic motivation, on the other hand, has been defined as enjoyment, entertainment, and satisfaction arising from the use of technology (Hashim, et al., 2022). Brown and Venkatesh (2005) reported that hedonic motivation plays an important role in the acceptance and use of technology. However, for non-essential technology acceptance environments, such as home or personal use, hedonic motivation is a more important driver than performance expectancy in determining intention to use technology (Venkatesh et al., 2012). Price value is the perceived cost of technology. Price value is among the factors that determine individuals' willingness to adopt technology (Venkatesh et al., 2012). Many Web 2.0 tools offer limited capabilities in their free versions. Therefore, several costs are faced by the users to benefit from the paid parts. In this case, it is thought that the price value will be effective in the adoption process. As a matter of fact, the inadequacy of the financial situation and the increasing prices of technological devices bring along difficulties in technology purchase (Dashtestani & Hojatpanah, 2020).

The studies on technology acceptance and use have revealed that the target groups of the studies conducted in Turkey are comprised of a wide variety of audiences including school administrators (Yahşi & Hopcan, 2021), teachers (Duyku 2021; Ömrüuzun, 2019), high school students (Diri, & Açıkgül, 2021), banking (Gursel, & Yanartas, 2021), women entrepreneurs (Özsungur, 2019), and consumers (Gündoğan, & Kazançoğlu, 2021; Belge, & Mutlu, 2020).

On the other hand, the international literature has demonstrated that the target group is mostly comprised of university students (Goto, et al., 2021; Apandi, & Raman, 2020; Liu, & Yan, 2020), teachers (Tseng, et. al., 2022; Avcı, 2022), pre-service teachers (Fung, Smith, & Gandolfi, 2022; Mutambara, & Chibisa, 2022; Goto, Batchelor, & Lautenbach, 2021; Ning, & Dong, 2021; Bower, DeWitt, & Lai, 2020; Raman, & Don, 2013), and managers (Dakduk, et al., 2018). In addition, the topics include MOOCs

(Tseng, et. al., 2022; Goto, et al., 2021), teacher professional development (Machingambi, & Batchelor, 2019), blended learning (Dakduk, et al., 2018; Apandi, & Raman, 2020). Learning management system (Zwain, & Haboobi, 2019), teaching tools (Liu, & Yan, 2020), digital game-based foreign language teaching (Fung, et al., 2022), and online shopping (Eneizan, et al., 2019). Technology acceptance and use, as a subject that researchers inquire about, is constantly investigated based on the effect of a tool, technology, or a need on individuals.

AlAwadhi and Morris (2008) scrutinized the adoption of e-government services in Kuwait to find out that performance expectancy, effort expectancy, and peer influence play a role in behavioral intention. In the study conducted on the basis of the UTAUT-2 model to determine the factors affecting the employees' intention to use Web 2.0 applications, the employees were reported to find Web 2.0 applications useful for their work and experience ease of use since they could use the applications easily along with an emphasis on the importance of the little effort required in individuals' acceptance and use of innovation for adoption (Wang et al., 2014). Alalwan et al. (2017) investigated mobile banking adoption, concluding that behavioral intention is significantly and positively affected by performance expectancy, effort expectancy, hedonic motivation, and price value. In a study on the Internet of Things and examining the perceived value effect, it was concluded that users could easily use IoT applications and in this context, a significant and expected positive effect on the perceived value was found in this context (Çoban & Özkan Tektaş, 2020). Tseng et al. (2019) studied teachers' acceptance and use of massive open online courses (MOOC) and revealed that performance expectancy, social influence, facilitating conditions, and price value variables affect teachers' behavioral intention while effort expectancy and hedonic motivation do not. Alkhwaldi and Abdulmuhsin (2022) investigated the acceptance of distance education and revealed that performance expectancy is a key predictor of facilitating conditions. In another study, Gu et al. (2021) employed the UTAUT-2 model and the structural equation model regarding e-health technology acceptance and use, concluding that effort expectancy, social influence, and facilitating conditions affect intention noticeably while performance has no effect on intention. Upadhyay, et al., (2022) revealed that effort expectancy does not have an effect on intention though it does have a positive effect on performance expectancy, social influence, hedonic motivation, and intention to accept artificial intelligence. Gender (Diri & Açıkgül, 2021; Nikolopoulou, Gialamas & Lavidas, 2020), experience, and age are observed to be used as intervening variables in the majority of studies on the technology acceptance and use model (Venkatesh, et al., 2012). Kandemir (2020) examined the use of educational environments such as EBA, Morpa Campus, Okulistik through many sub-variables such as gender, branch, age, institution, length of service, and technology use proficiency while variables of age and experience variables were not used since the same class and age group were taken into consideration. The acceptance of and intentions to use Web 2.0 tools were investigated in this study with the thought that Web 2.0 technologies could potentially affect their use in a cooperative way. UTAUT was used in this study to investigate behavioral intention to identify the technology as well as the factors affecting its adoption.

The literature review has shown that there are a limited number of studies that focuses on the acceptance of and intention to use Web 2.0 tools. It is noteworthy that a great number of such studies are based on a descriptive survey model with no experimental studies taken into consideration. Furthermore, peer mentoring is also expected to have an impact on the acceptance and use of Web 2.0 tools as it shows that the opinions of peers or other individuals around are key factors in the adoption of an innovation and such influence is what puts social influence into perspective (Usluel & Mazman, 2010). Thus, the present study has been designed to shed light on the effect of peer mentoring on the acceptance of and intention to use Web 2.0 tools. For this purpose, the following questions were addressed.

1. Is there a significant difference among the pre-implementation scores of the experimental and control group pre-service teachers in acceptance of and intention to use technology?
2. Is there a significant difference between the pre-implementation and post-implementation scores of the experimental and control group pre-service teachers in acceptance of and intention to use technology?
3. Is there a significant difference between the post-implementation and pre-implementation scores of the experimental and control group pre-service teachers in acceptance of and intention to use technology according to gender, ownership of a computer, and departments?
4. Is there a significant difference between the post-implementation and pre-implementation scores of the experimental and control group pre-service teachers in acceptance of and intention to use technology?

METHOD

This study was carried out through a weak experimental design based on the comparison of the pre-test and post-test scores of the experimental and control groups. The study group activities were carried out in two stages: peer mentoring and teacher guidance.

Research Model

The static group comparison pretest-posttest design, which falls into the weak experimental designs, was used in this study along with quantitative data. The static group comparison pretest-posttest design is a model used in cases where existing groups (experiment-control) are available without random assignment and matching (Fraenkel, et al., 2018). In this study, due to the

existence of the groups (six groups) and the presence of three teachers within the scope of the implementation, a lottery method was used regarding the intervention methods. In this context, it was decided that each teacher would lead the experiment and control group activities. The activities as part of the implementation were carried out within the scope of the "instructional technologies" course, and it was ensured that the experimental group activities were carried out through peer mentoring and the control group activities were carried out through teacher guidance.

Study Group

The study group consisted of 165 pre-service teachers continuing their second-year education in different departments at a public university in the 2021-2022 academic year. The demographic characteristics of the study group are summarized in Table 1.

Table 1: Demographic characteristics of the study group

Group	Gender	f	%	Ownership of the Computer	f	%	Department	f	%
Experimental	Female	50	65.8	Yes	35	46.1	Elementary Mathematics Education	22	28.9
							Primary School Education	17	22.4
	Male	26	34.2	No	41	53.9	Elementary Turkish Education	13	17.1
							English Language Education	24	31.6
	Total	76	100		76	100		76	100
Control	Female	63	70.8	Yes	27	30.3	Elementary Mathematics Education	21	23.6
							Primary School Education	29	32.6
	Male	26	29.2	No	62	69.7	Elementary Turkish Education	21	23.6
							English Language Education	18	20.2
	Total	89	100		89	100		89	100

A total of 165 (experimental=76, control=89) pre-service teachers participated in the study. 50 (65.8%) of the pre-service teachers in the experimental group are female, 26 (34.2%) are male, the number of pre-service teachers owning a computer is 35 (46.1%), the number of those without a computer is 41 (53.9%), 22 (28.9%) of them are in the field of Elementary Mathematics Education, 17 (22.4%) of them are in the field of Primary School Education, 13 (17.1%) of them are in the field of Elementary Turkish Education, and 24 (31.6%) of them are in the field of English Language Education. 63 (70.8%) of the pre-service teachers in the control group are female, 26 (29.2%) of them are male, the number of pre-service teachers owning a computer is 27 (30.3%), the number of those without a computer is 62 (69.7%), 21 (23.6%) of them are in the field of Elementary Mathematics Education, 29 (32.6%) of them are in the field of Primary School Education, 21 (23.6%) of them are in the field of Elementary Turkish Education, and 18 (20.2%) of them are in the field of English Language Education.

Implementation Process

In-class activities lasted two hours each week for a total of 16 hours for 8 weeks. Before the implementation, pre-test data were collected from the groups. Web 2.0 tools were part of activities in the context of the collaborative flipped classroom.

Both experimental and control cooperative study groups were formed under the guidance of the teacher. It was ensured that the groups consisted of 3 to 5 pre-service teachers. The videos prepared for Web 2.0 tools by the relevant collaborative study groups were shared with their peers on the YouTube channel created by the teacher (a special channel was created for each group). All the collaborative study groups were informed about how to prepare the videos along with an explanation of screen recording programs and implementation with the students. At the end of each in-class activity, the Web 2.0 tool, which would be held the next week, was explained to the groups through the lottery method. Thus, the time allocated for video preparation was equal in all groups to avoid any difference between the groups. Care was taken to include the following titles in the videos prepared for Web 2.0 tools.

1. Definition of the Web 2.0 tool
2. Membership login to the Web 2.0 tool
3. Introduction of the interface of the Web 2.0 tool
4. Use of the Web 2.0 tool
5. An in-class activity with the Web 2.0 tool

Before the videos prepared for this purpose were shared with the peers, the content and layout were confirmed by the teacher, and corrections were made after receiving feedback. Following the implementation process, data regarding the post-test were collected. The implementation process is summarized in Figure 1.
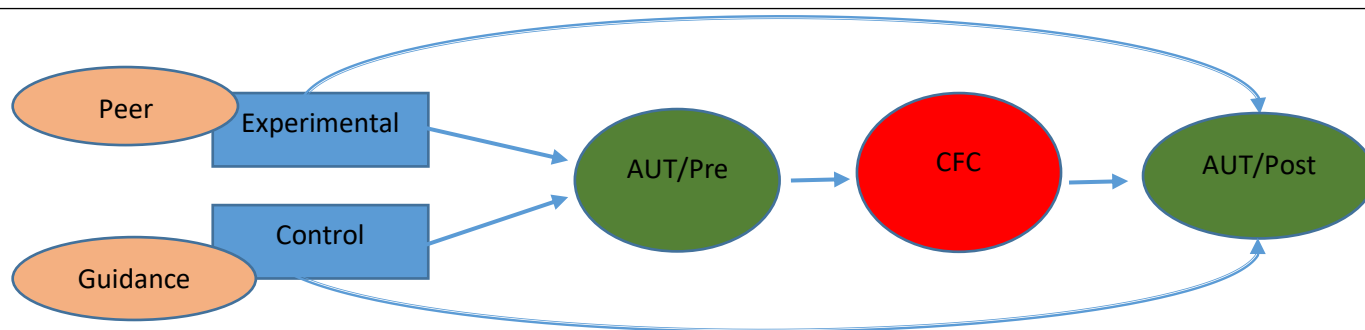
* AUT/Pre: Acceptance and Use of Technology/Pre-test, CFC: Collaborative Flipped Classroom, AUT/Post: Acceptance and Use of Technology/Post-test

Figure 1. Implementation process

Data Collection

The "unified theory of acceptance and use of technology model-2" scale developed by Venkatesh, et al., (2012) and adapted into Turkish by Yılmaz and Kavanoz (2017) was used to collect data from the experimental and control groups before and after the implementation.

The unified theory of acceptance and use of technology is a seven-point Likert scale rated as "(1) strongly disagree, (2) disagree, (3) partially disagree, (4) undecided, (5) partially agree, (6) agree, (7) strongly agree" and contains eight constructs and 28 items. The size and total Cronbach's alpha internal consistency coefficients of the scale, both in the original and in the present study, are presented in Table 2.

Table 2: Cronbach's alpha internal consistency coefficients

Constructs	In the scale adaptation study	In the present study	
		Pre-test	Post-test
Performance Expectancy	0.92	0.92	0.90
Effort Expectancy	0.89	0.82	0.87
Social Influence	0.87	0.79	0.81
Facilitating Conditions	0.82	0.74	0.86
Hedonic Motivation	0.93	0.95	0.92
Price Value	0.76	0.78	0.74
Habit	0.83	0.70	0.81
Behavioral Intention	0.89	0.86	0.85
Total	0.97	0.93	0.96

While calculating Cronbach's alpha internal consistency coefficients, $\geq .70$ is acceptable, $\geq .80$ is good, and $\geq .90$ is excellent (Cronbach, 1951). This indicates that the data obtained in the study are reliable (Murphy & Davidshofer, 2004).

Data Analysis

The SPSS 26 package program was employed in the analysis of the data. Before the data were analysed, the normality distribution to which analysis procedure the data would be subjected was evaluated. In addition to the Kolmogorov-Smirnov test of normality (experimental and control $p > .05$), the skewness and kurtosis values of the data were also evaluated. It was observed that the data ranged between ± 2 values. The literature review reveals that the data ranging between such values show the normal distribution and indicates the appropriateness to apply parametric tests in the analysis (Kerr, et al., 2002; George & Mallery, 2019). In this context, frequency, percentage, standard deviation, and arithmetic mean values were analysed through parametric tests. The mean scores of the pre-test data were primarily analysed in repeated measurements. Besides, a t-test was employed for independent samples and binary categories, a one-way analysis of variance (ANOVA) for more categories, and a correlational t-test for the difference between post-implementation and pre-implementation. Tukey test values were also evaluated to reveal the source of the difference as part of the ANOVA test.

FINDINGS

This section includes the findings of the analyses conducted to investigate the effect of peer mentoring on the acceptance of and intention to use pre-service teachers' Web 2.0 tools. Table 3 summarizes the results of the pre-implementation scores of the experimental and control group pre-service teachers regarding the acceptance of and intention to use technology.

Table 3: Pre-implementation scores of the experimental and control group pre-service teachers regarding the acceptance of and intention to use technology

Factors (Pre-test)	Group	Mean	Sd	t	p	Significant Difference
Performance Expectancy	Experimental	6.19	1.04	-0.522	.606	None
	Control	6.27	0.90			
Effort Expectancy	Experimental	5.19	1.00	-0.731	.466	None
	Control	5.31	1.01			
Social Influence	Experimental	5.75	0.97	-0.195	.846	None
	Control	5.78	0.97			
Facilitating Conditions	Experimental	4.30	1.23	-1.070	.286	None
	Control	4.51	1.24			
Hedonic Motivation	Experimental	5.54	1.22	0.101	.920	None
	Control	5.52	1.11			
Price Value	Experimental	4.84	1.16	-1.151	.258	None
	Control	5.03	0.98			
Habit	Experimental	4.83	0.97	-0.917	.361	None
	Control	4.97	0.95			
Behavioral Intention	Experimental	5.41	1.16	-1.031	.311	None
	Control	5.58	0.97			

* Experimental N=76, Control N=89, p< .05

Table 3 highlights that the pre-test mean scores of the acceptance and use of technology scale factors of the experimental and control groups are 6.19 and 6.27 for performance expectancy (t=-0.522), 5.19 and 5.31 for effort expectancy (t -0.731), 5.75 and 5.78 for social effect (t=-0.195), 4.30 and 4.51 for facilitating conditions (t=-1.070), 5.54 and 5.52 for hedonic motivation (t=0.101), 4.84 and 5.03 for price value (t=-1.151), 4.83 and 4.97 for habit (t=-0.917), and 5.41 and 5.58 for behavioral intention (t=-1.031). As a result of the t-test for independent samples, no statistically significant difference was found between the experimental and control groups, p> .05. This supports the finding that the experimental and control group pre-test mean scores are not statistically different from each other. Table 4 summarizes the results regarding the difference in post-implementation-pre-application scores of the experimental and control group pre-service teachers in terms of acceptance of and intention to use Web 2.0 tools.

Table 4: Difference in post-implementation-pre-application scores of the experimental and control group pre-service teachers in terms of acceptance of and intention to use Web 2.0 tools

Factors (Pre-test)	Group	Mean	Sd	t	p	Significant Difference
Performance Expectancy	Experimental	0.00	1.43	0.53	0.60	None
	Control	-0.11	1.20			
Effort Expectancy	Experimental	0.62	1.26	0.88	0.38	None
	Control	0.44	1.32			
Social Influence	Experimental	0.28	1.18	0.75	0.45	None
	Control	0.14	1.23			
Facilitating Conditions	Experimental	1.00	1.80	0.54	0.59	None
	Control	0.86	1.50			
Hedonic Motivation	Experimental	0.62	1.43	0.56	0.58	None
	Control	0.49	1.48			
Price Value	Experimental	0.66	1.36	1.22	0.23	None
	Control	0.40	1.39			
Habit	Experimental	0.61	1.30	1.62	0.11	None
	Control	0.27	1.38			
Behavioral Intention	Experimental	0.46	1.39	1.32	0.19	None
	Control	0.18	1.31			

* Experimental N=76, Control N=89, p< .05

Table 4 highlights that the posttest-pretest difference mean scores of the experimental and control groups in terms of acceptance of and intention to use Web 2.0 tools are 0.00 and -0.11 for performance expectancy (t=0.53), 0.62 and 0.44 for effort expectancy (t=0.88), 0.28 and 0.14 for social influence (t=. 75), 1.00 and 0.86 for facilitating conditions (t=0.54), 0.62 and 0.49 for hedonic motivation (t=0.56), 0.66 and 0.40 for price value (t=1.22), 0.61 and 0.27 for habit (t=1.62), and 0.46 and 0.18 for behavioral intention (t=1.32). As a result of the independent sample t-test test, no statistically significant difference was found between the experimental and control groups, p> .05. This indicates that the posttest-pretest difference mean scores of the experimental and control groups are statistically equal. The results of the post-implementation-pre-application difference scores of the experimental and control group pre-service teachers in terms of acceptance of and intention to use Web 2.0 tools according to the gender variable are summarized in Table 5a.

Table 5a: Post-implementation-pre-application difference scores of the experimental and control group pre-service teachers in terms of acceptance of and intention to use Web 2.0 tools according to the gender variable

Factors (Difference)	Gender	N	Mean	Sd	t	p	Significant Difference
Performance Expectancy	Female	113	0.07	1.35	1.87	0.06	None
	Male	52	-0.34	1.19			
Effort Expectancy	Female	113	0.58	1.28	0.87	0.39	None
	Male	52	0.39	1.32			
Social Influence	Female	113	0.35	1.16	2.29	0.02	In favour of female
	Male	52	-0.11	1.26			
Facilitating Conditions	Female	113	0.83	1.52	-1.15	0.25	None
	Male	52	1.14	1.87			
Hedonic Motivation	Female	113	0.73	1.43	2.40	0.02	In favour of female
	Male	52	0.15	1.45			
Price Value	Female	113	0.58	1.34	0.82	0.41	None
	Male	52	0.39	1.47			
Habit	Female	113	0.44	1.26	0.17	0.86	None
	Male	52	0.40	1.52			
Behavioral Intention	Female	113	0.38	1.32	0.97	0.33	None
	Male	52	0.16	1.41			

* Female N=113, Male N=52, p< .05

Table 5a highlights that the posttest-pretest difference mean scores of the experimental and control groups in terms of the factors of acceptance of and intention to use Web 2.0 tools according to gender are 0.07 and -0.34 for performance expectancy (t=1.87), 0.58 and 0.39 for effort expectancy (t=0.87), 0.83 and 1.14 for facilitating conditions (t=-1.15), 0.58 and 0.39 for price value (t=0.82), 0.44 and 0.40 for habit (t=0.17), and 0.38 and 0.16 for behavioral intention (t=0.97). On the other hand, the values are 0.35 for females and -0.11 for males in the social influence (t=2.29) factor, and 0.73 for females and 0.15 for males in the hedonic motivation (t=2.40) factor. As a result of the independent sample t-test, no statistically significant difference was found between the experimental and control groups in terms of gender (performance expectancy, effort expectancy, facilitating conditions, price value, habit, behavioral intention), p> .05, a statistically significant difference was found in the social influence and hedonic motivation factors, p< .05. In both factors, the difference was in favour of female pre-service teachers.

Table 5b summarizes the results of the post-implementation-pre-implementation difference scores of the experimental and control group pre-service teachers in terms of acceptance of and intention to use Web 2.0 tools according to ownership of a computer.

Table 5b: Post-implementation-pre-implementation difference scores of the experimental and control group pre-service teachers in terms of acceptance of and intention to use Web 2.0 tools according to ownership of a computer

Factors (Difference)	Ownership of the computer	Mean	Sd	t	P	Significant Difference
Performance Expectancy	Yes	0.17	1.41	1.74	0.08	None
	No	-0.20	1.23			
Effort Expectancy	Yes	0.69	1.36	1.26	0.21	None
	No	0.42	1.25			
Social Influence	Yes	0.22	1.25	0.09	0.93	None
	No	0.20	1.18			
Facilitating Conditions	Yes	1.45	1.36	3.25	0.00	In favour of "Yes"
	No	0.61	1.72			
Hedonic Motivation	Yes	0.87	1.51	2.19	0.03	In favour of "Yes"
	No	0.36	1.39			
Price Value	Yes	0.93	1.49	3.03	0.00	In favour of "Yes"
	No	0.28	1.25			
Habit	Yes	0.65	1.46	1.63	0.11	None
	No	0.29	1.26			
Behavioral Intention	Yes	0.40	1.65	0.68	0.50	None
	No	0.26	1.14			

* Yes N=62, No N=103, p< .05

Table 5b highlights that the posttest-pretest difference mean scores of the experimental and control groups in terms of the factors of acceptance of and intention to use Web 2.0 tools according to ownership of the computer are 0.17 and -0.20 for performance expectancy (t=1.74), 0.69 and 0.42 for effort expectancy (t=1.26), 0.22 and 0.20 for social influence (t=0.09), 0.65 and -0.29 for habit (t=1.63), and 0.40 and -0.26 for behavioral intention (t=0.68). On the other hand, the values are 1.45 and 0.61 for facilitating conditions (t=3.25), 0.87 and 0.36 for hedonic motivation (t=2.19), and 0.93 and 0.28 for price value (t=3.03). As a

result of the independent sample t-test, no statistically significant difference was found between the experimental and control groups according to ownership of the computer (performance expectancy, effort expectancy, social influence, habit, behavioral intention), p> .05, a statistically significant difference was found in the facilitating conditions, hedonic motivation, and price value factors, p< .05. The difference in these factors was in favour of pre-service teachers owning computers.

Table 5c summarizes the results of the post-implementation-pre-implementation difference scores of the experimental and control group pre-service teachers in terms of acceptance of and intention to use Web 2.0 tools according to departments.

Table 5c: Post-implementation-pre-implementation difference scores of the experimental and control group pre-service teachers in terms of acceptance of and intention to use Web 2.0 tools according to departments

Factor Difference)	Departments	Mean	Sd	F	P	Significant Difference
Performance Expectancy	1	-0.44	1.30	1.925	.128	
	2	-0.05	1.30			
	3	0.10	1.42			
	4	0.19	1.19			
Effort Expectancy	1	0.33	1.23	1.785	.152	
	2	0.32	1.26			
	3	0.64	1.59			
	4	0.86	1.07			
Social Influence	1	-0.03	1.22	1.971	.120	
	2	0.04	1.17			
	3	0.31	1.23			
	4	0.53	1.17			
Facilitating Conditions	1	0.74	1.30	1.002	.394	
	2	0.73	1.79			
	3	1.00	1.78			
	4	1.26	1.67			
Hedonic Motivation	1	0.11	1.48	2.727	.046	English Language Education -Elementary Mathematics Teaching
	2	0.45	1.42			
	3	0.75	1.58			
	4	0.94	1.26			
Price Value	1	0.43	1.37	1.084	.357	
	2	0.30	1.52			
	3	0.58	1.35			
	4	0.81	1.24			
Habit	1	0.36	1.32	1.148	.331	
	2	0.21	1.22			
	3	0.42	1.51			
	4	0.73	1.36			
Behavioral Intention	1	0.08	1.04	1.587	.195	
	2	0.14	1.49			
	3	0.45	1.30			
	4	0.63	1.47			

* Elementary Mathematics Education (1) N=43, Primary School Education (2) N= 46, Elementary Turkish Education (3) N=34, English Language Education (4) N=42, p< .05

Table 5c highlights that the posttest-pretest difference mean scores of the experimental and control groups in terms of acceptance of and intention to use Web 2.0 tools according to departments, while there was no statistically significant difference in the performance expectancy (F=1.925), effort expectancy (F=1.785), social influence (F=1.971), facilitating conditions (F= 1.002), price value (F=1.084), habit (F=1.148) and behavioral intention (F=1.587) factors p> .05, there was a statistically significant difference in the hedonic motivation (F=2.727) factor, p< .05. According to the Tukey and Scheffe tests conducted to reveal the source of the difference in this factor, the difference was found between the Elementary Mathematics Education and English Language Education departments. This difference was in favour of the pre-service teachers receiving education at the English Language Education department. The results of the post-implementation-pre-implementation scores of the experimental and control group pre-service teachers in terms of acceptance of and intention to use technology are summarized in Table 6.

Table 6: Post-implementation-pre-implementation scores of the experimental and control group pre-service teachers in terms of acceptance of and intention to use technology

Group	Factors	Implementation	Mean	Sd	t	p	Significant Difference
Experimental	Performance Expectancy	Post-test	6.19	0.91	-0.02	0.98	None
		Pre-test	6.19	1.04			
	Effort Expectancy	Post-test	5.81	0.81	4.27	0.00	In favour of post-test
		Pre-test	5.19	1.00			
	Social Influence	Post-test	6.03	0.81	2.08	0.04	In favour of post-test
		Pre-test	5.75	0.97			
	Facilitating Conditions	Post-test	5.30	1.29	4.85	0.00	In favour of post-test
		Pre-test	4.30	1.23			
	Hedonic Motivation	Post-test	6.15	0.93	3.77	0.00	In favour of post-test
		Pre-test	5.54	1.22			
	Price Value	Post-test	5.50	0.91	4.24	0.00	In favour of post-test
		Pre-test	4.84	1.16			
	Habit	Post-test	5.44	0.90	4.10	0.00	In favour of post-test
		Pre-test	4.83	0.97			
	Behavioral Intention	Post-test	5.87	0.83	2.89	0.01	In favour of post-test
		Pre-test	5.41	1.16			
Control	Performance Expectancy	Post-test	6.16	0.91	-0.88	0.38	None
		Pre-test	6.27	0.90			
	Effort Expectancy	Post-test	5.75	0.93	3.16	0.00	In favour of post-test
		Pre-test	5.31	1.01			
	Social Influence	Post-test	5.91	0.87	1.06	0.29	None
		Pre-test	5.78	0.97			
	Facilitating Conditions	Post-test	5.37	1.07	5.40	0.00	In favour of post-test
		Pre-test	4.51	1.24			
	Hedonic Motivation	Post-test	6.01	1.05	3.12	0.00	In favour of post-test
		Pre-test	5.52	1.11			
	Price Value	Post-test	5.43	1.00	2.72	0.01	In favour of post-test
		Pre-test	5.03	0.98			
	Habit	Post-test	5.24	0.99	1.85	0.07	None
		Pre-test	4.97	0.95			
	Behavioral Intention	Post-test	5.77	0.91	1.33	0.19	None
		Pre-test	5.58	0.97			

* < .05

Table 6 highlights that the posttest-pretest mean scores of the experimental group in terms of the factors of acceptance of and intention to use Web 2.0 tools of are 6.19 and 6.19 for performance expectancy (t=-0.02), 5.81 and 5.19 for effort expectancy (t=4.27), 6.03 and 5.75 for social influence (t=2.08), 5.30 and 4.30 for facilitating conditions (t=4.84), 6.15 and 5.54 for hedonic motivation (t=3.77), 5.50 and 4.84 for price value (t=4.24), 5.44 and 4.83 for habit (t=4.10), and 5.87 and 5.41 for behavioral intention (t=2.89). In the control group, the values are 6.16 and 6.27 for performance expectancy (t=-0.88), 5.75 and 5.31 for effort expectancy (t=3.16), 5.91 and 5.78 for social influence (t=1.06), and 4.51 and 5.37 for facilitating conditions (t=5.40), 6.01 and 5.52 for hedonic motivation (t=3.12), 5.43 and 5.03 for price value (t=2.72), 5.24 and 4.97 for habit (t=1.85), and 5.77 and 5.58 for behavioral intention (t=1.33). As a result of the independent sample t-test, while there was no significant difference in the performance expectancy factor between the post-implementation and pre-implementation mean scores of the experimental group, p> .05, a statistically significant difference was found in the factors of effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, habit, and behavioral intention, p< .05. As a result of the independent sample t-test for the control group, there was no significant difference between the post-implementation and pre-implementation mean scores in performance expectation, social influence, habit, and behavioral intention, p> .05 while there was a statistically significant difference in effort expectancy, facilitating conditions, hedonic motivation and price value, p< .05. Significant differences in both experimental and control groups were in favour of the post-implementation.

DISCUSSION

Discussion, conclusion, and recommendations are presented in light of the findings obtained in this study, which focused on the effect of peer mentoring on the acceptance of and intention to use Web 2.0 tools of pre-service teachers.

In this respect, no statistically significant difference was found between the pre-test mean scores of the constructs in terms of acceptance of and intention to use Web 2.0 tools of the experimental and control groups. Besides, no statistically significant difference was found between the posttest-pretest difference scores of the constructs in terms of acceptance of and intention to use Web 2.0 tools of the experimental and control groups. It can be implied that collaborative flipped classroom practices have

an equally positive effect on technology acceptance and use of pre-service teachers receiving both peer mentoring and teacher guidance.

Another finding was that while no statistically significant difference was found in the posttest-pretest difference mean scores of the constructs in terms of acceptance of and intention to use Web 2.0 tools of the experimental and control groups according to gender, a statistically significant difference was found in favour of female pre-service teachers in terms of social influence and hedonic motivation. No significant difference was found between female and male participants in terms of behavioral intention. The relevant result overlaps with the results of some studies included in the literature (Dečman, 2015; Korucu and Biçer, 2017; Diri and Açıkgül, 2021). This indicates that female pre-service teachers have a higher level of belief that others should use technology as part of the collaborative flipped classroom practice than male pre-service teachers and that female pre-service teachers have more enjoyment and pleasure when using Web 2.0 tools than male pre-service teachers.

One may notice that while no statistically significant difference was found between the posttest-pretest difference mean scores of the experimental and control groups in terms of acceptance of and intention to use Web 2.0 tools according to the ownership of a computer, a statistically significant difference was found for the pre-service teachers with a computer in terms of facilitating conditions, hedonic motivation, and price value. This indicates that as part of the collaborative flipped classroom, pre-service teachers owning a computer have more enjoyment and pleasure while using a Web 2.0 tool than those without a computer with a higher level of relationship between the price and the benefit of using Web 2.0 tools than those without a computer and the perception of the existence of technical infrastructure can support easy access to Web 2.0 tools. The literature review makes it clear that the acceptance levels of individuals with more experience (Ibrahim & Walid, 2014) are higher. It was also concluded that students owning a computer with internet access have a significantly higher level of competence and use of Web 2.0 technologies than those who do not (Baran & Ata, 2013). Korucu and Biçer (2017) reported an inverse relationship between the acceptance of information and communication technologies and the professional concerns of pre-service teachers while Kandemir (2020) reported that teachers' perceptions of efficacy for the use of educational platforms affect their perception of behavioral intention. Furthermore, the present study found that ownership of a computer can be considered an experience. It can be argued that individuals owning a computer are likely to use Web 2.0 tools more effectively than those without a computer.

It was observed in the present study that while no statistically significant difference was found in the posttest-pretest difference mean scores of the experimental and control groups in terms of acceptance of and intention to use Web 2.0 tools according to departments, a significant difference was found in favour of the English Language Education department pre-service teachers in hedonic motivation. Thus, it can be implied that the pre-service teachers receiving English Language Education experience more joy and pleasure when using a Web 2.0 tool than those receiving education in the field of Elementary Mathematics Education. Along the same lines, Baran and Ata (2013) investigated university students' use of Web 2.0 technologies and their competence, concluding that students with a good level of foreign language knowledge have a higher level of competence in using Web 2.0 technologies than others. The lack of Turkish language support in most of the Web 2.0 tools is potentially the biggest reason for this. In addition, while Avcu and Gökdaş (2012), who shed light on the acceptance of information and communication technologies, did not find any difference in terms of departments, Kandemir (2020) reported a significant difference in favour of Primary School Education teachers in terms of facilitating conditions and hedonic motivation.

No significant difference was found between the posttest-pretest mean scores of the experimental group in terms of acceptance of and intention to use Web 2.0 tools in performance expectancy, a statistically significant difference was observed in effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, habit, and behavioral intention. On the other hand, as regards the control group, while no significant difference was found in performance expectancy, social influence, habit, and behavioral intention, a statistically significant difference was found in effort expectancy, facilitating conditions, hedonic motivation, and price value factors. The result regarding behavioral intention revealed that the significant result in favour of the post-test for the peer mentoring group coincides with similar results in the literature (AlAwadhi & Morris, 2008). Venkatesh (2003) reported that the acceptance of technology is affected by the intention of individuals that matter to the user. The result is backed up in the present study which found that peers affect the behavioral intention of classmates. It can be argued that in terms of both social influence and behavioral intention, there was a change in acceptance of and intention to use Web 2.0 tools among the experimental group, the members of whom received peer mentoring. As cited by Hashim, et al., (2022), while describing hedonic motivation, the use of Web 2.0 tools in both groups is a source of enjoyment. This indicates a higher relationship between the perceived convenience of pre-service teachers receiving teacher guidance in using Web 2.0 tools, a higher perception of the existence of technical infrastructure, and a higher relationship between the price and the benefit. In addition, the use of Web 2.0 tools, the belief that others should also use technology, the tendency to exhibit behaviors in this sense, and the intention to perform the given tasks are higher among pre-service teachers receiving teacher guidance than among pre-service teachers receiving peer mentoring.

Another striking result of the study is that no significant difference was found between the posttest-pretest mean scores of the experimental and control groups in terms of acceptance of and intention to use Web 2.0 tools in performance expectancy. The potential reason behind the relevant result is the collaborative nature of the flipped classroom practice in both groups since performance expectancy represents the degree of personal belief about the contribution of technology use to professional performance. Venkatesh et al., (2012) also reported that hedonic motivation is more effective than performance expectancy in determining individuals' intention to use when there is no compulsory use of technology. In the present study, hedonic motivation

was a source of a significant difference in both groups. Dečman (2015), on the other hand, investigated the acceptance of compulsory e-learning environments in higher education, emphasizing that performance expectancy is one of the most important variables. Therefore, it can be argued that individuals' perception of benefiting from a Web 2.0 tool may change according to their compulsory use of that tool.

CONCLUSION AND RECOMMENDATIONS

In a nutshell, it was concluded that acceptance of and intention to use Web 2.0 tools among pre-service teachers receiving both peer mentoring and teacher guidance had a positive effect while the relevant effect was higher for those receiving peer mentoring. The effect of peer mentoring on pre-service teachers' technology acceptance and use in some constructs was in favour of female participants according to gender, in favour of pre-service teachers with computers in some constructs according to ownership of a computer, and in favour of the participants in the field of English Language Education solely in one construct. In this context, some recommendations are presented for future studies, as shown below.

- ➢ The effect of different blended models can be examined in similar studies.
- ➢ Similar studies can be carried out with a full experimental design.
- ➢ Similar studies can be carried out with mixed model methods.
- ➢ Similar studies can be re-examined with different variables.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, author-ship, and/or publication of this article.

Statements of publication ethics

I/We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The study was conducted and reported with equal collaboration of the researchers.

Ethics Committee Approval Information

As part of the procedures of collecting research data, no objection was observed in terms of research ethics as per the decision of the Ethics Committee of Siirt University dated 2022 and numbered 2501.

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| Research Article / Araştırma Makalesi|

Effects of Using Web 2.0 Tools in Mathematics Instruction on Academic Achievement and Attitude and Examination of Relevant Teacher-Student Views

Matematik Öğretiminde Web 2.0 Araçlarının Kullanımının Akademik Başarı ile Tutuma Etkisi ve Sürece İlişkin Öğretmen-Öğrenci Görüşlerinin İncelenmesi

İlknur Özpınar[1]

Abstract

Purpose: The research mainly aimed to identify the effect of mathematics courses performed with Web 2.0 tools on secondary school students' mathematical achievements and attitudes towards mathematics and to examine teacher-student views on the process.

Design/Methodology/Approach: The research was designed according to the mixed-method research approach. First, how mathematics courses performed with Web 2.0 tools (Plickers, Kahoot, and Edmodo) affected fifth- and eighth-grade students' mathematical academic achievements and attitudes towards mathematics was examined, thereafter semi-structured interviews were conducted with the teacher and student views were collected using a written view form. The participants of the study is a mathematics teacher working in a secondary school located in the center of a city in Turkey and 133 students of this teacher.

Findings: Consequently, while mathematics courses using Web 2.0 tools were found to have a positive effect on fifth-grade students' relevant achievements and attitudes, eighth-grades' achievements and attitudes did not differ. Moreover it has been determined that teacher and students have generally positive opinions about the process.

Highlights: Future studies can investigate the effectiveness of different Web 2.0 tools in other courses in the long run. In addition, different variables such as attitude towards technology and digital literacy can be investigated. Web 2.0 tools can be introduced to teachers, and preservice teachers, and training can be provided to them.

Öz

Çalışmanın amacı: Araştırmanın amacı, Web 2.0 araçları kullanılarak gerçekleştirilen matematik derslerinin ortaokul öğrencilerin akademik başarıları ile matematiğe yönelik tutumlarına etkisini belirlemek ve sürece ilişkin öğretmen-öğrenci görüşlerini incelemektir.

Materyal ve Yöntem: Bu araştırmada karma araştırma yöntemi kullanılmıştır. İlk olarak Web 2.0 araçları (Plickers, Kahoot ve Edmodo) ile işlenen matematik derslerinin beşinci ve sekizinci sınıf öğrencilerinin akademik başarılarını ve matematiğe yönelik tutumlarını nasıl etkilediği incelenmiş, ardından öğretmen görüşleri yarı-yapılandırılmış görüşmeler aracılığıyla ve öğrencilerin görüşleri hazırlanan yazılı görüş formları kullanılarak alınmıştır. Çalışmanın katılımcılarını Türkiye'deki bir şehrin merkezinde bulunan bir ortaokulda görev yapmakta olan bir matematik öğretmeni ile bu öğretmenin 133 öğrencisi oluşturmaktadır.

Bulgular: Sonuç olarak Web 2.0 araçları kullanılarak gerçekleştirilen matematik derslerinin beşinci sınıf öğrencilerinin başarı ve matematiğe yönelik tutumları üzerinde olumlu etkisi saptanırken, sekizinci sınıf öğrencilerinin başarı ve tutumları üzerinde etkili olmadığı belirlenmiştir. Ek olarak, sürece yönelik öğretmenlerin ve öğrencilerin genellikle olumlu görüşte oldukları tespit edilmiştir.

Önemli Vurgular: Araştırma sonuçlarına dayanarak, ileriki çalışmalarda Web 2.0 araçlarının etkililiği diğer dersler için de uzun süreli araştırılabilir. Ayrıca teknolojiye yönelik tutum ve dijital okuryazarlık gibi farklı değişkenler de incelenebilir. Öğretmenlere ve geleceğin öğretmeni olacak olan öğretmen adaylarına Web 2.0 araçları tanıtılıp etkili kullanımlarına yönelik eğitimler verilebilir.

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INTRODUCTION

Mathematics is one of the most important courses that every student must take. However, it is a critical problem that students in secondary school and high school education are not on the expected levels in mathematics achievement both on the national and international levels. Therefore, it is important to consider the factors that affect the success of students, especially in abstract courses such as mathematics (Aydın, 2018). Thus, it is aimed in education to improve affective properties such as attitude that play a central role in mathematics learning aside from improving the cognitive properties (McLeod, 1992; Ministry of National Education [MoNE], 2009). Neale (1969) defined attitude towards mathematic as "*a liking or disliking of mathematics, a tendency to engage in or avoid mathematical activities, a belief that one is good or bad at mathematics, and a belief that mathematics is useful or useless*" (p.632, as cited in Ma & Kishor, 1997). Students' experiences about mathematics are effective in the development of negative or positive attitude towards mathematics.

Given that attitudes have the power and importance which guide the behavior, one can mention about a relationship between attitudes towards mathematics and mathematics achievement. There are several studies in the literature which have concluded a positive relationship between attitudes towards mathematics and mathematics achievement (Aiken, 1970; Barkatsas, Kasimatis & Gialamas, 2009; Eyyam & Yaratan, 2014). Another important factor that affects students' attitude towards the course is their teachers. Students usually believe that they will be more successful when they like the mathematics course, and they learn more effectively when they are interested in what they have learned (Ma & Kishor, 1997). Hence, when designing the instructional settings, teachers need to use appropriate methods which will contribute to students' liking of the course and attract their attention.

The transformation led by technological development in the society has also reflected on education. New information and technologies have been constantly changing the ways to perform mathematics and establish communication from past to present. Indeed, learning styles of teachers who were trained in the environments rather using written sources differ from the learning processes and information processing among members of the digital generation. It is important to make certain inferences about learning behaviors of the digital members of this age. To this end, it is now obligatory to take the digital steps of instructional designs in consideration of educational requirement for this digital generation. Today, technology is advancing at an immense speed and creating new means for meaningful mathematics instruction. As a result of constant advancement in computer technologies, instructional software increase both in quality and quantity, and there are more and more alternatives each day (MoNE, 2009).

Determining the efficacy of instructional activities for mathematics is undoubtedly one of the important points in the teaching-learning process. With the extensive use of information and communication technologies in the learning and teaching process, use of effective and suitable technological tools have also gained currency in this process (MoNE, 2013; National Council of Teachers of Mathematics [NCTM], 1989, 2000). In the cases where feedback in the tools used is fast, clear and explicit, students can have the chance to correct their wrongs and make meaning of their learning (Freeman & Tashner, 2015). There are several new technologies, and therefore, software helping teachers use formative assessment which improves learning and assessment-evaluation in the instructional process. With the advancing technology, web applications have also evolved, and Web 2.0 applications that can be used at many steps of instruction have become an element of educational technology. There are several software (e.g. Plickers, Kahoot, and Edmodo) within the scope of these applications. Other than being low-cost, main attributes of these software are that they help teachers transform the learning environment effectively from being teacher-centered into being student-centered and assess knowledge and skills of their students efficiently and productively (Elmahdi, Al-Hattami & Fawzi, 2018).

Although mathematics course is one of the basic courses in primary education, from the secondary school years, reasons such as abstraction of mathematical subjects from daily life and courses being intense and boring lead to negative thoughts about mathematics and cause mathematical achievement to decrease (Sezgin Memnun & Akkaya, 2010). Thus, in meeting the expectations of digital individuals, it is necessary to benefit from Web 2.0 tools for its features that make things fun, contribute to retentive learning, assist peer teaching and offer equal opportunities and to maximize this benefit. In the literature, there are several studies performed on the software such as Plickers and Kahoot (Borst, 2017; Demirkan, Gürışık & Akın, 2017; Elmahdi, Al-Hattami & Fawzi, 2018; Freeman & Tashner, 2015; Layden, 2018; McCargo, 2017; Wood, Brown & Grayson, 2017; Wuttiprom et al., 2017; Zengin, Bars & Şimşek, 2017) and Edmodo (Al-Said, 2015; Çankaya, Durak & Yünkül, 2013; Ekici, 2017). However, these studies have not been conducted in mathematics courses of secondary school students but mostly addressed courses instructed in the company of a software. In line with these considerations, this research mainly aimed to identify the effect of mathematics courses performed with Web 2.0 tools on secondary school students' mathematical academic achievements and attitudes towards mathematics and to examine teacher-student views on this process. Therefore, sub-problems of the study were decided as follows:

1. Do courses performed with Web 2.0 tools have any effect on fifth- and eighth-grade students' academic achievement in mathematics course?
2. Do courses performed with Web 2.0 tools have any effect on fifth- and eighth-grade students' attitudes towards mathematics?
3. What are teacher and students views on mathematics courses performed with Web 2.0 tools?

METHOD/MATERIALS

Research design

The research was designed according to the mixed-method research approach, in which quantitative and qualitative research methods are used together. In the research, explanatory sequential design, one of the mixed methods, was used. In the explanatory sequential design, firstly, quantitative data are collected and analyzed, then qualitative data are collected and analyzed to explain the quantitative results (Creswell, 1999). First, how mathematics courses performed with Web 2.0 tools (Plickers, Kahoot, and Edmodo) affected fifth- and eighth-grade students' mathematical academic achievements and attitudes towards mathematics was examined; thereafter semi-structured interviews were conducted with teacher, and written view forms were conducted with students.

Study Group

Participants of this study is a teacher working in a secondary school in the central district of a city in Turkey and 133 students of his. Table 1 shows demographic information on teacher and his level of using computer, Internet and mobile devices.

Table 1. Information on teacher

Gender	Professional seniority (years)	Level of Internet Usage	Level of Computer Usage	Level of Mobile Device Usage	Competence of Technology Usage in Instructional Process
Male	15	Somewhat Competent	Somewhat Competent	Somewhat Competent	Somewhat Competent

According to Table 1, the teacher is male, and his professional seniority is 15 years. To describe the students, the students were handed a form about their chance to use Internet, smartphone and computer/tablet before the procedure. It was seen that all students had the chance to access at least one smartphone or computer, and none of them had problem with accessing Internet.

Measures

Measures used in the study are Mathematics Course Achievement Tests, Mathematics Attitude Scale, and interviews. These measures are described below.

Mathematics Course Achievement Tests (MCAT):

The Mathematics Course Achievement Test developed by Abalı Öztürk (2014) for fifth-graders was used in the study. Mean difficulty of the 33-item test was found to be .502, and its Spearman-Brown reliability coefficient of .82 indicates its reliability. The Mathematics Course Achievement Test which consists of 14 items and applied to the eighth-graders was developed by Özpınar, Gökçe and Aydoğan Yenmez (2017). Test's Cronbach-α reliability coefficient was found to be .906. It was decided to use the tests with the mathematics teacher upon the examination of test questions in consideration of the program.

Mathematics Attitude Scale (MAS):

The 20-item and 5-point Likert-type Mathematics Attitude Scale developed by Aşkar (1986) was used to measure students' attitudes towards mathematics course. The scale is composed of ten positive and ten negative items. Reliability coefficient (Cronbach's Alpha) of the scale was found to be .89.

Interviews:

Teacher views on the mathematics courses performed with Web 2.0 tools were collected with semi-structured interviews whereas student views were collected using a written view form (WVF) which were prepared by researcher.

Procedure

First, the teacher was met and informed of the usage of Web 2.0 tools; exemplary applications were discussed, and questions were answered in a three-week period. Teacher's accounts were created together with him, and training was provided about how to use necessary information and questions, shapes, videos, etc. and features and scopes of Web 2.0 tools (Plickers, Kahoot, and Edmodo). Students were trained by the teacher about the software they would use. In this stage, brief information on Web 2.0 tools to be used in the application was provided to the students, and questions from students were answered. Teacher conducted the applications in his classrooms for eight weeks.

The study was performed to examine and compare the effects of the applications made with Web 2.0 tools of fifth and eighth grade students on their success and attitudes. For this purpose, MCAT and MAS were applied to both the experimental and control groups before and after the study in the classrooms of the teacher who was teaching mathematics in the fifth and eighth grades. Research design is presented in Table 2.

Table 2. Design of the research

Groups	Pretests	Procedures	Posttests
Experimental Group 5th-Grade	MCAT MAS	Applications that can be performed with Web 2.0 tools	MCAT MAS WVF
Control Group 5th-Grade	MCAT MAS	Teaching according to the methods predicted by the curriculum	MCAT MAS
Experimental Group 8th-Grade	MCAT MAS	Applications that can be performed with Web 2.0 tools	MCAT MAS WVF
Control Group 8th-Grade	MCAT MAS	Teaching according to the methods predicted by the curriculum	MCAT MAS

Students who took the courses with Web 2.0 tools were included in the experimental group while others consisted of the control group. The courses in the experimental and control groups were instructed by the same teacher. Experimental group students performed their activities individually on Plickers, both individually and in groups on Kahoot and Edmodo. Activities in the control group were performed in compliance with the constructivism and in line with textbooks. In experimental group of the study, the activities about relevant subjects in the textbook were transformed into applications that can be performed with Web 2.0 tools. The teacher ensured that the time and effort spent on the activities were the same in the experimental and control groups. It was seen that all students knew how to use a tablet, they had at least one tablet or smartphone at home which they could use, and they did not have difficulty entering the software.

At the end of the application, teacher views were obtained through semi-structured interview, and the views of the experimental group students were collected through WVFs in order to support and explain the quantitative data.

Data Analysis

Research data were subjected to both qualitative and quantitative analyses. The SPSS software package was used in the study to analyze the quantitative data. T-test were utilized in the analysis of quantitative data whereas qualitative data were interpreted with frequency.

Highest possible score in MCAT applied to fifth-graders is 100 points. Given the highest possible score and the 5-point grading system, achievement groups were determined to be 0-20 (very low), 21-40 (low), 41-60 (moderate), 61-90 (high), and 81-100 (very high). In the pretest and posttest assessments of MCAT questions applied to the eight-graders, answers were examined in four categories of totally correct (2 points), partly correct (1 point), incorrect (0 point), and unanswered (0 point). The achievement grade of students in MCAT was calculated so as to be 0 being the lowest and 28 being the highest.

Depending on what kind of attitudes the feelings, thoughts and behaviors mentioned in the items of MAS did stir in the individual, the scale used five-point Likert grading. Accordingly, range coefficient calculated for the four ranges in the five-point Likert scale (5-1=4) is 4/5=0.80. For the positive items, the ranges are 1.00-1.79 (strongly not applicable), 1.80-2.59 (not applicable), 2.60-3.39 (neutral), 3.40-4.19 (applicable), and 4.20-5.00 (strongly applicable). Negative items are reverse-scored, and the total score was considered students' attitude score for mathematics course.

The qualitative data were subjected to a content analysis. The main purpose of the content analysis is to reach concepts and relationships that can explain the collected data. With content analysis, it is attempted to define data and explore the truths that might be implicit within data (Yıldırım & Şimşek, 2006). Coding achieved from the semi-structured interviews and WVFs of the research was reviewed by two experts, disagreed items were discussed to make the necessary adjustments, and the inter-rater reliability's percentage agreement index was found to be 88%. Since the index was above 70%, it was considered acceptable for the present research (Miles & Huberman, 1994). The study included the opinions supportive of the content analysis findings for the WVFs completed by all students about the mathematics course using Web 2.0 tools and the findings achieved from the teacher interview.

FINDINGS

Findings of the research are presented under three headings in line with the sub-problems.

Findings concerning the First Sub-problem of the Research

Students' pretest and posttest scores of MCAT were compared to examine whether the mathematics courses performed with Web 2.0 tools affected academic achievement, and the analysis results are provided below.

Table 3. Results concerning the MCAT pretest and posttest scores of 5th-grade experimental and control groups

		N	$\overline{X}$	S	sd	t	p
Pretest	Experimental Group	32	41.38	20.27	60	.52	.606
	Control Group	30	39.05	14.94			
Posttest	Experimental Group	32	55.20	17.71	60	2.27	.027*
	Control Group	30	45.55	15.54			

*Significant at .05

As seen in Table 3, according to the pretest results, no significant difference was found between the mean MCAT scores of the experimental and control groups at a significance level of .05 (p=.606). This finding indicates that there was no difference between the groups by academic achievement before the procedure.

As for the posttest results, an important difference was found between the mean posttest scores of the experimental and control groups [t(60)=2.27, p<.05]. The experimental group had higher posttest scores ($\overline{X}$ =55.20) than the control group ($\overline{X}$ =45.55). Hence, one can argue that courses using the Web 2.0 tools were more effective in fifth grade students' academic achievement.

Table 4. Results concerning the MCAT pretest and posttest scores of 8th-grade experimental and control groups

		N	$\overline{X}$	S	sd	t	p
Pretest	Experimental Group	36	7.53	2.58	69	.39	.695
	Control Group	35	7.28	2.61			
Posttest	Experimental Group	36	17.03	4.74	69	1.26	.213
	Control Group	35	15.66	4.44			

No significant difference was found between achievement pretest scores of the eight-graders by the groups [t(69)=.39, p>.05]. According to Table 4, the experimental group's mean score of achievement pretest was $\overline{X}$ =7.53 whereas the control group's mean score was $\overline{X}$ =7.28. This finding indicates that there was no difference between the groups by academic achievement before the procedure.

No significant difference was observed between the achievement posttest scores of the eight-graders by the groups [t(69)=.1.26, p>.05]. It is seen in Table 4 that the experimental group's mean score of the achievement posttest was $\overline{X}$ =17.03 while the control group's mean score was $\overline{X}$ =15.66. As indicated by this finding, whereas there was no statistically significant difference between the groups by academic achievement, the experimental group students had higher mean scores than the control group students.

Findings concerning the Second Sub-problem of the Research

Students' pretest and posttest scores of MAS were compared, and whether the software used had any effect on the attitude was examined with independent samples t-test. Analyses on the attitudes of the fifth- and eighth-grade experimental and control groups are presented below.

Table 5. Results concerning the MAS pretest and posttest scores of 5th-grade experimental and control groups

		N	$\overline{X}$	S	sd	t	p
Pretest	Experimental Group	32	3.15	.22	60	1.13	.261
	Control Group	30	3.09	.19			
Posttest	Experimental Group	32	3.83	.38	60	10.11	.000*
	Control Group	30	3.05	.20			

*Significant at .05

Table 5 shows the experimental and control groups' levels of attitude towards mathematics course. According to the pretest analysis, there was no significant difference between the experimental and control groups' attitudes towards mathematics course ([t(60)=1.13, p>.05]. This finding indicates that there was no difference between the groups by attitude before the procedure.

However, a significant difference was observed between the posttest scores of groups ([t(60)=10.11, p<.05]. Given the analysis results, the experimental group had an arithmetic mean of $\overline{X}$ =3.83 for the posttest scores, the control group's arithmetic mean of the posttest scores was $\overline{X}$ =3.05.

As indicated by Table 5, experimental group students' attitude scores increased in the posttest whereas a decrease was observed in the control group, albeit low. Consequently, one can argue that the courses instructed with Web 2.0 tools had a positive effect on attitudes towards mathematics.

Table 6. Results concerning the MAS pretest and posttest scores of 8th-grade experimental and control groups

		N	$\overline{X}$	S	sd	t	p
Pretest	Experimental Group	36	2.80	.81	69	1.36	.178
	Control Group	35	3.01	.37			
Posttest	Experimental Group	36	2.93	.76	69	.828	.411
	Control Group	35	3.06	.47			

As seen in Table 6, according to the pretest results, no significant difference was found between the mean MAS scores of the experimental and control groups at a significance level of .05 (p=.178). This finding indicates that there was no difference between the groups by attitude before the procedure.

No significant difference was observed between the achievement posttest scores of the eight-graders by the groups [t(69)=.828, p>.05]. It is seen in Table 6 that the experimental group's mean score of the achievement posttest was $\overline{X}$=2.93 while the control group's mean score was $\overline{X}$=3.06.

Findings concerning the Third Sub-problem of the Research

In this section, findings on the teacher and student views are provided respectively. Semi-structured interview and WVFs were used to support the findings obtained from the quantitative data with qualitative data. First, the teacher was asked for his view on the applications with Web 2.0 tools in mathematics teaching. When teacher opinions were examined, it was determined that the teacher mostly emphasized the advantages and disadvantages of applications performed with Web 2.0 tools. Themes concluded from the analysis on the advantages of applications using Web 2.0 tools as reported by teacher and the relevant codes are shown in Table 7.

Table 7. Themes and codes regarding the advantages of applications implemented with Web 2.0 tools

Themes	Codes
In terms of educator	Opportunity to receive instant feedback
	Effective instruction thanks to participation to the process
	Increased course efficiency
	Diversified purpose of usage (homework, course document, announcement, discussion, survey, evaluating questions, etc.)
In terms of learner	Opportunity to see deficiencies and mistakes
	Making the course fun
	Supporting the learning
	Making the course liked
	Increased motivation and interest
In terms of the software	Opportunity to perform off-course activities
	Low cost
	Being very practical to use and easy to apply
	Saving time on reviewing exam papers in crowded classes
	Allowing parent-student-teacher communication
	Property to archive questions and results

As can be seen in Table 7, three themes (in terms of educator, in terms of learner and in terms of software) emerged regarding the advantages of applications realized with Web 2.0 tools. Teacher's views on the advantages of the process and software were as follows:

"It is very nice that feedback is instant and collective in Plickers; it also ensures the right use of time. It is a positive software also for the ability to be applied to all students at the same time, motivation, learning, and energy. [...] Kahoot was quite positive for supporting the questions with visuals or videos. They are easy to use; their archiving features are nice. [...] Edmodo is a useful tool that can be used for every stage of the course since we can send students individual messages, open up discussions on the classroom panel, send course documents, and it gives the chance to do homework and activities. [...] It makes mathematics instruction easier both inside and outside the classroom with features such as following up student's progress, saving on time, being intriguing with ability to ask questions that encourage to research, ensuring a constant student-teacher communication, keeping courses from monotony and making them fun, and offering attention-grabbing environments."

According to the teacher views, he notably stated that he could use Web 2.0 tools at every stage of mathematics course. The teacher also mentioned about the adversities and limitations they experienced in the process. Views of teacher on disadvantages of software and procedure are provided below.

"At the beginning, the greatest problem with Plickers was that kids focused on the paper (QR code), software and how their names appeared on the program, and they were curious about its operation. Therefore, they had problem with focusing on the questions. Achievement of the goal was delayed. But it contributes greatly to motivation and learning when they get accustomed over time. […] The greatest problem with using Kahoot is that a tablet or phone is required for each student, and Internet for software. When you do not pay attention in group activities, some of the students in the group may remain in the background, or the competitive environment may offend students and lead to lack of confidence. […]"

The teacher was asked whether he considered himself competent at using Web 2.0 tools and the planned to continue these applications in his future courses. The teacher stated that he would utilize the software when required since he used them for a long time during the procedure and they were not complex to use, and the students liked them, and the software supported their learning. He provided his view as follows: *"Of course I will apply them. Kids like them. […] I will use such software actively and when necessary for supporting and assessing the subjects and gains, not instead of assessments performed to grade students, that is, the actual exams."*

The secondary school students were asked about their views on the applications using Web 2.0 tools. When the responses of the students were examined, it was determined that they focused on the advantages and disadvantages of the application process in parallel with the opinions of their teacher. Themes and codes achieved from the analysis of students' views on the procedure and software are given in the table below.

Table 8. Themes and codes achieved from students' views on the advantages of Web 2.0 tools and procedure

Theme	Codes	5	8	Total
		f	f	f
Advantages about learning	Assisting the learning	19	12	31
	Receiving instant feedback	2	9	11
	Novel (different) applications	2	7	9
	Enabling the learning in cooperation with peers	7	-	7
	Assisting the reinforcement of the learning	3	3	6
	Increased participation in the course	-	5	5
	Increased retention	1	3	4
	Increased achievement	2	1	3
	Rapid and flexible learning	2	1	3
	Reducing the noise during course	-	1	1
Advantages about affective properties	Ensuring learning by fun	28	28	56
	Being attention-grabbing	22	23	45
	Ensuring the liking of mathematics	9	-	9
	Adding excitement to the course	5	-	5
	Reducing the test stress	1	1	2
	Increasing the desire to learn	-	1	1
Advantages about the software	Effective and nice	13	10	23
	Being necessary	-	5	5
	Easy and applicable	2	-	2
	Embellishing teacher's instruction	1	-	1
	Being practical	-	1	1
	Opportunity to rehearse and reinforce the past subjects	1	-	1

According to Table 8, three themes were derived from the student views. In the theme *advantages about learning*, the most emphasized codes were found to be "assisting the learning" and "receiving instant feedback". Relevant student views are given below.

"It contributes to our learning. Because we find out about what we do right or wrong immediately." (Fifth-grade S4)

"[…] I wish all courses were like that. We would understand better, then. For example, I understood mathematics more in Plickers and Edmodo applications." (Fifth-grade S29)

Under the theme *advantages about affective properties*, the most stated codes were "ensuring learning by fun", and "being attention-grabbing". Students provided the following statements:

"I think the software are very nice. They were fun and different. That is why they intrigued me. […] It contributed to the course instruction. Because I used to get so bored in mathematics courses, and I had so much fun with them." (Fifth-grade S15)

"It made me learn more easily. […] I liked the course. Now I love it." (Fifth-grade S23)

"I would like very much if the mathematics courses were to continue like that. Because a boring and unenjoyable course like mathematics became fun. It was very good." (Eighth-grade S17)

Frequently repeated codes under the theme *advantages about the software* was "effective and nice", and "being necessary".

According to the student views on adversities and limitations of mathematics courses performed with Web 2.0 tools, in line with teacher views, they emphasized that these software required technical infrastructure and Internet. 8 students stated that lack of Internet quota was among general problems. Students who did not have a computer/tablet but a smartphone stated that small screen size was an obstacle (f=5) and that storage capacity of their mobile devices was not sufficient when downloading the learning materials (f=2). In addition, 3 students from fifth-grade and 5 students from eighth-grade reported that they did not like Kahoot and Edmodo, respectively, and 5 eighth-grade students found Plickers boring.

When asked about whether they would like Web 2.0 tools to be used in future mathematics courses, majority of the students stated that they would whereas some of the students added that it would be effective to use them in other courses, too. Relevant student views are given below:

"I would like the courses to continue like that. Because some of us used to find mathematics course boring. But our teachers can continue these applications to make the course nice. All courses would be more enjoyable and fun like so." (Fifth-grade S5)

"I think courses should continue like that. Because both mathematics being fun and technology are my interest. […]" (Fifth-grade S17)

"[…] Because it is more fun. It should be applied not only in mathematics, but also in other courses. […] And according to a research I have read, kids comprehend things better when having fun. I want such activities to continue so we can understand better." (Eighth-grade S1)

"Yes, because technology should be everywhere now. These software attract our attention. These applications are so much fun." (Eigth-grade S27)

According to the students' views, some students did not want the courses to continue using Web 2.0 tools. While 18 eighth-grade students stated that they did not want the courses to continue using Web 2.0 tools because they considered them a waste of time as they were preparing for the High School Entrance Exam (HSEE), generally they notably emphasized that the applications were fun and enhanced the learning. In parallel with this view, one student stated that the mathematics courses should be performed with papers and pencils, and therefore, such usage of technology was not suitable for mathematics courses as they would take the HSEE in years to come.

CONCLUSION, DISCUSSION AND RECOMMENDATIONS

Technology is one of the most important factors affecting human life since the early ages and it has changed our methods and habits in meeting our needs and solving our problems in all areas of our lives. Along with the developing technology, Web applications have also developed and Web 2.0 tools that can be used in many stages of education have become an element of educational technology. In this study Plickers, Kahoot and Edmodo were used, and effects of using these software on secondary school students' academic achievement in mathematics, attitudes towards mathematics and relevant teacher and students views were examined.

In the study using the mixed-method research design, as for the academic achievement, experimental and control group's mean pretest and posttest scores of MCAT were compared, and while a significant difference was observed between the fifth-grade groups, no significant difference was observed between the eighth-grade groups; however, experimental group students were found to have higher mean scores than control group students. It is thought that the increase in the posttest achievement scores of the experimental groups resulted from the applications performed using Web 2.0 tools. This finding also indicates that Web 2.0 tools are effective in supporting the learning and increasing the achievement. There are studies in the literature that coincide (Deniz, 2019; Gürleroğlu, 2019; Güzeller & Akın, 2012; Maguire et al., 2010; Tuncer & Şimşek, 2019; Wuttiprom et al., 2017) and do not coincide (Bennett et al., 2008; Korkmaz et al., 2019; Layden, 2018) with these results of the study. Gürleroğlu (2019) concluded that science instruction using the Web 2.0 tools had a positive impact on students' academic achievement. A similar result was achieved by Tuncer and Şimşek (2019). The study conducted by these researchers with fifth-grade students found Plickers to have affected the achievement in mathematics course. Like the study results regarding the eight-grade students, the study performed by Batıbay (2019) with seventh-grade students to examine the effect of Kahoot as a Web 2.0 tool on achievement in the Turkish course could not observe any significant relationship between the pretest and posttest achievement scores. Among the reasons why there was no significant difference in the achievements of eighth-grade students in this study, the following points which are also mentioned in the literature may be effective: Students are more focused on technology than the content of the subject, and some of the applications are carried out as group work (Kantar, 2022; Özyalçın, 2020), or they encounter problems caused by software (Kantar, 2022; Öner, 2009). As a matter of fact, the teacher also stated that the students' focus on software affects the application.

Compared to the MAS mean pretest and posttest scores of the fifth- and eighth-grade experimental and control groups, a significant difference was found between the fifth-grade groups while no significant difference was observed between the eighth-grade groups. This result may be due to the fact that eighth-grade students are preparing for the HSEE and some students see the applications as a waste of time. There are studies which concluded important effect of technology-assisted instruction on student attitudes in the literature (Deniz, 2019; Güzeller & Akın, 2012; Hangül & Üzel, 2010; Pilli & Aksu, 2013; Wuttiprom et al., 2017).

Several research studies have concluded attitude towards mathematics to be an important factor in explaining students' mathematics achievements (Eyyam & Yaratan, 2014; Ma, 1997; Reyes, 1984). Similarly, a statistically significant increase was observed in both achievements and mathematical attitudes of the fifth-grade experimental group students, and an increase was found in both achievements and mathematical attitudes of the eighth-grade experimental group students, albeit statistically non-significant. This relationship found in the study has some similarities with other study results in the literature (Barkatsas, Kasimatis & Gialamas, 2009; Eyyam & Yaratan, 2014; Fabian, Topping & Barron, 2016). Negative prejudice among students in mathematics instruction should be eliminated, and individuals who have developed a positive attitude towards mathematics should be raised (Hangül &Üzel, 2010). To this end, student-centered learning such as Web 2.0 tools that make courses fun should be preferred. Hence, features of these software such as making learner responsible for their learning, supporting the retentive learning, ensuring active participating, and assisting the peer teaching should be utilized at maximum to satisfy such expectations of learners.

Considering the usage of Web 2.0 tools in mathematics courses and the views on these software, it was observed that both teacher and students had positive views on the application and the software. There are studies in the literature that coincide with this result of the study (Al-Said, 2015; Çankaya, Durak & Yünkül, 2013; Demirkan, Gürışık & Akın, 2017; Elmahdi, Al-Hattami & Fawzi, 2018; Enriquez, 2014; Gürışık, 2018; Gürleroğlu, 2019; Ningsih & Mulyano, 2019; Wood, Brown & Grayson, 2017; Zengin, Bars & Şimşek, 2017). The teacher made evaluations in terms of educator, learner, and software in consideration of the advantages and disadvantages. The points emphasized in regard to the advantages coincide with the evaluations made by teacher on applications which he performed in different levels and various courses with Web 2.0 tools. Both in this study and in the literature, the teacher emphasized that software have the ability to provide instant feedback, give the chance to see and correct mistakes thanks to individual feedbacks, and support the learning (Demirkan, Gürışık & Akın, 2017; Elmahdi, Al-Hattami & Fawzi, 2018; Freeman & Tashner, 2015; Gürışık, 2018; Zengin, Bars & Şimşek, 2017), have the ability to archive questions and results (Elmahdi, Al-Hattami & Fawzi, 2018; Gürışık, 2018; Özpınar, 2020), make the courses fun (Özpınar, 2020; Zengin, Bars & Şimşek, 2017), and effective instruction (Demirkan, Gürışık & Akın, 2017; Elmahdi, Al-Hattami & Fawzi, 2018; Gürışık, 2018; McCabe, 2006; VandeWalle, 2016).

Another point emphasized by the teacher was about the disadvantages of Web 2.0 tools used in the procedure. The limitation stated by the teacher was requirement of technical infrastructure and Internet. Other emphasized limitations included problem with class management in crowded classrooms and student focus on software. This result is in parallel with the results of other studies in the literature (Çankaya, Durak & Yünkül, 2013; Demirkan, Gürışık & Akın, 2017; Ekici, 2017; Gürışık, 2018; Gürleroğlu, 2019; Kantar, 2022; Ningsih & Mulyano, 2019; Özpınar, 2020; Saleem, 2011).

Teacher added what purposes he would use the Web 2.0 tools for and stated that it would be more appropriate to use these software for assisting the learning rather than for judging the students and for exams conducted to grade students. Indeed, Bloom (1969, p. 48) states that formative assessment should be discriminated from grading as judging and classifying functions and should mainly assist the teaching so that it can be more efficient. In addition, in parallel with the finding of the present study, participants in the studies performed by Çankaya, Durak and Yünkül (2013), and Ekici (2017) also stated that they would use Web 2.0 tools in their future instructions.

Regarding the student views, the most emphasized points were that courses performed with Web 2.0 tools helped them learn, ensured that they learned by fun and were attention-grabbing. Similar findings are observed in the literature (Borst, 2017; Gürışık, 2018; Gürleroğlu, 2019; VandeWalle, 2016). Other advantages of the mathematics courses performed with the Web 2.0 tools and the relevant software, which are 'being easy to apply and increased achievement' (Al-Said, 2015; Borst, 2017; Gürışık, 2018), 'opportunity to receive instant feedback' (Al-Said, 2015; Elmahdi, Al-Hattami & Fawzi, 2018; Gürışık, 2018; Enriquez, 2014), 'ensuring the liking of mathematics and affecting the attitude positively, increased retention, and opportunity to rehearse and reinforce the past subjects' (Gürleroğlu, 2019; Wuttiprom et al., 2017), and 'being nice learning software' (Enriquez, 2014; Gürışık, 2018) show parallelism with the studies conducted with students in the literature.

As indicated by the students, the adversities and limitations of the mathematics courses performed with the Web 2.0 tools included requirement of technical infrastructure and Internet, small screen size for students who did not have a computer/tablet but a smartphone, and low storage capacity for the applications. This result coincides with the results achieved by Gürışık (2018) and the result 'technical challenges of mobile learning' as achieved by Saleem (2011).

Students' achievement in mathematics is influenced by several factors. It is necessary in education to focus not only on what is learned and how it is learned, but also on the feedbacks to enhance mathematics achievement of students (Köğce & Baki, 2014). In this study, fifth- and eighth-grade students of the experimental groups were found to have higher increases in their achievement in mathematics course than the control group. It was also notably observed that both teacher and students stressed out the feedback, contribution to learning and students stressed achievement aspects of the Web 2.0 tools. The teacher addressed the

contribution of Web 2.0 tools to achievement through instant feedback, and students having the opportunity to see and overcome their deficiencies. The students emphasized the contribution of these software as assisting the learning, ability to receive instant feedback, and increased achievement. Based on these findings, one can argue that feedbacks provided in every stage of the mathematics instruction using the Web 2.0 tools were effective.

When asked about whether they would like Web 2.0 tools to be used in future mathematics courses, majority of the students stated that they would whereas some of them would like them to be used in other courses, too. These results are in parallel with the results of the applications performed by Wuttiprom et al. (2017) using Plickers with undergraduates. Similarly, Wood, Brown and Grayson (2017) concluded that the participants recommended that courses should continue with Plickers applications and these applications should be utilized in other courses. On the other hand, Gürışık (2018) achieved a different result. At the end of the three courses instructed with Plickers applications in the relevant study, the secondary school students stated that these applications could be utilized in courses other than mathematics and science courses. They justified this suggestion by stating that science courses require paper-pencil. In parallel with this result of the study carried out by Gürışık (2018), some of the eighth-grade students reported that they would not want the courses to continue using Web 2.0 technologies; however, they emphasized that these applications were fun and enhanced the learning. This might have been due to the anxiety caused by HSEE which secondary school students would take at the end of the eighth grade. Indeed, a student argued that mathematics course should be only taken with paper-pencil as they would take the HSEE. Similarly, Wood Brown and Grayson (2017) observed that 9% of the students would rather paper-pencil or other electronic exams than Plickers applications.

Consequently, while mathematics courses using Web 2.0 tools were found to have an effect on fifth-grade students' relevant achievements and attitudes, eighth-grade students' achievements and attitudes did not differ. Moreover, the teacher and students were observed to have positive views on the process in general. This study addressed the variables of academic achievement and attitude within the context of mathematics course. Future studies can investigate the effectiveness of Web 2.0 tools in other courses in the long run. In addition, different variables such as attitude towards technology and digital literacy can be investigated. Web 2.0 tools can be introduced to teachers, and preservice teachers as the future teachers, and training can be provided to them in aplication and effective usage of software.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author received no financial support for the research, author-ship, and/or publication of this article.

Statements of publication ethics

I hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The study was conducted and reported by the corresponding author, who is the single researcher in the study.

Ethics Committee Approval Information

Ethical approval was obtained from Nigde Omer Halisdemir University Scientific Research and Publication Ethics Committee, with document no E-86837521-050.99-58115.

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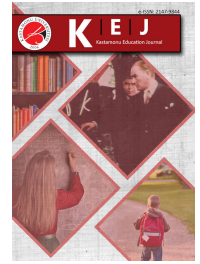
| Research Article / Araştırma Makalesi|

Comparison of Visual Representations used in the Biology Units of 7th and 8th Grade Middle School Science Textbooks

Ortaokul Fen Bilimleri Ders Kitaplarının 7. ve 8. Sınıf Biyoloji Ünitelerinde Kullanılan Görsel Sunumların Karşılaştırılması

Nurcan Keleş[1]

Abstract

Purpose: This study was carried out to examine and compare the visual representations used in the biology units in 7th and 8th-grade middle school science textbooks with various criteria.

Design/Methodology/Approach: A document review model from qualitative data analysis was used for this research. The content and descriptive analysis techniques were used in the analysis of the textbooks. The code list used in this study consisted of five main categories, which were type of visual representation, surface feature of visual representations, captions of visual representation, the relation of visual representation with text, and function of visual representation.

Findings: As a result, visuals were used in different varieties and proportions according to the examined categories in both textbooks. The most common type of use was picture, followed by diagram. The examined rates of other subcategories of the categories were displayed in separate tables, as they showed differences at each grade level of the biology units. Highlights: When the findings were examined, it was found that the designs of the visuals in both textbooks and their relationships with the text were not sufficient to comprehend the biology subjects. For this reason, the biology content in these textbooks should be designed by taking into account the students' cognitive learning system, readability, and meaningful learning.

Öz

Çalışmanın amacı: Bu çalışma ortaokul 7. ve 8. sınıf fen bilimleri ders kitaplarındaki biyoloji ünitelerinde kullanılan görsel sunumları çesitli kriterler düzeyinde incelemek ve karşılaştırmak amacıyla yapılmıştır.

Materyal ve Yöntemi: Araştırma için nitel veri analizlerinden doküman inceleme modeli kullanılmıştır. Ders kitaplarının çözümlenmesinde içerik ve betimsel analiz teknikleri kullanılmıştır. Bu çalışmada kullanılan kod listesi görsel sunum çeşidi, görsel sunum yüzey özelliği, görsel sunum altyazısı, görsel sunumun metin ile olan ilişkisi ve görsel sunumun fonksiyonu olarak beş ana kategoriden oluşmuştur.

Bulgular: Sonuç olarak görseller her iki ders kitabında da incelenen kategorilere göre farklı çeşitlilikte ve oranlarda kullanılmıştır. En çok kullanım türü resim olmuştur ve bunu diyagram izlemiştir. İncelenen kategorilerin diğer alt kategorileri nin oranları ise biyoloji ünitelerinin her sınıf düzeyinde farklılıklar gösterdiği için tablolarda ayrı ayrı gösterilmiştir.

Önemli Vurgular: Bulgulara bakıldığında her iki ders kitabında da yer alan görsellerin dizaynlarının ve metin ile ilişkilerinin biyoloji konularını kavramada yeterli olmadığı bulunmuştur. Bu nedenle bu ders kitaplarındaki biyoloji içeriğinin öğrencilerin bilişsel öğrenme sistemi, okunabilirlik ve anlamlı öğrenmeyi de göz önüne alarak düzenlenmesi gerekmektedir

INTRODUCTION

Textbooks are the primary education material that students and teachers use the most in educational settings since they reflect the curriculum and are easily accessible (Kesidou & Roseman, 2002; Unsal & Gunes, 2002; Yucel & Karamustafaoglu, 2020). For this reason, their design features of the content are a significant factor for learning. One of these design features of textbooks is the use of visual representations because many researchers has been agreed upon that using visual representations in the textbooks contribute to students' conceptual understanding and learning. Visual representations in textbooks mostly consist of many types including pictures, graphs, diagrams, tables, and equations and are useful in promoting scientific discourse especially in biology. As visual representations are the parts of science language discourse in biology, their appropriate usages have been a concern for the researchers (Akçay et al., 2020; Carney & Levin, 2002; Kozma & Russel, 1997; McTigue, 2009; Pekel, 2019; Wernecke et al., 2018). However, visual repres/ntions have not been used consistently in the same form of design in biology textbooks. For this reason, many studies have been done to reveal the rates of usage different types of visual representations and the differences of their design features in each biology units, all which point to lack of standardization in their designs of visual representations with different rates of types usages, including missinformation and lack of labels and captions (Buckley, 2000; Pozzer Roth, 2003; Yilmaz et al., 2017; 2021). As the visuals representations, which are used in biology subjects, support learning and a standardized design feature has not been found in a biology unit of a textbook, this study was conducted to examine and compare the visual representations that were used in the biology units of the 7th and the 8th grade middle school science textbooks with various criteria.

As stated above, visual representations (in short: visuals) in biology are used in various forms and purposes in textbooks. Particularly, the use of visuals allows the concretization of abstract concepts and theories in biology, by illustrating elements from daily life, and showing images of biological structures (Buckley, 2000; Larkin & Simon, 1995). There are many more examples of usage of visuals in biology, such as creating theories, taxonomies, specifying and marking parts of anatomical structures, and showing connections between concepts (Ryoo & Linn, 2012). For instance; subjects such as genetics, ecology, and blood structure contain abstract concepts. Visuals have an important place in learning to make easier such difficult subjects by establishing visual connections with various shapes, formulas, and pictorial representations between the key concepts of such subjects (Wood, 1999). Thus, with variety of visuals shapes, students can see the entities of these subjects, make connections between these subjects, and learn more easily. Without visuals, students may have difficulties on their own to make sense of such abstract concepts (Yılmaz et al., 2017; Wernecke et al., 2018).

In order for students to learn the subjects meaningfully, the designs of the visuals in the textbooks should be designed according to the students' grade levels because the abstract concepts in the content are higher in upper grades (Pinto, 2002). It is not always easy for students to understand the visuals and they are not able to make comments and connections with the content (Kozma & Russel, 1997). Textbooks should clearly provide information about visuals in order to reduce the cognitive load that might occur while students are learning the visuals. The purpose of the visuals in the textbooks and their connections with the content should also be arranged in accordance with the principles of cognitive learning (Smith et al., 2021). For these reasons, this study was prepared based on learning with visual representations and the cognitive load theory.

Learning with Visual Representations

Visual representations (briefly visuals) play an important role in supporting learning (Bernard, 1990; Kozma & Russell, 1997; Cook, 2006; McTigue, 2009; Ryoo & Linn; 2012). For this reason, many studies have been carried out on visuals in science teaching and learning, especially in science textbooks (Buckley, 2000; Vojíř & Rusek, 2019).

Visuals in science, at all grade levels including higher education, are also used for many different purposes such as creating theories, solving problems, and transferring to other contexts. Understanding the sciences requires both understanding the text and comprehending the visual content. For example, radiologists, who need to be experts on biological structures, must be able to understand and interpret the image contained in the X-ray. For this reason, they are called visual experts (Wood, 1999). Ryoo and Linn (2012) stated that in biology textbooks, visuals of content in photosynthesis, matter cycles and ecological energy flows, are often are often emphasized using formulas and arrows. The abstractness of these subjects is often reduced through the use of diagrams, schematic and realistic drawings, or photographs. In a related study, middles school students' understanding of energy transformation in photosynthesis with dynamic and static descriptive visuals. Due to these functions of visuals in science, visuals are also included in many textbooks in many ways such as graphics, pictures, drawings, tables and concept maps (Kozma & Russell, 1997).

Important factors to help students understand visuals include the teaching technique with appropriate learning theories and the design of textbook content (Cook, 2006; Yılmaz, et al., 2017). The visuals in the textbooks should also be arranged by showing what they mean in a clear way for students to connect the meaning in the textual content with the meaning on the visual content (Pozzer & Roth, 2003). Some of the methods used to make these connections are captions and labels (Gkitzia, etal., 2011). Bernard (1990) stated that long captions have some facilitating effects on comprehension and learning of complex visuals such as graphics. Additionally, McTigue's (2009) study with middle school students showed that the middle school

students had difficulty in learning the structures that make up the diagrams. Those middle school students understood the diagrams better when there were features that clarified its components of structures such as labels and captions. In another study, by labeling the elements in the diagrams, the students understood their functions better (Mayer & Gallini, 1990). It should be noted that visuals alone do not have sufficient effect on students' understandings but should be used in connections within the content as necessary through labels and appropriate captions (Peeck, 1993). In this way, students are able to understand what the visuals mean more easily instead of trying to understand by looking at the surface of the visuals alone (Bernard, 1990).

Another type of design technique is the use of indexing in the text such as using an expression like "Examine Picture 1". This technique can help students establish a connection between the text and the visual. These expressions, which direct the reader from the text to the visuals, help the integration of the text and the visual (Pozzer & Roth, 2003). Similarly, indexes such as "Picture 1" should be included in the visuals' captions in order to fully establish the connection between the text and the visuals. Studies on visuals indicate that presenting pictures and without any linkage to the texts can cause students' attention to be divided (Mayer & Moreno, 1998). Linking the visual to the text with some textual explanations with indexes can reduce or eliminate this distraction. Students become distracted by looking at the text and the image over and over when they do not make an immediate connection between them This is also called the split attention effect and one of the cognitive load types (Mayer & Moreno, 2003; Sweller, et al., 2019). The cognitive load theory is explained later in the next section.

Moreover, Pozzer and Roth (2003) stated that the purpose for using visuals in the text, namely its function of the visuals contributes to sense making. Their study revealed that the visuals were used in biology subjects for four different purposes: decorative, illustrative, explanatory and complementary. These four functions were used as the last category in the analysis in this study to reveal the functions of the visuals in the Turkish textbooks.

Cognitive Load Theory and Instructional Materials

The cognitive load theory explains the method of storing and learning information. In particular, the way, which learning materials are presented, has some effects on learning. For this reason, many studies on cognitive load theory have been conducted to show the effects of instructional materials (Mayer & Moreno, 2003). Among these studies, the cognitive load theory and visuals were examined according to the method of the connections of visuals to text their effects on learning (Vojíř & Rusek, 2019).

John Sweller explains in his study that the durations and limits of storing information of long term memory and working memory in the cognitive structure of learners' memories are different from each other (Sweller, 1988). Working memory has a limited memory and processes all conscious activities in a limited capacity; however, long-term memory is unlimited and uses changing schemas to automatically store schemas effectively. During cognitive functioning, schemas, which can be numerous and complex, need to be configured. Schemas are formed by bringing together relevant parts of multiple pieces of information and removing irrelevant parts. When students try to learn more than one piece of information at the same time, they can create cognitive load because the capacity of the working memory is limited. Removing irrelevant information is called the "consistency effect." By removing the irrelevant parts, empty places in the working memory are created; which would otherwise be due to its limited capacity (Sweller, et al., 1998; 2016; 2019).

Sweller further recommends designing educational materials' textual and representational content in relations to each other. Materials with related content play a role in reducing the cognitive load and improve learning (Sweller, 2016). For this reason, the design of the visuals is important because they have an effect on students' cognitive load depending on the way they are presented, their nature, and how they are designed (Mayer & Moreno, 2003; Cook 2006,). While students learn with visuals, the content should be designed in such ways that provide some links between the textual content and the visuals. Otherwise, the visuals, unrelated to the texts, can overwhelm the capacity of working memory as unrelated information, which are able to cause extra information in the working memory. Therefore, the cognitive load theory suggests instructional materials and related student activities that help process information to optimize cognitive capacity and process (Sweller et al., 1998; 2019).

It is stated that students come across three different cognitive loads while learning with instructional materials (Sweller, 1988; Sweller et al., 1998; Cook, 2006). These are intrinsic cognitive load, extraneous cognitive load, and germane cognitive load. The sum of these three types of load constitutes the total cognitive load, and their sum should remain within the capacity of the working memory.

Intrinsic cognitive load is related to the nature of the subject to be learned. For example: if the subject is difficult and visual representations and textual connections require interaction with another discourse, the internal load increases and it has potential to exceed the capacity of working memory. In this case, learners experience difficulty in learning (Sweller, 1988; Cook, 2006).

Germane cognitive load occurs in the processes of creating and editing schemas. The capacity of the internal load does not change, and unlike the internal load, the germane cognitive load includes the external load which affects the quality of the instructional design. For this reason, instructional designers' controls of external load can optimize learning (Sweller, 2016).

Extraneous cognitive load is related to the way of information that is presented to students, and the quality design feature of the teaching material. Since the capacity of working memory is limited and the internal load is in a determined capacity and its capacity does not change in the working memory; in order to increase the working memory capacity, the teaching materials should be designed in a way that does not force the cognitive load capacity by especially considering extraneous cognitive load. For example, images should be in connection with the text in one piece of information other than separately as two pieces (Sweller et al., 1998; Sweller; 2016).

Importance of the Study

Textbooks are fundamental teaching materials, that students can access information from which are primarily used in lessons throughout their education life (Chambliss & Calfee, 1998). They are especially important in countries such as Turkey which has a central education system and where the most of students go to public schools (Kahveci, 2010). The contents of the textbooks should be arranged in a way that enables students to learn meaningfully with combination of visual representation with the text (Pekel, 2019; Pozzer & Roth, 2003). For this reason, the design of the visuals in the textbooks is important.

Due to the importance of textbooks in teaching and their possible shortcomings, many studies have been carried out to examine the qualities of textbooks. The most common types of research on science textbooks include revealing the distributions of visual representations based on their types (pictures, diagrams, etc.), counting and showing different types of representations in a specific topic (Slough et al., 2010; Ge et al., 2018; Parthasarathy & Premalatha, 2022). In addition, as previously discussed, functions of visuals have been studied in biology textbooks (Pozzer & Roth, 2003; Utami & Subiantoro, 2021).

The studies specific to Turkey include the examination of chemistry images in the high school textbooks using various criteria (Kapıcı & Acıkalın, 2015). In biology, the method of inclusion of visuals in the nature of science in textbooks was also examined (Irez, 2009). Further, the misconceptions in the visuals of the certain biology units in Turkey have been determined (Yılmaz et al., 2017; Pekel, 2019). Another study has looked at visuals in the middle school science textbooks to find out the proportions of the categories such as the gender of the scientists and the captions of visuals (Kahveci, 2010; Karacam, et al., 2012). However, a study has not been conducted to determine and compare the design of visuals on the biology subjects in the middle school textbooks in the 7th and 8th grade textbooks in Turkey. This type of study is necessary because the inappropriate use of visuals has been concerns of research in Turkey and many inappropriate usages have been found in certain topics with particularly a limited visual design category in the middle school science textbooks (Akçay et al., 2020; Pekel, 2019; Yilmaz et al., 2017; 2021). Consequently, it is essential to examine the visuals' design features of biology topics in science textbooks with various categories to show how their designs were and how inadequate designs might affect learning with visuals. The biology units in the 7th and the 8th grade science textbooks are cognitively connected together (Sternberg, 2003). Therefore, this study is important to show the qualities of design features and effects and restrictions on learning of visual representations of biology units at these grade levels textbooks. The following research question was used in this study:

What are the differences between the designs of the visual representations used in the biology units in the 7th and the 8th grade science textbooks?

METHOD

In this study, the qualitative design research method is used following the document review model. This method reveals descriptive and in-depth information of the content that allows documents to be examined with themes and codes (Yıldırım & Şimşek, 2003). In this study, this method was preferred because it was suitable for the aim of the study to examine the visuals with appropriate codes under the certain categories.

Textbook Selection

The purpose of this study was to examine the visuals in the biology units of the 7th and 8th grade science textbooks used in Turkey. The main data collection sources in the study were selected by the purposeful sampling.

The middle school science textbooks   taught in the 2020-2021 academic year were selected and the visuals in the units belonging to the biology subjects were analyzed.These books were designed to use for some following academic years for the whole country. Since the connections of the visuals with the text would also be examined, all the visuals used in the content of the subject were selected in the process of determining the visuals. As the usage of visuals by the same publishers were similar, different publishers were selected to show how visuals were designed at both of grade levels. Thus, more examples of design features of representations revealed in different textbooks. The visuals in the questions at the beginning of the unit, at the end of the chapters and at the end of the units were excluded from the analysis becuase they did not match in terms of content. For these reasons, only the visuals in the textual content were examined. The units used in the analysis in the 7th and the 8th grade textbooks are given in Table 1 below.

Table 1. The information of Units and Publishers

Grade Level	Unite Name	Pages	Publisher
7	Unit 2: Cell and Divisions	44-73	MEB
	Unit 6: Reproduction, Growth and Development in Living Things	184-202	
8	Unit 2: DNA and the Genetic Code	37-73	SDR Dikey
	Unit 6: Energy Conversions and Environmental Science	185-223	

Data Analysis

Descriptive and content analysis techniques were used to examine the textbooks. The content analysis is an analysis technique that allows determination of codes and their categories in the documents by calculating their percentages and frequencies of the codes (Silverman, 2001). Descriptive analysis also allows reusing the codes in the literature (Yıldırım & Şimşek, 2003). In this study, the visuals in the biology units of both textbooks were coded with the categories, and their percentages and frequencies were calculated. Some of the codes, which were previously used in similar textbook analysis, adapted to analyze of visuals for this study.

The coding list was created as a result of various methods. The first category, "type of visual representation", was created with the content analysis of the visuals in the textbooks by comparing the visuals' types' differences and similarities in each textbooks. Three other categories were adapted from Gkitzia et al. (2011). These are surface features of the visuals, the captions, and the relatedness to the text. The other two categories from Gkitzia's (2011) study, "connection between multiple representations" and "multi-representation types", were omitted because they were specific for images on chemistry subjects and did not match the visuals used in the biology subjects of the selected textbooks. The category named "the function of the visual" used by Pozzer and Roth (2003) in the analysis of the visuals in the biology textbooks was adapted to analyze the visuals' functional properties.

The reliability and the validity of the codes were determined by face validity through taking opinions from two other researchers in the relevant field (Yıldırım & Şimşek, 2003). The previous use of four of the categories added provided content validity to the study. In their study, Gkitia et al (2003) determined the appropriateness of these codes was determined and a refined using the result of the pilot analysis. For coding reliability, the author coded the images twice with a one-month break. Two different researchers also coded 20% of the images. Reliability was approximately 89% (Miles & Huberman, 1994). The discrepancies were coded again by discussion until consensus was reached. The coding was was compiled in an excel spreadsheet and the percentage and frequency values calculated. Further analysis was carried out using the SPSS 21 program.

Coding List

The coding list includes five main categories which consist of types, surface features, captions, relatedness and functions of visual representations. The first category is the type of visual representation created after analyzing the types of representations found in the two textbooks. This category includes five subcategories: pictures, diagrams, tables, graphs, and equations. It is important to note that the pictures subcategory included photos, regular pictures, and drawings because their function is similar in general.

The second category is the surface feature of visual representation i.e clarity and meaning of surface features are presented on a representation. This category includes three subcategories: (1) ambiguous, (2) implicit, and (3) explicit. The ambiguous feature means that the surface of the representation is not clear, does not adequately represent the explanations in the text, and does not include labels and captions. Implicit means visuals that are clear but lack sufficient labels and captions. Visuals without labels and captions were also coded as implicit because the shapes and images on them were basic and at times unconnected to the content. The explicit feature means that learners can understand the meaning of the visual through labels and captions and the visual and the concept are well represented. To adapt the visuals to the analyzed textbooks for this study, some of the visuals withouht labels and captions were also coded as implicit because the visuals had some basic images and drawings on them which showed some relation to the textual content.

The third category is the caption of the visuals. This category was evaluated with three sub-categories: (1) not available, (2) short/problematic captions, and (3) appropriate captions. Pilot analysis showed that some visuals did not have captions. In addition, some of them were used like labels to express only the name of the visuals. The indexing was also problematic. Indexes were also absent in many of the long captions. However, the captions, those with some long descriptions and explanations, were coded as appropriate to adapt the codes for this study in order to provide a degree in between codes of the design of the visuals. Therefore, the coding was adapted in this way for this study.

The fourth category is the relatedness to the text. This category had five subcategories including (1) not related partially, (2)related and unlinked, (3) partially related and linked, (4)completely related and unlinked, and (5) completely related and

linked. The degree of connection of the visuals was determined by the presences of expressions in the text such as "in the picture below" and indexes (in Table 1, as shown in Picture 1).

The fifth category is the function of the visual representation. This category had four subcategories: (1) decorative, (2) illustrative, (3) explanatory, and (4) complementary. First, "decorative visuals" means that the visual does not have captions and indexes in the text, and its direct description is not included in the text. The second subcategory, illustrative, are the visuals with short captions. In the absence of captions, such visuals were coded as illustrative by looking at the expressions in the textual content such as "as shown in the picture" or there needs to be matching the description with the visual in the text . This was also for the adaption the codes to this study. The third subcategory, explanatory, means that visuals have long captions that provide descriptions or explanations. The fourth subcategory, complementary, means that visuals have more detailed descriptions and labeling that provide more information to the text.

FINDINGS

According to the results of the analysis, different values were found in the 7th and 8th grade biology units for each category. The frequencies and percentages of the number of types of 7th and 8th grade visuals obtained as a result of coding each category of biology units are presented in Table 2 below.

Table 2. Frequency and Percentage Values of Types of Visual Representation

Types of Visual Representation	7th Grade Textbook		8th Grade Textbook	
	f	%	f	%
Picture	46	63.9	85	70.2
Diagram	25	34.7	26	21.5
Table	1	1.4	6	5.0
Graphic	-	-	1	.8
Formula	-	-	3	2.5
Total	72	100	121	100

As shown inTable 2 the 8th grade textbook had more visuals in the biology units than the 7th grade ones (f:121 and f:100). The varieties of visuals were also used in the two textbooks in different proportions. There was more variation in the 8th grade textbook, with few graphics and formulas. The amount of pictures in were higher in the eight grade textbook (70.2% versus 63.9%) as were tables (5% vs 1,4 %). However diagrams used in the 7th grade textbook were higher than the 8th grade textbook (34.7% vs. 21.5%). While formulas and graphics were used in the 8th grade textbook (.8% and 2.5% respectively), they were not found in the 7th grade textbook.

The frequencies and percentages of the number of surface features are presented in Table 3 below:

Table 3. Frequency and Percentage Values of Surface Features Analysis

Surface Feature	7th Grade Textbook		8th Grade Textbook	
	f	%	f	%
Ambigious	4	5.6	8	6.6
Implicit	23	31.9	56	46.3
Explicit	45	62.5	57	47.1
Total	72	100	121	100

As shown in Table 3, ambigious visuals in the 8th grade textbook were slightly higher than that of the 7th grade (6.6% vs. 5.6%). In addition, the type of implicit surface was found to be higher in the 8th grade textbook than in the 7th grade textbook (46.3% vs 31.9%). On the other hand, the explitcit visual type was found at a higher rate in the 7th grade textbook than in the 8th grade textbook (62.9% vs. 47.1%).

The frequencies and percentages of captions are presented in Table 4 below:

Table 4. Frequency and Percentage Values of Caption Analysis

Captions	7th Grade Textbook		8th Grade Textbook	
	f	%	f	%
Not avaiable	9	12.5	91	75.2
Short	45	62.5	9	7.4
Appropriate	18	25.0	21	17.4
Total	72	100	121	100

As shown in Table 4, the most of the visuals in the 8th grade textbook fell in the "not available" subcategory (f:91, 75.2%). In contrast the 7th grade textbook in this subcateogry was found to be quite low (12.5%). The rates of short captions were found to be higher in the 7th grade textbook than in the 8th grade textbook (7.4% vs. 62.5%). Appropriate captions of the long and descriptive type were found to be more in the 7th grade textbook than the 8th grade textbook (25.0% vs. 17.4%).

The frequencies and percentages of relatedness of the visuals to the text are presented in Table 5 below.

Table 5. Frequency and Percentage Values of the relatedness to the text analysis

Relatedness to the text	7th Grade Textbook		8th Grade Textbook	
	f	%	f	%
Not related	-	-	-	-
Partially related and unlinked	4	5.6	8	6.6
Partially related and linked	10	13.9	49	40.5
Completely related and unlinked	52	72.2	34	28.1
Completely related and linked	6	8.3	30	24.8
Total	72	100	121	100

As shown in Table 5, the 2nd subcategory, partly related and unlinked, was found in approximately similarly proportions to the both textbooks (6.6% and 5.6%). The third subcategory, partially related and linked, was higher in the 8th grade textbook than the 7th grade textbook (40.5% vs. 13.9%); The fourth subcategory, completely related and unlinked code, was quite higher in the 7th grade textbook thanthe 8th grade textbook (72.2% versus 28.1%). The ratio of the last subcategory, completely related and linked codes, was found as higher in the 8th grade textbook than in the 7th grade (24.85% vs. 8.3%).

The frequencies and percentages of the function category are shown in Table 6 below.

Table 6. Frequency and Percentage Values of Function Analysis

Functions	7th Grade Textbook		8th Grade Textbook	
	f	%	f	%
Decorative	5	6.9	8	6.6
Illustrative	49	68.1	73	60.3
Explanatory	5	6.9	22	18.2
Complementary	13	18.1	18	14.9
Total	72	100	121	100

As shown in Table 6, the visuals used for decorative purposes were found as close to each other in the both textbooks (6.9% and 6.6%). The proportions of visuals used as illustrative were found to be slightly higher in 7th grade textbooks than 8th grade one (68.1% and 60.3%). While the visuals used as explanatory were found more in the 8th grade textbook compared to the 7th grade textbook (% 18.2 vs. %6.9%), the proportions of complementary visuals were slightly higher in the 7th grade textbook than in the 8th grade textbook (18.1% vs. 14.9%).

DISCUSSION

This study was conducted to reveal and compare the design fetures of visual presentations used in biology units of the 7th and 8th grade science textbooks. The visuals coded with the categories and their subcategories were examined in t both grade levels. The results showed ratios of design features based on the codes of the visuals differed in the both textbooks.

First of all, the proportions of the visuals' types were found similar in the both textbooks. The most commonly used visual type was found as the pictures. The pictures were used in higher numbers than the diagrams in both textbooks (about 70% in both textbooks). Diagrams are important visuals for biology content because they provide more information than pictures, as they show the structural parts of the visuals and the connection between the parts (Ge et. al, 2018; Larkin & Simon, 1995; Utami and Subiantoro, 2021). Thus, the use of diagrams should be more, especially since as mentioned earlier diagrams show the parts that make up the biological structures and make easier for students to understand those structures (Mayer & Moreno, 2003; Yılmaz et al., 2017; 2021). Lastly, there were found some grahics and formulas in the 8th grade level textbooks in the biology units. Tables could show main information all together; therefore, using different types of representations could be more beneficial to students (Akçay et al., 2020). Not having formulas might be because of the nature of Biology.

Considering the visual surface ratios' results examined in the second category, the ratios of visuals described as explicit in the 7th grade textbooks were more than the 8th grade visuals. Surface features should present what the images mean and the explanations as described in the text. In particular, the labels and captions on the images provide information about what the images mean (Pozzer & Roth, 2003). This result overlapped with Pekel (2019) study. In his study, Pekel found that the images were not labeled appropriately in the 8th grade science textbook. Since it might be difficult for students to try to understand which information the visual represent just by looking at the visual without such labels and captions, the 8th grade visuals with an implicit surface structure would probably increase the cognitive load (Sweller et al., 2019). For these reasons, the 8th grade textbook was found to be more inadequate in this category than the 7th grade textbook in terms of students' understanding of the visual surfaces.

The caption category's findings, which were similar to visual surface results, were found to be higher in the 7th grade textbook than in the 8th grade textbook. 75% of the visuals in the 8th grade textbook had no captions. In addition, the appropriate captions in both textbooks were low. Considering the general characteristics of the captions, there were not enough index expressions such as "Picture 1" or "Diagram 1" in both grade levels of the textbooks. The index expressions direct students to images and help them connect to the text, clarify the image, and so reduce the cognitive load (Pozzer & Roth, 2003). Not having captions would probably cause attention split effect so would cogntive load (Mayer & Moreno, 1990). As mentioned before, captions provide information about how the image is used for and add meaning (Bernard, 1990). Therefore, lack captions and problematic captions were likely to cause an increasement in the externsal cognitive load. This is because visuals might not be adequately comprehended by students, as it might not provide the integration of the visuals with the text (Sweller, 2019).

The fourth category, relatedness to the text, revealed some differences in the both textbooks. The rates of the subcateories showed variation for both textbook. There were similarities in the way that visuals contained multiple features but only one feature was described in the text. These caused low relatedness codes. Also pictures were used where fuaframs of tables would have been more appropriate in increasing the relatedbess. Studies have shown that students have the most difficulty in learning the concepts in biology; however, when the images representing the concept in the textbooks are used appropriately, it is easier for students to learn these concepts (Pozzer & Roth, 2003; Yılmaz et al., 2017). Such inadequate connections and unrelated visuals are also likely to impose a cognitive load on students as the unrelated information increases the capacity of working memory and could cause cognitive load thus it could be possible for students to have difficulties in learning of the visuals in both textbooks (Sweller et al., 2019).

The last category was the function of the visuals. The rates of visuals as illustrative in this category were found to be higher in the both textbooks than in other subcategories (68.1% and 60.3%). The use of visuals in the textbooks as an illustrative might help students see what the biological structures were. Thus, students could easily access the subject described in the content with examples and what these biological structures were in the subjects, and so, they might not need to imagine this structure in their minds themselves (Pozzer & Roth, 2003). Contrary to Pozzer and Roth's (2003) definition, some of the images coded as illustrative did not contain captions and labels. However, in this study, they were coded as illustrative because there were similar expressions or definitions related to the visuals that were found within the text. If students did not read these expressions in the text carefully, these pictures would remain as decorative for them. These type of visuals might create a cognitive load on them as they would be extra information unrelated to the text and would force the limitation of working memory (Sweller et al., 2019). In addition, the possibility of not having captions in such visuals and the effect of distraction should also be considered for possibility of causing cognitive load (Mayer & Moreano, 2003). These results showed that the functions of the visuals were used as quite basic, the more informative functions of the visuals were not included in the textbooks in sufficient quantities, and some of the visuals had the potential of causing cognitive load and diminish learning. Visuals had low complimentary and explanatory categories which can have negative consequences to learning (Mayer & Moreano, 2003).

As described aboves, visuals were used in different types and proportions in each category in both textbooks. The visuals were not used in a standardized design in each textbook. This was demonstrated by the variations in each category. The use of visuals in different textbooks in comparable patterns as well as their intergration with text is important for students to comprehend and learn biology subjects meaningfully (Pozzer & Roth, 2003). In particular, visuals should be given clearly in connection with the text; thus, students do not develop cognitive load while learning with visuals (Sweller, 2016; Sweller et al., 2019). Considering the findings, the designs of the visuals in the biology units in the both textbooks had some insufficient visual designs in terms of teaching and learning quality since some of the visuals were highly likely to bring cognitive load to the students.

CONCLUSIONS RECOMMENDATIONS AND LIMITATIONS

This study was carried out to reveal and compare the designs of the visuals used in the biology units of the 7th and the 8th grade textbooks. In the light of the findings, some suggestions were made in this study that will be helpful in improving future versions of the textbooks. The findings obtained as a result of the study showed that the visuals in both textbooks could cause cognitive load for learners. More in depth learning could occur if more attention is paid to the design of visuals e.g clearly labeling the parts of a biological structure that are described within the text, including vivid and clear captions, etc.

Another factor, which should be considered on the design of the textbooks, was the lack of indexing. Indexing was an emerging category could be used in the future studies. Indexes are expressions that can guide students to make a connection between the text and the visuals which should have numbers in the text with relevant caption. In order to establish connection between the text and the visuals and not to create an external load, the use of indexing in a standard method that can provide the link that should be included both in the text and in the images.

Finally, the functions of the visuals were also examined in this study and these functions were mostly found as illustrative. Considering the functions of visuals that have potential to increase learning, more sophisticated ones like explanatory and complementary functions should be included more in textbooks. Apart from these codes, more codes can be analyzed by considering criteria such as the places of visuals in the content and indexing.

This study shows the importance of taking students' learnings theories should be taken into considerations while designing the visuals. In particular, visuals should be designed with the intent of reducing the cognitive load that may occur while learning In this study, visuals were coded using categories firmly grounded in the cognitive load thoery whose importance should be used in future studies for the benefit of the learners.

One limitation of the study was that the visuals were analyzed by reading the content and each visual was analyzed carefully during coding, which took long time. Therefore, lower grades, 5th and 6th grade levels, were not coded for this study. This is one of the limitations of this study. By examining the 5th and the 6th grade level textbooks of biology units, students can benefit more from the content of the textbooks. This kind of study can be recommendation for the future studies.

Another limitation was that actual visuals from the textbooks could not be displayed in the study. This is because a funding was not received for this study to pay for copyright permission. However, in future studies, this kind of study can be prepared as projects for getting funds and code samples can be explained on the visuals for future researchers.

In conclusion, textbooks are the primary educational materials for students from all diffferent economical levels. For this reason, the content of the textbooks should be arranged by taking into account primarily cognitive learning theories, readability, and meaningful learning. There are many studies about the analysis of textbooks for different purposes in the literature which continue to increase interest among research. More textbook analysis studies have been carried out in the USA and Europe than in other countries including Turkey (Vojir & Rusek, 2019). As the concepts in biology are difficult to learn (Yılmaz et al., 2017), textbook analyses should be done with the same rigour worldwide to increase quality of textbooks. In addition, in-service training should be given to teachers on the use of the visuals in the textbooks with the correct design. Such studies involving visuals in biology will increase the instructive quality of the textbooks which will be of benefit to students, curriculum developers, and teachers.

Funding

Statements of publication ethics

I hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Ethics Committee Approval Information

In this study, the document analysis model, one of the qualitative research methods, was used to analyze the visual representations' usage rates according to determined categories. Thus, ethics committee approval was not required for document analysis research.

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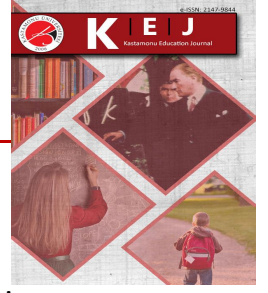
| Research Article / Araştırma Makalesi|

Middle School Teachers' Views on Mathematical Creativity and Supporting Mathematical Creativity[1]

Ortaokul Öğretmenlerinin Matematiksel Yaratıcılığa ve Matematiksel Yaratıcılığın Desteklenmesine Yönelik Görüşleri

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Abstract

The aim of this study is to examine middle school mathematics teachers' views on mathematical creativity. Phenomenology, one of the qualitative research designs, was used in the study. Ten middle school mathematics teachers, who are actively working, participated in the research. Purposive sampling method was used to determine the participants. In order to collect the data in the research, first of all, a teacher behavior scale that encourages creativity was applied to ninety-two middle school mathematics teachers. Then, semi-structured interviews were conducted with ten teachers with high scores. In these interviews, teachers were asked questions to support mathematical creativity. The obtained data were analyzed with descriptive analysis. As a result of the research, it was seen that teachers emphasized the concept of creativity with originality, and they emphasized problem solving, originality and high-level thinking for the concept of mathematical creativity. These views are concepts that many researchers have mentioned in the literature. Therefore, many of the opinions of the mathematics teachers interviewed are valid expressions for mathematical creativity.

Öz

Bu çalışmanın amacı, ortaokul matematik öğretmenlerinin matematiksel yaratıcılığa yönelik görüşlerini incelemektir. Araştırmada nitel araştırma desenlerinden biri olan olgu bilim çalışması kullanılmıştır. Araştırmaya, aktif olarak görev yapmakta olan on ortaokul matematik öğretmeni katılmıştır. Katılımcıları belirlemek için amaçlı örnekleme yöntemi kullanılmıştır. Araştırmada verileri toplamak için öncelikle doksan iki ortaokul matematik öğretmenine yaratıcılığa teşvik edici öğretmen davranışları ölçeği uygulanmıştır. Ardından yüksek puan alan on öğretmen ile yarı yapılandırılmış görüşmeler yapılmıştır. Bu görüşmelerde öğretmenlere matematiksel yaratıcılığı desteklemeye yönelik sorular sorulmuştur. Elde edilen veriler betimsel analiz ile analiz edilmiştir. Araştırmanın sonucunda, öğretmenlerin yaratıcılık kavramına orijinallik ile vurgu yaptıkları, matematiksel yaratıcılık kavramı için problem çözmeyi, orijinalliği ve üst düzey düşünmeyi vurguladıkları görülmüştür. Bu görüşler alan yazında da birçok araştırmacının değindiği kavramlardır. Dolayısıyla, görüşme yapılan matematik öğretmenlerinin görüşlerinin birçoğu matematiksel yaratıcılık için geçerli ifadelerdir.

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[1] This article is produced from Mine Turan's master's thesis entitled "Investigation of the Processes of Supporting Mathematical Creativity of Middle School Teachers".

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INTRODUCTION

In this rapidly changing world, the new generation must have the necessary knowledge, skills and qualifications to keep up with the age. The new generation skills that successful individuals should have are problem solving, metacognitive thinking, critical and creative thinking skills (Yükseltürk and Altıok, 2016). Research on the concept of creativity started in the 1950s and has continued until today (Esi, 2018). Creativity is encountered not only in the field of art or science, but in every part of daily life (Craft, 2003; Pehkonen, 1997). Creativity has an important place in the field of education for the development of countries and the training of people who will make inventions (Esi, 2018). There is no single accepted or used definition of creativity in studies (Haylock, 1997; Pehkonen, 1997). Although the definition of creativity changes over time (Leikin; 2009), Mann (2006) stated that there are more than 100 definitions of creativity. However, there are some features that are common to all definitions. According to Plucker, Beghetto and Dow (2004), when the definitions for creativity in the literature are examined, novelty and usefulness as common concepts in creativity appears. For example, Sternberg and Lubart (2000) defined creativity as the process by which a useful and adaptable product of extraordinary originality is produced. This definition can encompass many features of creativity.

Torrance (1974) mentions four components of divergent thinking which is referee to creativity are fluency, flexibility, originality (authenticity) and elaboration (as cited in Leikin, 2009). While fluency means the continuity of ideas, the flow of reasoning and the use of universal and basic knowledge, flexibility is about being able to change ideas, look at a problem from different perspectives and produce different solutions to a problem (Akgül, 2021; Leikin, 2009). While originality is defined as a unique way of thinking, mentally and artistically creating unique products, elaboration is explained as clarifying, defining and generalizing ideas (Akgül, 2021; Leikin, 2009). The concept of originality, which is one of these four components, is the most mentioned component of creativity because creativity is seen as putting forward original ideas and products (Leikin, 2009).

Although creativity was considered as a general skill in the early days, studies have revealed that creativity is a field-specific concept (Leikin, 2009; Mann, 2005; Sriraman, 2005). Thus, after the general definitions of creativity, mathematical creativity, which is field-specific, appeared as a concept. Just as there is no single accepted, precise definition of creativity in general, there is no single definition of mathematical creativity (Haylock, 1997; Mann, 2006). According to Krutetskii (1976), mathematical creativity is to formulate incomplete mathematical problems, find ways to solve these problems, find theorems and proofs, find original methods and solve non-standard problems. Balka (1974) expressed creative ability in the field of mathematics as using the mathematical structures in our minds to obtain a solution to mathematical situations. Mathematical creativity is the ability to find new solutions to problems and apply mathematical principles in different ways to produce mathematically correct results (Bahar & Maker, 2011). Adapting the components of creativity introduced by Torrence (1974) for problem solving, Silver (1997) defines the fluency component as generating too many ideas and finding many already existing solutions to a problem. While explaining the flexibility component as producing many different solutions, he uses the expression of finding new, extraordinary solutions for originality.

The concept of mathematical creativity is also encountered in research on the support and development of mathematical talent (Shieffield, 1994; Şengil-Akar, 2018) because mathematical creativity is one of the basic elements of the development of mathematical talent (Mann, 2005). Sheffield (1994), examining the development of mathematical talent, stated that the top stage of the development process in her theory is creativity in mathematics. Sheffield (1994) divided talent development into six stages. While individuals who are at the lowest stage, being the stage of ignorance, cannot even understand the logic of simple calculations, creators who are at the highest stage are defined as individuals who construct mathematics. Accordingly, it can be said that the thinking skill that enables the construction of the science of mathematics is creativity. In addition, when answering the question of at which level the creativity should be in children, we encounter the definition of relative creativity (Leikin, 2009). While absolute creativity is defined as being able to make mathematical discoveries at the adult level, relative (sample-based) creativity refers to the creativity that K-12 level students can exhibit in school (Csikszentmihalyi, 1988; as cited in Akgül, 2021). Children are creative while discovering (constructing) different structures at their own level, producing different solutions to problems and trying to produce different problems (Usiskin, 2000). Through mathematical creativity, students improve their problem solving ability by finding original solutions (Sriraman, 2004). In addition, this concept is part of the mathematical thinking skill, because creativity plays a vital role in advanced mathematical thinking (Ervynck, 1991; Mann, 2006).

Mathematical creativity is seen as an important skill to be demonstrated by students in schools, expected to be supported by teachers and to be mastered for the development of mathematical talent (Şengil-Akar, 2017; Şengil-Akar, 2021). In the Middle School Curriculum (2013) of the Ministry of National Education, it was stated that one of the skills that should be imparted to students is creative thinking. The most important factor in supporting mathematical creativity skill is mathematics education in schools (Leikin, 2009). One of the important factors in supporting mathematical creativity is the activities given to students in classes (Sak and Maker, 2006; Sternberg and Davidson, 2005; Şengil-Akar, 2021). Mathematical creativity should be included in classroom activities because creativity is not a static skill; on the contrary, it is a dynamic skill that can be developed with activities (Leikin, 2009). Therefore, teachers have a great influence on creativity because the activities carried out in the classroom are decided and conducted by the teacher (Yıldız and Baltacı, 2018). In order to develop mathematical creativity, teachers need to

bring rich activities and problems to the classroom and create environments that enable students to make decisions and think on their own (Sheffield, 2006). The traditional teaching method, which uses closed-ended questions with predetermined answers, is not sufficient for learning mathematics. In schools that teach in this way, students acquire calculation skills, but they cannot notice the meaningful ways necessary for mathematics (Mann, 2006). According to Sheffield (2006), while learning mathematics, students should not only know the procedures and concepts, but also discover new concepts and solve problems in original ways. Problem solving and problem posing activities can be used as basic tools for the development of mathematical creativity of all students (Sheffield, 2006; Pehkonen, 1997). According to Silver (1997), mathematics teaching enriched with creativity contributes to students making different representations for solutions, being flexible, fluent and original while finding a solution. Open-ended mathematics activities enable students to use divergent thinking skill while doing the activity and improve students' creative thinking skill (Haylock, 1997; Leikin and Lev, 2013; Mann, 2006). In fact, although all the examples given emphasize that mathematical creativity develops through the given activities and in the classroom, it is the teacher who gives, develops these activities, presents them in the classroom and creates this educational environment. In this context, investigation of whether teachers are aware of this fact is one of the purposes of the current study.

The teacher plays an important role in supporting mathematical creativity because it is difficult for students of a teacher who is unwilling to support creativity to display such behaviour (Mann, 2006). According to Sheffield (2006), in order to support mathematical creativity, teachers should listen carefully to students' ideas, ask them questions for them to defend and explain their ideas, follow them and encourage them to participate in the lesson. Moreover, methods and techniques such as critical thinking, questioning and brainstorming used in the classroom contribute to the development of creative thinking skill (Yalçın, 2021). Therefore, the teacher as the implementer of these methods, which are also used in mathematics lessons, is seen to be the main element. Philips and Higginson (1997) stated that creating a classroom and school environment that will allow students to show their creativity in mathematics education will help them develop their creativity (as cited in Yıldız and Baltacı, 2018). Accordingly, in order to ensure the development of mathematical creativity in schools, learning environments should become an environment that puts students into the centre, develops problem-solving skills and does not limit learners (Tezci and Dikici, 2003). However, in order for all these to be done, teachers need to have a conceptually meaningful view of mathematical creativity because conceptual foundations that come from the definition of mathematical creativity such as providing opportunities for different solutions, developing different solutions, posing problems cannot be addressed as independent from teaching. While the teacher factor is so important in developing mathematical creativity and the importance of creative thinking skill has been emphasized in all curricula since 2006, teachers' conceptual views on this subject are worth being researched.

When the relevant literature is reviewed, it is seen that the great majority of the studies conducted on the concept of creativity with the participation of teachers have been carried out on preschool or primary teachers (Pehlivan, 2019; Özel and Bayındır, 2015; Özkan, 2016; Yuvacı, 2017; Yalçın, 2021). These studies have focused on the concept of general creativity and it has been seen that the studies conducted with the participation of mathematics teachers on mathematical creativity, which is a field-specific creativity, different from general creativity, are limited at the middle school level. In particular, studies on mathematical creativity and teacher views on supporting mathematical creativity are seen to be limited in Turkey (Cansız-Aktaş, 2016; Demir and Açıkgül, 2021). In this respect, it has been determined that there is a gap in the literature and it is thought that a gap in the literature will be partially filled with the current study, which is focused on middle school mathematics teachers. When the relevant literature is reviewed, it has been noticed that there are a limited number of studies on mathematical creativity in Turkey (Alkan, 2014; Ayvaz, 2019; Dündar, 2015; Kıymaz, 2009; Şengil Akar, 2017; Yulet Yılmaz, 2016). In these limited number of studies on mathematical creativity, the focus is on gifted students or pre-service teachers' mathematical creative thinking skill (Ayvaz, 2019; Dündar, 2015; Kandemir and Gür, 2009; Kıymaz, 2009; Şengil-Akar, 2017). In addition, the effects of posing or solving problems on mathematical creativity have been examined in these studies (Kavgacı, 2016). However, teachers are the ones who will support the development of mathematical creativity in the classroom. With this study, it is aimed to fill a part of this gap in the literature. In this connection, the purpose of the current study is to examine the opinions of middle school mathematics teachers about creativity, mathematical creativity, supporting mathematical creativity and barriers to supporting mathematical creativity. To this end, answers to the following questions were sought.

1. What are the opinions of middle school mathematics teachers about general creativity?

2. What are the opinions of middle school mathematics teachers about mathematical creativity?

METHOD

Research Model

Due to the detailed examination of the opinions of middle school mathematics teachers about mathematical creativity, the qualitative research method was used in this study. Qualitative research is conducted to explain and interpret a situation in detail (Yıldırım and Şimşek, 2021, p.45). Since the current study was conducted to draw conclusions about teachers' opinions on supporting mathematical creativity, the phenomenological study design was employed. In a phenomenological study, it is aimed to reveal the images in the minds of individuals regarding a phenomenon (Yıldırım- Şimşek, 2021, p.66). Detailed information about the participants of the study is given below.

Participants

The purposive sampling method was used to determine the participants of the study. Purposive sampling enables to carry out the study with the participation of the people who have knowledge about the subject to be researched (Yıldırım and Şimşek, 2021, p.116). In this study, participants were selected with the assumption that people who see themselves as teachers who support mathematical creativity support creativity as well. Therefore, mathematics teachers who were actively working were first selected in the study. In order to collect the research data, approximately nine hundred teachers were sent the Creativity Fostering Teacher Behaviour Index, but only ninety-two of these teachers returned the index. The Creativity Fostering Teacher Behaviour Index was sent to groups of many mathematics teachers on social media (WhatsApp, Telegram, Instagram) via Google forms. In order to determine the participants to be interviewed in the Index, information such as name, surname, mobile phone number were requested. Therefore, it is thought that the participation in the survey is low due to the request for this partly private information.

The participating middle school mathematics teachers, who completed the Creativity Fostering Teacher Behaviour Index, were ranked from the highest to the lowest according to the score obtained from this index. The participants who were thought to not have given correct data were excluded from the sample, and ten volunteer participants who were willing to participate and who could express themselves well were selected from among the participants with total scores higher than the average and semi-structured interviews were conducted with them to make sense of their knowledge about the relevant concept. The purpose of selecting teachers with high scores is to ensure that teachers who define themselves as creativity-fostering teachers participate in the study. The study was structured by collecting data from these teachers. The names of the participants of the study are expressed as T1-T10 in the rest of the study. The table (Table 1) below contains information about the teachers interviewed.

Table 1: Information about Participants

Teachers	Age	Graduated university	Experience	Institution served	Training for math.creativity
T1	25	METU	1-5	State School	No
T2	28	METU	6-10	Private School	Yes
T3	23	Uludağ University	1-5	State School	Yes
T4	39	Hacettepe University	16-20	State School	Yes
T5	25	METU	1-5	Private School	No
T6	27	METU	1-5	Private School	No
T7	31	Hacettepe University	6-10	State School	Yes
T8	31	Hacettepe University	6-10	State School	No
T9	25	METU	1-5	State School	No
T10	26	METU	1-5	State School	No

The table above shows that the most of participants graduated from METU or Hacettepe University. Most teachers have 1-10 years of experience. The reason for choosing these teachers is that there is a possibility of obtaining more data. Four of the teachers stated that they participated in a training for mathematical creativity. Seven of the teachers work in public schools and three of them work in private schools.

Data Collection Process

Ten teachers were selected to be interviewed on a voluntary basis, starting from those with the highest scores from the index. Semi-structured interviews were conducted using Zoom application at different times to collect more detailed data from the selected teachers. An interview was held with each teacher. These interviews lasted at least twenty-five and at most fifty minutes. In the interviews, questions about general creativity, mathematical creativity and fostering mathematical creativity were asked to the teachers. All the interviews were tape-recorded. The dataset was created by analyzing the collected data. The data collection tool used in the data collection process is explained below.

Instrumentations

The Creativity Fostering Teacher Behaviour Index was developed by Soh (2000) to measure how much teachers support students' creativity and creative thinking skill through their classroom behaviours. This index was created based on Cropley's (1997) definition of nine behavioural characteristics to be possessed by teachers in order to develop students' creativity. These nine behavioural characteristics correspond to nine sub-dimensions in the index called "independence, integration, motivation, judgment, flexibility, evaluation, question, opportunities, frustration". The sub-dimension of independence includes behaviours exhibited to encourage students independently, the sub-dimension of integration includes behaviours exhibited to have students use cooperative learning, the sub-dimension of motivation includes behaviours exhibited to motivate students to have basic knowledge and skills, the sub-dimension of judgement includes behaviours exhibited to have students think before receiving feedback for their ideas, the sub-dimension of flexibility includes behaviours exhibited to encourage students to think in different ways, the sub-dimension of evaluation includes behaviours exhibited to encourage students for self-evaluation, the sub-dimension of question includes behaviours showing that the teacher cares for students, the sub-dimension of opportunities include behaviours exhibited to enable students to use their ideas in different conditions and the sub-dimension of frustration includes behaviours exhibited to support students when they fail. Each sub-dimension consists of five items and there are a total of forty-five items in the index. The index was adapted into Turkish by Akar (2014). A total of 192 teachers participated in this adaptation study. Confirmatory factor analysis was performed for the validity and reliability of the scale, and correlation and Cronbach Alpha coefficients were calculated. The Cronbach Alpha reliability coefficient was found to be 0.95. As a result, since the index was seen to have a linguistic equivalence, to be structurally equal, valid and reliable, it was accepted in the current study that teachers who score high in this index see themselves as teachers who foster creativity.

The semi-structured interview form used in this study was prepared by the researchers in order to elicit the opinions of the teachers about mathematical creativity. First, an item pool was created by reviewing the relevant literature and the items were submitted to expert review and some corrections were made in light of the feedbacks given by the experts. Then, the opinions of two academicians having studies in the field of mathematical creativity were sought on the items and then the piloting of the items was performed. In line with the data obtained from the pilot application, some items considered to be directing were removed, and the items that could be related to each other were grouped and the final form of the interview form was obtained. The interview form consists of six items. The items are about general creativity, mathematical creativity and their definitions, creative people and mathematically creative people and their characteristics, methods, classroom environment and problems that support mathematical creativity. First of all, it started with the question of "What is creativity in your opinion?" in order to warm up the participants. Then, the question of "What is mathematical creativity?" was asked. The question of "Who can be mathematically creative?" was used as a probe for the participants to detail their views. Then, the participants were asked "What should be done to support mathematical creativity?". When participants have difficulty expressing their ideas, "Which teaching methods, what kind of problems, what kind of behaviors support creativity?", such questions were used as probes.

Data Analysis

In the study, the interviews were transcribed during the week of the interviews and for the transcription of the interviews, the Voiser application was used. These transcriptions constituted the dataset of the study. The transcribed data were grouped and made suitable for analysis. The data were analyzed using the MAXQDA program. While some of the codes used while analyzing the data were created before the analysis by reviewing the relevant literature (Biçer, 2021; Cropley, 1997; Ervynck, 2002; Haylock, 1987; Leiken, 2009; Luria, Sriraman and Kaufmann, 2017; Sheffield, 2006; Silver, 1997; Soh, 2000; Sriraman, 2005; Torrance, 1974), some codes were created from the data collected from the participants. While creating the codes in accordance with the theoretical framework, the theoretical framework proposed by Torrance (1974) was used for the codes and sub-codes under the theme of general creativity and the theoretical framework proposed by Ervynck (2002), Haylock (1987), Silver (1997) and Sriraman (2005) for the codes and sub-codes under the theme of mathematical creativity. In addition, for the codes and sub-codes under the theme of fostering creativity, the theoretical framework proposed by Biçer (2021), Cropley (1997), Luria, Sriraman and Kaufmann (2017), Sheffield (2006), Silver (1997) and Soh (2000) was used. Since the purpose of the study is to reveal the opinions of teachers on fostering mathematical creativity in depth, descriptive analysis was used for the analysis of the data. In descriptive analysis, all data are analyzed using relevant codes, presented in detail and in depth and interpreted (Patton, 2002).

Validity and Reliability

Some precautions were taken to ensure the validity and reliability of the study. In qualitative research, one method that increases internal validity is expert review (Merriam, 2012; Neuman, 2007). The study was carried out under the supervision of two experts through all the processes from the preparation of the data collection tools to the analysis and interpretation of the data. The triangulation strategy was used to ensure the credibility of the study. For triangulation, interviews were conducted with teachers of different ages, teaching at different levels of schooling, working in different cities and institutions and having graduated from different universities. In order to ensure the transferability of the study, the opinions of the teachers were given as direct quotations and no comments were added. In order to ensure the reliability of the study, the theoretical framework of the interview form was developed by examining the relevant literature and the opinions of two experts working in the field of mathematical creativity were taken during the preparation of the interview items. The necessary corrections were made in light of the feedbacks given by the experts and then a pilot study was conducted and the interview items were given their final form.

Moreover, the conceptual framework was taken into account and the relevant literature was reviewed while determining the themes and codes for data analysis. In addition to these, during the interviews, using the participant consent method, the participants were asked questions such as "Did I understand correctly?" and thus, the reliability of the data was increased. In order to ensure the confirmability of the study, the collected data were reanalyzed by the researcher at different times and the data were re-coded by another expert working in the field of mathematical creativity. The inter-rater reliability was calculated to be 73 % by using the formula "The number of codes agreed upon/The total number of codes X 100". According to Yıldırım and Şimşek (2016), a reliability value above 70% is acceptable. Thus, the level of reliability between the raters in the current study was considered to be acceptable.

FINDINGS

In this section, the findings obtained from the analysis of the interview data are presented under five main headings; creativity, mathematical creativity, mathematically creative people, their characteristics and teacher creativity, fostering mathematical creativity and factors hindering the development of mathematical creativity. Under these headings, similar expressions of the participants come together to form codes and codes emphasizing the same area come together to form themes. An expression of a participant can be included in more than one code and theme. These headings are explained in detail below.

1. Creativity

Under this heading, there are four themes derived from the responses of the participations to questions such as "What is creativity? Who are creative people? What are the characteristics of these people?". These four themes are cognitive characteristics, affective characteristics, creative people and personality characteristics. The participations who mentioned a total of 20 codes and sub-codes under these themes are shown in Table 2.

Table 2. Opinions of the Teachers on the Concept of Creativity

THEME	CODE		PARTICIPANT
Cognitive	Definitional Concepts (Torance,1974)	Originality	T1, T2, T3, T4, T5, T6, T7, T8, T9, T10
		Flexibility	T3, T4, T7
		Fluency (Productivity)	T2, T4, T7, T8
	Cultural Concepts	Thinking Skills	T2, T3, T4, T6, T7, T8, T10
		Imagining	T6, T7
Affective	Motivation		T1, T6
	Need		T1, T6
Creative People	Scientists		T3, T9
	Artists and people related to arts (Art)		T5, T6, T7
	Others	Acquaintances	T1, T2, T4
		Students	T7
		Children	T10, T8
		Leaders	T3, T5
Personality Characteristics	Talented		T1, T6, T10
	Able to change facts		T10
	Open to new ideas		T10
	Solution-oriented		T2
	Having confused minds		T4
	Sensitive		T6
	Having practical intelligence		T8

As seen in Table 2, the themes formed by analyzing the interview data are cognitive, affective, creative people and personality characteristics. From the answers given to the question "what is creativity?", the cognitive and affective themes were derived. The creative people theme was obtained from the answers given to the question "Who are creative people?". The personality characteristics theme was created from the answers given to the question "What are the characteristics of these people?" and moreover, some answers given to this question were also included in the cognitive and affective themes. These themes and codes are explained in detail below.

1.1 Cognitive

This theme consists of codes containing mental processes and codes related to the characteristics of the products and behaviours revealed as a result of these processes. The theme consists of two codes: the code for definitional concepts (Torrance, 1974), which includes the definitions in the literature and the code of cultural concepts, which includes the concepts obtained from the opinions of the teachers that are not explicitly mentioned in the literature. The code of descriptive concepts consists of three sub-codes: originality, flexibility, fluency (productivity) and the code cultural concepts consists of two sub-codes: thinking skills and imagining and all the teachers mentioned this theme. Each of the codes under this theme is explained below in light of the findings.

1.1.1. Definitional Concepts

Under this code, the opinions expressed by the teachers were grouped according to the components of originality, flexibility and fluency proposed within the definition of divergent thinking by Torrance (1974). The sub-codes of originality, flexibility and fluency are explained in detail below.

1.1.1.1. Originality

Originality, as stated in the literature, means extraordinary, unusual, different and is one of the first concepts that come to mind when creativity is concerned (Leikin, 2009). Therefore, the opinions of the teachers who uttered expressions such as creating original ideas, doing unique things, being extraordinary, thinking different things, looking from a different perspective, putting forward something new, doing things that have not been done before were gathered under this code. All the teachers expressed opinions related to originality, and nine out of ten interviewed teachers first emphasized originality when they were asked "What is creativity?". Therefore, it is seen that the code that teachers mostly referred to in relation to the concept of creativity is originality. In addition, the teachers again referred to originality at different times and in different questions throughout the interview. Some of these expressions are given below. In the opinions of the three teachers given below as direct quotations, originality is emphasized on the basis of being unique and having not been done before.

> *"When I hear the word creativity, I think of something which has not been done before. That is, like doing something unique, something unique that hasn't been done before". (T1)*

> *"Creativity, I think, is to create more original ideas by combining ideas that exist with completely different ideas." (T2)*

> *"I think creativity is to think differently, to come up with something new, to think innovatively." (T4)*

The above participants emphasized originality by talking about uniqueness. The teachers refer to originality by emphasizing the idea of something new and different, something that has never been done before. Other teachers, whose opinions are given below, emphasized the concept of originality with the expressions such as "Looking from a different perspective, revealing things that no one has done or thought about before".

> *"It can be generating something like an idea or a product that no one has done or thought before, on the basis of one's own knowledge or what he/she knows, feels or senses. I mean, to put forward or think about something, to do something that has not been done before … Or to be able to interpret something that someone has thought differently, to add something different, to look at it from a different perspective. This is creativity." (T5)*

> *"I think creativity is to come up with something new, different and useful." (T9)*

> *"Creativity is a different idea, design, thought that no one has put forth and that is unique to this person." (T10)*

Given the delineations above, it is clear that the most prominent concept in the minds of the teachers regarding the concept of creativity is the concept of originality.

1.1.1.2. Flexibility

One of the sub-codes under the definitional concepts code is flexibility. One of the sub-codes emerging under the code of definitional concepts is flexibility. Flexibility means that a person has thoughts different from each other and develops approaches different from each other (Yazgan- Sağ, 2019). Accordingly, the opinions of teachers including expressions such as thinking differently and finding different ways were gathered under the sub-code of flexibility. However, only three out of ten teachers expressed opinions that could be related to flexibility. The fact that few teachers mention flexibility, which has an important place in the definition of creativity, shows that teachers have a conceptual weakness in this regard. The opinions of the teachers who mentioned flexibility are given below.

"Creativity… Finding different ways, benefiting from the unknown, not the known. "(T3)

"…producing different ideas, different from each other each time…" (T4)

The teacher, whose opinion is given as direct quotation below, stated that many different thoughts came to his/her mind while watching cartoons in his/her childhood. Different ideas are included in the definition of flexibility.

"…As a kid, while watching Tom and Jerry, I used to wonder why he is chasing him, whether he doesn't like him, whether he missed him or why they are fighting, etc.… But now I don't think at all, I take what I'm given." (T7)

1.1.1.3. Fluency (Productivity)

Another sub-code mentioned under the definitional concepts code is fluency. Fluency is defined under the concept of creativity as generating too many ideas (Yazgan- Sağ, 2019). None of the teachers used the expression of producing a lot of ideas. But the opinions including the term 'producing' were gathered under the sub-concept of fluency. Therefore, expressions such as producing easy and practical solutions, being productive and productivity were included under the sub-code of fluency. Four out of ten teachers referred to the sub-code of fluency, but three of the teachers who mentioned fluency emphasized productivity. Therefore, there are no teachers who explicitly mentioned the concept of fluency and this may indicate that teachers do not have enough knowledge about fluency, which is one of the components of creativity. The expression of producing practical solutions in the teacher's opinion given as direct quotation below is included under the sub-code of fluency.

" … He/she is solution-oriented and tries to produce easy practical solutions. "(T2)

Three out of ten teachers referred to fluency through the emphasis they put on productivity. The answers given by the participants are given below as direct quotations.

" … I think they are productive…" (T4)

"…here, actually, the child thinks creatively, tries to produce something by himself/herself; that is, without us giving him/her anything. That's what I call creativity…" (T7)

"Creativity is productivity. Generating an idea for what is needed according to your environment is productivity." (T8)

Therefore, from the expressions of the participants, it can be said that fluency and productivity are perceived as similar concepts.

1.1.2. Cultural Concepts

The code of cultural concepts consists of two sub-codes: thinking skills and imagining. Cognitive concepts that are not explicitly mentioned in the literature, but are related to creativity, are gathered under this code. The sub-codes are explained in detail below.

1.1.2.1. Thinking Skills

The sub-code of thinking skills includes expressions such as critical thinking, analyzing, questioning, multidimensional thinking, forward thinking, straight thinking and thinking. Seven out of ten teachers mentioned this sub-code. The teachers especially emphasized that inquiring individuals can be creative, and that children do this very well. The participant, whose opinions are given as direct quotation below, emphasized that the critical thinking of creative people is high.

"The main trait of creative people is that they can think very well. They can analyse events from different perspectives. Their critical thinking is high." (T3)

Participants whose opinions are given as direct quotations below have associated creativity with the skill of questioning. T7 stated that multidimensional and straight thinking positively affects creativity.

"In my opinion, they can think multidimensionally. So let me put it this way, I don't know if it's because of our age or our living conditions. We have children, our spouse, we have a job, business life and so on, so we feel confused but they think more clearly. They think simple and straight. So I think they can think of

new things more easily. I mean, they think creatively, for example, when I was watching cartoons when I was little, I used to design different things with my imagination, but now I watch whatever is given to me in movies, animations, but it is not like that when I was a kid. As a kid, while watching Tom and Jerry, I used to wonder why he is chasing him, whether he doesn't like him, whether he missed him or why they are fighting, etc. … But now I don't think at all, I take what is given to me, but children are not like that, they question and do not have ulterior motives like me, they are pure and clean. That's why I think they are better at creativity because they think simple." (T7)

"Their questioning ability is high and their horizons are open. For example, we say that clouds are blue, we say that all clouds are blue, and people with less creativity say yes, they are blue. But there can be pink clouds and white clouds in age groups with high creativity. In other words, they do not think that the colour of clouds must be blue. You know, they can think that it can be in different colours." (T10)

1.1.2.2 Imagining

Expressions emphasizing imagining were gathered within the sub-code of imagining. Two out of ten teachers mentioned imagining. The participant, whose opinions are given as direct quotation below, stated that it is creativity to imagine things that do not exist now and to come true in the future.

"In other words, to make something that is not possible now true in the future by imagining it. For example, let's think of something impossible. For example, 10 years ago, 10 years ago, or 50 years ago, there was no such thing as a mobile phone, but someone thought of it through imagination and made it possible. In other words, we can even think of something that won't happen right now. This is in our imagination, but we can say that it can be true with the talent of some people in the future." (T6)

One of the participants emphasized his/her imagination by giving an example from his/her childhood. He/she explained that he/she was thinking and dreaming even while watching TV..

"…For example, when I was watching cartoons when I was little, I designed more different things with my imagination, but now I watch whatever is given to me in movies, animations, but it wasn't like that when I was a kid …" (T7)

1.2.   Affective

The theme of affective consists of two codes as need and motivation, and only two teachers mentioned this theme. While the sub-code of motivation was created by bringing together expressions such as interest and desire, the expressions indicating that creativity would arise out of a need were included in the sub-code of need. Below, one of the participants mentioned both the sub-code of need and the sub-code of motivation, saying that because his/her friend does not use technology while teaching, he/she needs to produce materials and he/she likes to produce materials. The opinions of this participant are given below as direct quotation.

"I use Geogebra in my lessons, but for example he/she (talking about his/her friend) produces a game with cards, he/she does something, for example he/she uses it. He/she needs to create something because he/she likes to have something like this because he/she thinks more traditionally. Therefore, he/she is more creative than me … He/she always wants to design something. He/she has cardboard in his/her hand constantly designing something." (T1)

While emphasizing motivation with the words of interest and desire, the participant whose opinions are given as direct quotation below, emphasized the sub-code of need with the expressions such as bothering about something and wanting to tell it to other people.

"They like it because of their interest and desire … For example, I am not a person who can create something out of the blue, let me speak for myself, but if I want to tell something to other people, this is because something bothers me. That is, I like or do not like something and I want to tell it to other people." (T6)

1.3.   Creative People

Three codes were created on the basis of the opinions expressed by the teachers under the theme of creative people. These are scientists, artists and people related to arts (Art) and others. The code of others consists of four sub-codes: acquaintances, students, children and leaders. While each of the sub-codes of scientists, children and leaders was mentioned by two teachers, each of the sub-codes of acquaintances and artists and people related to arts (Art) was mentioned by three teachers, and one teacher said that students could be creative. In addition, three teachers who gave artists or those who are interested in arts as examples of creative people stated that creativity is related to music, literature, painting and technology-design. The most mentioned branch of arts is painting. The participant, whose opinions are given as direct quotation below, emphasized that leaders like Atatürk and scientists like Edison can be creative people.

"I can say Edison, Atatürk. Scientists." (T3)

The following two participants (T5 and T7) emphasized concepts related to art such as painting, music, design and literature. In addition, artists such as painters and poets or teachers in a branch related to art were given as examples to creative people. The opinions of these participants are presented below as direct quotations.

"For example, painting especially seems very creative to me. Maybe because I don't have the talent, I don't know. In other words, everyone sees it, but he/she interprets it differently, draws differently, and something different comes out of his/her brush. I think painting involves a lot of creativity, writing a novel, that is, things related to art, seem very creative to me. They produce something and no one has produced it before … In other words, everyone sees the rose, but everyone's drawing and interpretation of roses is very different … For example, Atatürk has creative ideas, I find painters and poets creative." (T5)

"When I think of creativity, what always comes to my mind is students and Turkish teachers, or technology design teachers … In other words, Turkish teachers can write compositions and poems in different styles. They can make different comments. This is not something easy. I think this is also true for technology design, visual arts and music; in these fields, different products are designed." (T7)

In addition to the above findings, there were also participants who emphasized that children are creative.

"Children are very creative, especially in the preschool period." (T8)

"I find the world of children more creative." (T10)

1.4. Personality Characteristics

Under the theme of personality characteristics, there are codes that include expressions that contain more specific characteristics of people and that cannot be placed in any other theme. These codes are divided into seven sub-codes; talented, able to change facts, open to new ideas, solution-oriented, having confused minds, sensitive and having practical intelligence. While the sub-code of being talented was mentioned by three teachers and each of the other sub-codes was mentioned by one teacher. The participant, whose opinions are given as direct quotation below, emphasized the sub-code of having confused minds.

"People who are creative have also somewhat confused minds. I think this can be disadvantageous sometimes but it also makes them more productive. I also think that they make better use of the potential of their minds." (T4)

The participant, whose opinions are given as direct quotation below, referred to the code of being talented with the expression of an innate ability, while he/she referred to the code of being sensitive by stating that they are sensitive towards society.

"They have developed imagination and they are sensitive towards society. For example, sometimes we can feel some feelings and thoughts and that is all, but people with high artistic abilities can feel something and then depict is in a picture. That is, they can show what they feel. They can also make other people see what they feel. They are sensitive people … Maybe they have an innate talent, maybe they have developed their talent later by means of training … Sometimes I think it's inborn." (T6)

The participant, whose opinions are given as direct quotation below, referred to the sub-code of having practical intelligence through the expression of not going into much detail.

"I think they think without going into too much detail. In other words, it is more superficial, for example, children can produce very creative ideas; they are more bright-minded because they do not go into too much detail." (T8)

The participant, whose opinions are given as direct quotation below, referred to the sub-code of being talented with the expression of creativity coming from the nature and to the sub-code of being able to change the facts with the expression of not taking the facts as something impossible to change.

"There is a creativity that comes from the disposition of children … That is, they do not take facts as something immutable. They can shape them as they wish." (T10)

2. Mathematical Creativity

Under the heading of mathematical creativity, the opinions expressed by the participants in response to the questions "What is mathematical creativity? And what are the characteristics of creative people?" are grouped into two themes. The two themes, seven codes and eight sub-codes obtained under this heading and the participants who referred to these codes are shown in Table 3.

Table 3. Opinions of the Teachers on the Concept of Creativity

THEME	CODE		PARTICIPANT
Cognitive	Concepts coming from the general definition of creativity (Silver, 1997;Torrance, 1974)	*Originality*	*T1, T3, T4, T5, T6, T7, T9, T10*
		Flexibility and Fluency	*T2, T6, T8, T9, T10*
		Higher-Order Thinking (Ervynck, 2002)	*T1, T2, T3, T5, T6, T7, T10*

	Concepts coming from the definition of mathematical creativity	Associating (Ervynck,2002; Haylock,1987)	T1, T2, T4, T8, T10
		Different Representation	T5, T10
		Problem Posing (Silver, 1997)	T1, T2, T9, T10
		Problem Solving (Silver, 1997; Sriraman, 2005)	T1, T2, T3, T5, T6, T9, T10
		Discovering Mathematics (Sriraman, 2005)	T3, T4, T9
Affective	Interest		Ö6
	Self-confidence		Ö2, Ö4, Ö9
	Curiosity		Ö3, Ö7
	Need		Ö3, Ö4, Ö6, Ö7
	Risk Taking		Ö9

When Table 3 is examined, it is seen that the themes derived from the analysis of the data are cognitive and affective. From the answers given to the questions ""What is mathematical creativity? And what are the characteristics of creative people?", the themes of cognitive and affective were obtained. These themes and the codes within them are discussed in detail below.

2.1. Cognitive

This theme, which deals with mental processes in a mathematical sense, is divided into two codes: concepts coming from the general definition of creativity and concepts coming from the definition of mathematical creativity. Concepts that come from the general definition of creativity and that are also mentioned in the literature (Silver, 1997; Torrance, 1974) are gathered under two sub-codes called originality and flexibility. Concepts that come from the definition of mathematical creativity are gathered under six sub-codes called higher-order thinking, associating, different representation, problem posing and discovering mathematics. From among these, higher-order thinking (Ervynck, 2002), associating (Ervynck, 2002; Haylock, 1987), problem posing (Silver, 1997), problem solving (Silver, 1997; Sriraman, 2005) and discovering mathematics (Sriraman, 2005) are concepts found in the literature. All the teachers mentioned this theme while explaining their opinions.

2.1.1. Concepts That Come from the Definition of General Creativity

The concepts of originality, flexibility and fluency, which are mentioned in the definition of general creativity, can also be associated with mathematical creativity (Silver, 1997). None of the participants in this study mentioned the concept of fluency for mathematical creativity. Therefore, this code is divided into two as originality and flexibility. These sub-codes are explained in detail below.

2.1.1.1. Originality

Eight of the ten teachers referred to the originality sub-code by means of such expressions as generating a new idea, producing a new solution in a mathematical sense, thinking differently from a mathematical point of view, looking from a different perspective, producing unusual solutions, developing one's own strategy. As in the concept of creativity, it is one of the most mentioned sub-codes in mathematical creativity. The teachers generally focused on producing solutions that are different from others in their opinions. One of the participants whose opinions are quoted directly below wanted to mean original solutions, solutions different from others by means of the expression of creating one's own solution. This is explained with the concept of originality. Some of the teachers' opinions are presented below.

"It can be creating your own solution. I think that producing and developing your own strategy is creativity." (T1)

The participant, whose opinions are given below as direct quotation, emphasized originality by using the expression of unknown methods.

"If considered mathematically, it means solving a problem using unknown methods rather than familiar ways." (T3)

The participant, whose opinions are given as direct quotation below, referred to the concept of originality by using the expression of using one's own style.

"Students, for example, sometimes see things as some certain patterns when they look at any question, but sometimes some students come out and say, "Can we do this in that way?" So yes, I like it very much; he/she sees something different; she thinks very simply. For example, at that moment I have an equation in my mind, I don't know, there is a more classical solution, then he/she offers something very different, very sweet, small. In this sense, students also have mathematical creativity … For example, there might be three different ways of solving an problem and an ordinary student or any student can think of these three different ways to solve the problem, but a student who finds a different method and solves it in a unique way, with a unique pattern, with a unique material, is mathematically creative." (T5)

The teacher, whose opinions are given as direct quotation below, referred to creativity by means of the expressions such as a different solution, one's own method.

"For example, he/she accepts the methods given by the teacher, but he/she also wonders if there is a different method or what his/her method might be, he/she may also look for a different method." (T10)

2.1.1.2. Flexibility and Fluency

This concept was mentioned by five out of the ten teachers. Unlike the originality code, which includes the expression of producing a different solution, the flexibility code means that a student produces solutions different from each other. Some of the opinions are presented below.

All of the participants whose opinions are given as direct quotations below mentioned a student's producing different ways of solution; this expression can be associated with the concept of flexibility.

"In other words, it may be producing different solutions while solving problems." (T2)

"For a child who approaches a question not only through a memorized solution, but through multiple different solutions, I can say that his/her mathematical creativity is high." (T6)

"There is one solution to a mathematical problem, the child learns it, or for example, we explain how the operations of addition and subtraction can be done from the mind to students in the 5th grade; there are different methods of doing this. There is a method of separating into tens, ones. We teach several methods of doing this. The student accepts these but tries to find different alternative methods. This is creativity to me." (T10)

As can be understood from the above-given expressions of the teachers, the concept of fluency and flexibility in mathematical creativity is associated with producing different solutions.

2.1.2. Concepts That Come from the Definition of Mathematical Creativity

There are some concepts that come to the fore in creativity specific to the field of mathematics. These concepts are gathered under six sub-codes called higher-order thinking, associating, different representation, problem posing, problem solving and discovering mathematics. These sub-codes are explained in detail below.

2.1.2.1. Higher-Order Thinking

Expressions that refer to higher-order thinking skills such as critical thinking, questioning, analyzing, making inferences and reasoning are included under this code. Eight out of the ten teachers referred to the sub-code of higher-order thinking. This sub-code is one of the most mentioned sub-codes in the opinions on mathematical creativity, and it is mostly emphasized by means of the expression of questioning. Some opinions of the teachers are presented below.

The participant, whose opinions are given as direct quotation below, referred to higher-order thinking by means of the expressions of critical thinking and examining the reason without memorizing.

"They have high critical thinking … They do not rely on rote-learning in the lesson. For example, instead of memorizing what the teacher has told, he/she examines the reasons and consequences of it." (T3)

The participant, whose opinions are given below emphasized higher-order thinking by means of the expressions of internalizing the information instead of memorizing it.

"Instead of memorizing the given information completely and repeating it like a parrot, it is a bit like constructivism that he/she can absorb the given information and add something to it, constructs it." (T4)

The participant, whose opinions are given as direct quotation below, mentions that a creative child examines differences, asks different questions, all of which are indicators of higher-order thinking.

"Frankly, I think he/she is creative with his/her questions rather than presenting a product. It's not about solving problems rather about asking questions. For example, we are studying the subject of rational numbers. One of my students asks "How is this different from fractions?" After all, both are related to numerator and denominator. To me, this is creativity because one person out of 30-35 people asked this, the other 34 people didn't. Then I say that this student thinks creatively because if both of them were same, their names would also be same. So, they are different. This student analyses this difference. Accordingly, he/she thinks that rational numbers and fractions are different.

This is creativity in my opinion; it is not an absolute necessity to generate a product. He/she does not have the means to do this. The questions he/she asks show that he/she is creative." (T7)

2.1.2.2. Associating

The opinions of the teachers who mentioned associating mathematics with real life, associating mathematical ideas with each other and associating mathematics with different disciplines are gathered under this sub-code. Five out of the ten teachers stated that mathematical creativity is related to the ability to associate and the most frequently mentioned type of association is association with real life. Some opinions of the teachers are given below.

The participant, whose opinions are given as direct quotation below, talks about recognizing that there is mathematics in a real-life situation, in a game, that is, associating mathematics with real life. He/she also stated that establishing associations between mathematics subjects also requires creativity.

"Sometimes students say things and I realize that there is mathematics in them. Like, for me, it's like something that I thought never existed. Here can be mathematical creativity … For example, they have a card and they say something about the numbers on it and say that there is mathematics in here. Yes, it is indeed used, for example, you do not associate the game of taso with mathematics, you know, it has no conceptual relationship but yes there is mathematics there … Or if he/she associates what she finds with other subjects, this is also creativity." (T1)

The participant, whose opinions are given as direct quotation below, referred to the association with daily life by means of the expression of giving examples of rectangular-like objects around him/her and the association between the subjects by means of the expression of the student's being able to think about the pentagon when he/he has learned about the rectangle.

"Or, for example, I think the ones who can give examples of different shapes that look like rectangles or the different objects he/she can see around him/her while he/she is learning the subject of rectangle; this can be an example of creativity. Or the ones who can imagine polygons or hexagons and heptagons while I am teaching the subject of rectangle." (T2)

The participant, whose opinions are given as direct citation below, talked about associating mathematics with different disciplines under the concept of creativity.

" Or, as I said, bringing together different disciplines and mathematics, integration." (T4)

The participant, whose opinions are given as direct quotation below, stated that associating mathematics with daily life requires creativity.

"He/she can transfer mathematics to daily life, that is, if he/she can better understand fractions from the examples he/she sees, for example while he/she is cutting a cake, he/she can see the examples of fractions." (T8)

2.1.2.3. Different Representation

Expressions to explain mathematical concepts with pictures, manipulatives, symbols or verbally are included under this sub-code. Two out of the ten teachers mentioned the sub-code of different representation and these teachers also emphasized the symbolic or visual dimension of different representation.
The participant, whose opinions are given as direct quotation below, mentioned that it requires creativity to be able to show concepts with pictures or mathematical symbols.

"For example, there may be students who can paint them and put them on paper, even though I have not taught them. There may be children who can interpret the question, translate it into mathematical language, or show it in different representations. Or, for example, he/she is not satisfied when I teach something, so he/she needs to visualize it. These students can be considered to be creative." (T5)

2.1.2.4. Problem Posing

One of the most important components of mathematical creativity is problem posing. The expressions of the participants, who mentioned students creating their own questions and problems, are gathered under the sub-code of problem posing. Four out of the ten teachers mentioned this sub-code. Some of the teachers' opinions are given below. The participants, whose opinions are given as direct quotation, stated that writing questions or posing problems requires creativity.

"…Last week, I went to a course called question writing techniques. For example, I think creativity is needed there as well. You know, they expect us to write different questions. In fact, mathematical creativity can be something like that. Writing different questions. Yes, I think it's very difficult to write a mathematical question, and there is a need for creativity." (T1)

"For example, when we look at it in terms of problem posing, I think problem posing is a creativity in itself as It requires bringing out something different from the things given." (T9)

2.1.2.5. Problem Solving

Problem solving, which is one of the most frequently mentioned sub-codes by the teachers, has an important place in mathematical creativity. Expressions such as producing solutions to problems are gathered under this sub-code. Seven out of the ten teachers mentioned this sub-code.
The participants whose opinions are given below as direct quotations associated problem solving with creativity.

"That is, it may be producing different solutions while solving problems." (T2)

"When it comes to mathematical creativity, we can look at it from different perspectives. For example, if we look at it from the perspective of problem solving, we can say that mathematical creativity is high if he/she can come up with different solutions to that problem." (T9)

2.1.2.6. Discovering Mathematics

One of the most important findings of this study is that the teachers did not put much emphasis on the concept of discovering mathematics in the context of mathematical creativity. Only three of the ten teachers associated discovering knowledge and finding it by oneself by researching with the concept of mathematical creativity and emphasized discovering knowledge as mathematical creativity.

"He/she is not satisfied with what is said but discovers. The teacher has taught the subject to some extent. The ones who want to further discover the subject are creative." (T3)

"Discovering knowledge, for example, is something that increases creativity." (T9)

"Instead of memorizing the given information completely and repeating it like a parrot, it is a bit like constructivism that it can absorb the given information and add something to it, build it." (T4)

2.2. Affective

The opinions of the teachers who associated mathematical creativity with emotions and feelings are gathered under this theme. Six out of the ten teachers mentioned the theme of affective. The theme consists of five codes: self-confidence, curiosity, need, interest and risk taking. Three teachers mentioned the code of self-confidence, two mentioned the code of curiosity, one mentioned the code of interest, four mentioned the code of need and one teacher mentioned the code of risk taking. Some of the opinions are given below. The participant whose opinions are given below as direct quotations referred to the code of interest.

"For example, he/she can design an activity on his/her own; he/she has a high interest in mathematics. For example, he/she says "Look, I thought about this event, can I do something like that?"; thus, we can say that he/she has a high interest in mathematics." (T6)

The participant whose opinions are given as direct quotation below mentioned the code of self-confidence.

"I think creativity also requires self-confidence. You must be self-confident to come up with a creative idea. In particular, you need to be able to explain clearly what you think." (T2)

The participant whose opinions are given as direct quotation below referred to self-confidence and risk taking.

"… Students who can take risks. Apart from that, self-confident students, self-confident students are different … That is, those who can think differently and take risks." (T9)

3. Mathematically Creative People, Their Characteristics and Teacher Creativity

On the basis of the answers given to the questions "What is mathematical creativity?, Who are mathematically creative people and What are the characteristics of these people?", under the heading of "Mathematically Creative People, Their Characteristics and Teacher Creativity" three themes were obtained. The three themes, eighteen codes and the participants who mentioned these codes for the concepts of mathematically creative people, their characteristics and teacher creativity are shown in Table 4.

Table 4. Opinions of the Teachers about Mathematically Creative People, Their Characteristics and Teacher Creativity

THEME	CODE	PARTICIPANT
	Students	*T1, T4, T5, T6*
	Teachers	*T1, T3, T4, T5, T6, T7, T8*

Mathematically Creative People	Academicians	T4
	Researchers	T4
	Parents	T6
	Anyone	T6, T9
Their Characteristics	Mathematically talented students	T5, T7, T8, T10
	Foresighted	T10
	Solution-oriented	T10
	Extravert	T10
	Emotional thinking	T2
	Open to new ideas	T2
	Developing a method and activity to understand the subject	T3, T5, T6
	Thinking three-dimensionally	T5
Teacher Creativity	Teacher's writing different problems	T1, T7
	Teacher's thinking differently	T4, T5
	Creativity in teaching method	T3, T4, T5, T6, T7, T8
	Material design	T5, T7

When Table 4 is examined, it is seen that the themes derived from the analysis of the data are mathematically creative people, their characteristics and teacher creativity. The theme of teacher creativity was derived from the answers given to the question "What is mathematical creativity?". The theme of mathematically creative people was derived from the answers given to the question of "Who are mathematically creative people?" and the theme of their characteristics was derived from the answers given to the question of "What are the characteristics of these people?". These themes and related codes are given below.

3.1. Mathematically Creative People

According to the opinions received from the teachers, six codes were formed under this theme; students, teachers, academicians, parents, researchers and anyone. Each of the codes of academicians, researchers and parents was mentioned by one teacher.

"They can academicians at universities. Then, they can be teachers. Or they can be researchers or people studying mathematics; that is, they can be students." (T4)

The opinions of the participant coded as T4 correctly point to people having mathematical creativity. In order to be mathematically creative, an individual must be studying in the field of mathematics. Seven of the ten teachers stated that the mathematically creative person could be teachers, and four of them stated that they could be students. Therefore, it is seen that the participants associate teachers with mathematical creativity more than students. Two of the ten teachers said that anyone can be mathematically creative. The participant whose opinions are given below as direct quotation stated that parents, teachers, students and anyone could be mathematically creative.

"They can be parents too. That is, the parents who try to support the development of their children can be mathematically creative; therefore, not just teachers and students. In other words, I think that parents should also have strong mathematical creativity because it is not enough just to give birth to the child, but also to support him/her in every sense. This can be education or career in a profession. They need to instil that creativity in them at least until they reach a certain age. Instead of keeping the child in front of the television all the time, they will be able to teach him/her a different way of thinking. At least, they should be able to explain where some things come from and be able to answer the questions of a 3-year-old. That's why I think it should be a feature that belongs to anyone. At least to a certain extent." (T6)

3.2. Their Characteristics

The specific features that are distantly related to mathematical creativity are gathered under the theme of their characteristics. This theme mentioned by seven teachers consists of eight codes: mathematically talented students, foresighted, solution-oriented, extrovert, emotional thinking, open to new ideas, developing a method or activity to understand the subject and thinking three-dimensionally. Four teachers referred to the code of talented students and three teachers referred to the code of a method or activity to understand the subject. Each of the other codes was mentioned by one teacher. Therefore, it is seen that the most emphasized characteristic in this theme is talent. Some opinions of the teachers are presented below. The participant whose opinions are given as direct quotation below mentioned the codes of emotional thinking and open to new ideas.

"I think there may be people who think emotionally, so since mathematics requires a very abstract thinking, one must actually be a little emotional and open to ideas in order for creativity to be involved." (T2)

The participant whose opinions are given as direct quotation below mentioned the code of developing a method or activity to understand the subject.

"Develops a method in order to understand the subject" (T3)

The participant whose opinions are given as direct quotation below referred to the codes of mathematically talented students and three-dimensional thinking.

"First of all, these children are talented on numbers, so I think that their mathematical intelligence is high. When they look at the question, for example, most students think about what I teach, while those children think differently, or while I teach the first way, for example, they say the second way, while I'm about to teach it. Or what else can it be … There might be students thinking three-dimensionally, there may be students who can look from many other different perspectives. Sometimes students think in a much more sophisticated way than their peers, they may be these students. In other words, they can look at the subject from a different point of view." (T5)

The participant whose opinions are given as direct quotation below mentioned the code of mathematically talented students.

"Genetic background is very important in mathematics. I have seen over time that if the child does not have a genetic background, it is difficult to achieve results no matter how hard he/she works. So there may be some genetic background and family support since childhood." (T8)

The participant whose opinions are given as direct quotation below referred to the codes of mathematically talented students, foresighted, solution-oriented and extrovert.

"His/her mathematical intelligence is high; his/her perception is clear. He/she is foresighted. He/she can solve problems in future life, solve them easily, has extravert personality." (T10)

3.3. Teacher Creativity

When the opinions of the teachers are examined, it is seen that most of them associated the concept of mathematical creativity with the teachers' use of creative methods in their lessons. Seven out of the ten teachers mentioned this theme. This theme consists of four codes: creativity in teaching method, material design, teacher's writing different problems and teacher's thinking differently. While six teachers mentioned the code of creativity in teaching method, each of the other codes was mentioned by two teachers. Some of these opinions are presented below.The participant whose opinions are given below as direct quotation referred to the code of creativity in teaching method by means of the expression of creating a participatory method.

"Creating a method suitable for children's thoughts by seeing their thoughts and characteristics, creating methods suitable for them to participate and planning the lesson accordingly." (T3)

"Producing mathematical stories that will solve the misconceptions in mathematics … While applying differentiated education practices during the lesson, or constructivist education, learning by doing, there might be variation in the practices in the process …" (T4)

The participant whose opinions are given as direct quotation below related mathematical creativity to the creativity of the teacher and mentioned all the codes of creativity in teaching method, material design and teacher's thinking differently.

"Mathematical creativity, in my opinion, is; we are all teachers, we all teach about the same topics but everyone has a different way of teaching. For example, adding something from yourself, creativity, for example using materials. Yes, there are some materials, these are fraction bars, ten blocks, these are the blocks we use in patterns, yes, these are the materials we all use, but if a math teacher can design something himself/herself, for example, if he/she can design materials, or look from different perspectives, I think he/she has creativity on that subject. That's mathematical creativity for me. That is, if he/she can look at the questions from a different point of view, yes, it may be to be able to look at the questions from a different perspective. It can be producing different materials." (T5)

DISCUSSION and RESULTS

This study was conducted to examine the opinions of the teachers who received high scores from the Creativity Fostering Teacher Behaviour Index on creativity, mathematical creativity and fostering mathematical creativity. In this regard, using the findings obtained from the data analysis, discussions and results supported by the literature are presented.

First, the teachers' opinions on creativity were examined, and as a result of the examinations, four themes were obtained: cognitive, affective, creative people and personality characteristics. When the teachers were asked about the concept of creativity, it was seen that the most focused feature was the code of originality (ten teachers) under the theme of cognitive. The teachers emphasized the originality dimension of creativity by using expressions such as thinking and doing unique, original, unusual, different, new things. This finding of the current study concurs with the literature (Akcanca and Cerrah-Özsevgeç, 2016; Aljughaıman and Mowrer-Reynolds, 2005; Ersükmen, 2010; Panaoura and Panaoura, 2014). Panaoura and Panaoura (2014) asked pre-service teachers about the concept of creativity and they concluded that eight out of ten pre-service teachers associated creativity with originality. In the current study, it was seen that while teachers mentioned the flexibility (three teachers) and fluency (four teachers) components of creativity within the concept of general creativity, they did not emphasize these

components as much as originality. The reason why flexibility and fluency were not mentioned as much as originality is Leikin's (2009) claim that the concept of originality has a cultural acceptance. Here, it can be said that teachers focus on original solutions in the concept of creativity, and that they are far from concepts such as productive (fluent) and flexible thinking.

In the findings related to cultural concepts in the theme of cognitive, it was seen that teachers (seven teachers) associated creativity with other thinking skills. Thinking skills that the teachers associated creativity with are critical thinking, questioning, analyzing and multidimensional thinking. This finding is consistent with the results of Demir and Açıkgül (2021). In the study conducted by Biber (2006), the teachers stated that one of the characteristics of creative students is questioning, which is similar to the current study. Sheffield (1994) expressed creativity as the ability to observe events quickly, to grasp the cause-effect relationship and to question. Similar to Sheffield (1994), Altın and Saracaloğlu (2018) stated that there is a similarity between creativity and critical thinking in terms of being multi-dimensional. Accordingly, the opinions expressed by the teachers in this study concur with the literature. In addition, some teachers (two teachers) described creativity as imagining. In addition, as can be seen from the findings, there emerged no conceptual consensus on creative people and the personality characteristics of creative people and it was revealed that teachers had different subjective opinions.

Two headings were derived from the opinions expressed by the teachers on mathematical creativity: mathematical creativity and mathematically creative people, their characteristics and teacher creativity. Under these headings, the themes of cognitive, affective, mathematically creative people, teacher creativity and personality characteristics were formed. In the theme of cognitive, as in the theme of general creativity, the most emphasized code was originality (eight teachers). The teachers mentioned the originality dimension of creativity by using expressions such as producing an unusual, different, new solution, and developing one's own strategy. In previous studies that conducted interviews on mathematical creativity, participants expressed opinions similar to the ones expressed in the current study (Demir and Açıkgül, 2021; Dündar, 2015; Leikin, Subotnik, Pitta-Pantazi, Singer and Pelczer, 2013). In the current study, some teachers (five teachers) emphasized the flexibility and fluency component of mathematical creativity by using expressions such as producing different solutions, thinking about different things. However, considering the fact that these teachers are teachers with higher scores from the Creativity Fostering Teacher Behaviour Index, it can be said that the rate of 50% is below the expected value. However, the fluency and flexibility component means generating a lot of ideas, productivity and has a place in mathematical creativity (Silver, 1997). It can be considered as an important finding that the teachers mentioned the idea of producing too many and too few ideas because although the teachers' emphasis on originality is important for the concept of creativity, mathematical creativity requires mental capacity, flexibility and competence to produce many solutions as much as it requires producing original solutions. In this respect, the fact that teachers are conceptually far from these important sub-components of creativity suggests that supporting these sub-skills may be overlooked.

The other code that many (seven) of the teachers referred to is higher-order thinking, which includes expressions such as questioning, reasoning and analysis. In this regard, the opinions elicited in the current study concur with opinions and definitions encountered in the literature (Cansız-Aktaş, 2016; Demir and Açıkgül, 2021; Dündar, 2015; Ervynck, 1991; Mann, 2006). Moreover, some of the teachers (five teachers) associated mathematical creativity with establishing connections among the subjects of mathematics and with different disciplines. Similarly, it is seen in the literature that mathematical creativity is defined as being able to establish connections with other disciplines, create mathematical relationships and connect ideas (Haylock, 1997). The fact that only half of the teachers referred to this concept may enable us to conclude that teachers do not put much emphasis on the ability to associate as an important component.

Other concepts that the teachers associated with mathematical creativity are problem solving (seven teachers), problem posing (four teachers) and they especially emphasized that the solutions to problems should be unique and different. Mathematical creativity has been associated with problem solving (Leikin et al., 2013) and problem posing (Shriki, 2010) in many studies, as in the current study. Problem posing skill is as important as problem solving skill and supporting the development of these skills is very important for mathematical creativity. However, while most of the teachers (seven) emphasized problem solving skill, only a few (four teachers) mentioned problem posing skill. It is a remarkable finding that the majority of the teachers did not mention problem posing skill while talking about the concept of creativity.

In addition, mathematics is a science of discovery. Mathematicians enable science to progress by discovering different problems and theories in the mathematical space. At the same time, students learn mathematics by combining and discovering the links between different pieces of mathematical knowledge at the K-12 level. However, in the current study, only three teachers emphasized the conceptual link between mathematical creativity and discovering mathematics. It is a remarkable finding that the teachers of the Ministry of National Education, where the constructivist approach has been applied within the framework of the curriculum, did not emphasize this concept. This finding gives rise to the idea that there is a gap in the opinions of teachers on the concept of mathematical creativity.

Another remarkable finding of the current study is related to teacher creativity. When the participants were asked what mathematical creativity is, it was seen that most of them (seven teachers) associated this concept with a creative teacher. Teachers' using creative teaching methods (six teachers), designing materials (two teachers), writing questions (two teachers) and thinking differently (two teachers) were perceived as mathematical creativity. Similar opinions have been seen in the literature but not under the concept of creativity rather under the concept of creative teacher. Seen from this perspective, it can be argued that the teachers in other studies in the literature think of their own creativity as mathematical creativity; thus, they have partially distanced themselves from the concept and attributed a different meaning to the concept.

As a result, in the interviews conducted with the teachers who scored above the average in the Creativity Fostering Teacher Behaviour Index, it was seen that even if the teachers did not take a course on mathematical creativity, they had some opinions on creativity and mathematical

creativity and these opinions concur with the relevant literature. In particular, originality emphasized for creativity, problem solving emphasized for mathematical creativity and originality and higher-order thinking are the concepts that have been widely mentioned by many researchers in the literature. Therefore, the opinions of the interviewed mathematics teachers are valid expressions for mathematical creativity. However, the fact that many of the teachers did not mention concepts such as discovering mathematics, making connections within mathematics itself and posing mathematical problems which are indispensible part of the concept of mathematical creativity shows that teachers have conceptual gaps. It is one of the remarkable findings of this study that the teachers who scored well above the average in a scale measuring teachers' ability to foster creativity in the classroom did not mention these important concepts. Future research on how teachers can foster mathematical creativity can answer the questions raised by the findings of the current study. Research to be conducted on how and to what extent the teachers who can express mathematical creativity well can foster mathematical creativity in the classroom can help fill the void in the literature.

The current study was conducted to draw conclusions about teachers' opinions on mathematical creativity and supporting mathematical creativity via interviews. In order to collect more detailed data for future research, it may be suggested to make classroom observations on how teachers support mathematical creativity in the classroom. In addition, the main purpose of this research is to examine teachers' views on supporting mathematical creativity. However, in the research, it was understood from the teachers' views that there are barriers to supporting mathematical creativity. Therefore, it may be recommended to conduct more detailed interviews in order to examine the barriers to mathematical creativity for future research. Finally, in this study, it was noticed that teachers had gaps in mathematical creativity. For this reason, it is recommended to organize in-service trainings in order to eliminate these deficiencies.
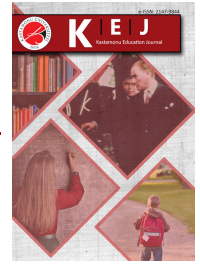
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| Research Article / Araştırma Makalesi|

The Investigation of The Differential Item Functions of The 2012 High School Entrance Exam Mathematics Test Based On The G-DINA Model

2012 SBS Matematik Alt Testinin G-DINA Modeli Kullanılarak Model Parametrelerinin ve Değişen Madde Fonksiyonlarının İncelenmesi

Sinem ŞENFERAH[1], **Mahmut Sami KOYUNCU**[2]

Abstract

Purpose: This study aims to determine the item parameters and estimations of student attribute profiles related to the 2012 8th Grade HSEE Mathematics subtest item responses using the G-DINA model and examine whether the items show DIF according to the gender variable.

Design/Methodology/Approach: The study was conducted on the data of 1.063.570 students who took the 2012 HSEE Mathematics subtest. The analysis was carried out on the target population data to avoid sampling error. This study is a descriptive, survey type study.

Findings: When the model fit indices and comparison results were examined, it was concluded that the model that best explained the behavior of students responding to the items in the 20-item form of the 2012 HSEE Mathematics subtest was G-DINA. When the G-DINA model parameters were examined, it was found that the $\alpha_1 = [0000]$ attribute profile (with 61%) in which none of the four defined attributes were found in the student, and the $\alpha_{16} = [1111]$ attribute profile (with 17%) in which all four attributes were present in the student (17%) were the most common attribute profiles. As a result of DIF analysis within the scope of CDM, and it was identified that item 4 showed a significant uniform DIF in favor of female students while item 19 showed a uniform DIF in favor of male students at moderate level.

Highlights: It is thought that DIF analyses within the framework of cognitive diagnostic models can provide a statistical basis for item bias decisions.

Öz

Çalışmanın amacı: G-DINA model kullanarak 2012 SBS 8. Sınıf Matematik alt testi madde cevaplarına ilişkin madde parametreleri ve öğrenci nitelik profili kestirimlerinin belirlenmesini ve maddelerin cinsiyet değişkenine göre DMF gösterip göstermediğinin incelenmesidir.

Materyal ve Yöntem: Çalışma, 2012 yılı SBS Matematik alt testini alan 1.063.570 öğrenci verisi üzerinde yürütülmüştür. Analizler, örnekleme hatasının önüne geçmek amacıyla evren verisi üzerinde gerçekleştirilmiştir. Betimsel düzeyde, tarama türünde bir araştırmadır.

Bulgular: Model uyumu indeksleri ve karşılaştırma sonuçları incelendiğinde, öğrencilerin 2012 SBS Matematik alt testinin 20 maddelik formunda yer alan maddelere cevap verme davranışlarını en iyi açıklayan modelin GDINA olduğu sonucuna ulaşılmıştır. GDINA model parametreleri incelendiğinde, tanımlanan dört nitelikten hiçbirinin öğrencide bulunmadığı $\alpha_1 = [0000]$ nitelik profili (%61) ile dört niteliğin de öğrencide bulunduğu $\alpha_{16} = [1111]$ nitelik profilinin (%17) en çok rastlanan nitelik profili olduğu belirlenmiştir. BTM kapsamında DMF analizleri sonucunda, 4. maddenin önemli düzeyde kız öğrenciler lehine tek biçimli DMF gösterdiği; 19. maddenin ise orta düzeyde erkek öğrenciler lehine tek biçimli DMF gösterdiği bulunmuştur.

Önemli Vurgular: Bilişsel tanı modelleri çerçevesinde DMF analizleri ile madde yanlılığı kararlarına istatistiksel bir zemin oluşturulabileceği düşünülmektedir.

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INTRODUCTION

Central examinations conducted by the Ministry of National Education (MoNE) are decisive in the secondary education placement process in Türkiye. In our country, the secondary education placement exams held at the national level by the MoNE have differed in terms of method and content in various periods. Student selection and placement was carried out centrally, sometimes by applying a single exam and sometimes more than one exam. Although it was expressed with different names (OKS, SBS, TEOG, LGS, and so on.) in different periods, the common purpose of the exams is to select and place students for high schools. In our country, the exam conducted by MoNE between 2007-2013 to place students in secondary education is the High School Entrance Exam (HSEE). Ensuring the validity of large-scale exams such as HSEE, which had special purposes such as selection and placement, and whose results could directly affect the lives of students, accordingly, was of great importance in terms of the accuracy of the decisions taken.

Determining whether the test items in the exams provide an advantage to any of the subgroups due to the characteristics of the test taker groups that are not related to the measured attribute by differential item function (DIF) analysis is of great significance as evidence of the validity of the test scores and the decisions taken accordingly. DIF analysis, which has become a part of item analysis in recent years, is routinely performed to ensure the validity and fairness of test scores. Although many DIF methods have been developed within the scope of Classical Test Theory (CTT) and Item Response Theory (IRT), the applications of these methods in cognitive diagnosis models (CDM) are quite limited.

Cognitive diagnosis models are latent classroom models developed to assess whether students have interrelated but distinguishable latent attributes (de la Torre, 2011; Hou et al., 2014; Haagenars & McCutcheon, 2002). The fact that cognitive diagnosis models are more related to classroom teaching and learning processes and that they provide more diagnostic information have caused them to be considered more as a psychometric research topic (Rupp & Templin, 2008; de la Torre, 2011; de la Torre & Douglas, 2004; Embretson, 1997; Junker & Sijtsma, 2001; Tatsuoka, 1985). Cognitive diagnostic models have been developed as an alternative to one-dimensional item response models to determine whether the respondent has the multi-component skills required to answer test items correctly (de la Torre, 2009).

IRT models only provide a single score that assesses the overall ability level of the respondent. However, the CDM analysis provides a profile that shows what attributes, skills, or knowledge each respondent has. These profiles contain important information that can have an impact on learning and teaching. Instead of just giving a total score, CDM shows the attributes, strengths, and weaknesses of individuals and the reasons for failure in detail. This provides valuable guidance for better guiding learning processes and improving instructional design. Traditional IRT methods examine whether the probability of answering the item correctly differs between respondents in different subgroups who are at the same ability level or get the same total score (Hambleton et al., 1991; Zumbo, 1999). DIF within the scope of CDM, on the other hand, evaluates the differentiation of the probability of answering the item correctly among respondents who are in different groups and have the same latent attribute profile. DIF assessments under CDM provide evidence of the invariance of the item-attribute interaction between groups (Hou et al., 2014). According to Hou et al. (2014), the presence of items with DIF in terms of CDM may lead to item parameters and latent trait profile estimations that are not valid for each group. Therefore, DIF analyzes are necessary to determine parameter and structure invariance (Zumbo, 2007). Since item parameters represent interactions between attributes and items, DIF analysis sheds light on whether the attribute-item interaction is invariant between comparison groups. Group membership, which can affect how items are perceived and resolved, may act as a variable leading to DIF. For this reason, controlling the invariance between groups with DIF analysis is considered as the necessary first step of CDM applications (Hou et al., 2014).

In the context of CDM, DIF can be represented by $\Delta_{j\alpha_l} = P(X_j = 1|\alpha_l)_F - P(X_j = 1|\alpha_l)_R$. Here $\Delta_{j\alpha_l}$ indicates item j. in DIF for respondents with latent attribute profile; α_l the probability of success in the item j. for respondents with latent attribute profile. A value of $\Delta_{j\alpha_l} > 0$ indicates that the item shows DIF in favor of the focus group, while a value of $\Delta_{j\alpha_l} < 0$ indicates that the item shows DIF in favor of the reference group. The fact that $\Delta_{j\alpha_l} = 0$ for all attribute profiles is interpreted as the case where the item does not show DIF.

Similar to DIF under IRT, uniform and non-uniform DIF can be identified in cognitive diagnostic models. Regardless of the latent attribute profile, if the probability of answering an item correctly is consistently higher or lower for a group, in other words, if $\Delta_{j\alpha_l}$ is either positive or negative in all latent attribute profiles, the item shows uniform DIF. While the probability of answering the item correctly is lower in some latent trait profiles for a group, and while it is higher in some other latent profiles for the same group, non-uniform DIF is the case there. Namely, in non-uniform DIF, the sign of $\Delta_{j\alpha_l}$ changes depending on the latent attribute profiles (Hou et al., 2014).

In the current study, the aim is to determine whether the 2012 HSEE 8th Grade Mathematics subtest items based on the G-DINA model, which is one of the cognitive diagnosis models, show DIF according to the gender variable, and to identify the model parameters and student qualification attributes. It is thought that this study will contribute to the relevant literature due to the limited number of studies in which DIF studies are handled within the scope of CDM (Milewski & Baron, 2002; Zhang, 2006; Li, 2008; Hou et al., 2014; Li & Wang, 2015). When the relevant literature is analyzed, it is seen that studies using cognitive diagnosis models are generally carried out on simulation data (de la Torre & Douglas, 2004; Zhang, 2006; Hou et al., 2014; Li & Wang, 2015; Ömür Sünbül & Kan, 2015). In the current study, it is thought that large-scale HSEE real data at the national level will make important contributions to the field in terms of seeing how the G-DINA model will produce results, providing empirical information about learning and teaching processes, and providing evidence for the validity of test scores.

METHOD/MATERIALS

Research Design

This study is a descriptive, survey type study as it aims to determine whether the 2012 HSEE 8th Grade Mathematics subtest items show DIF according to the gender variable, and to estimate model parameters and student attribute profiles using the G-DINA model. The purpose of survey research is generally to make a description by taking a picture of an existing situation related to the research topic (Büyüköztürk et al., 2014). Survey studies are studies conducted on larger samples compared to other studies in which certain characteristics of a group (e.g., ability, attitude, belief, and knowledge) are described (Fraenkel & Wallen, 2012).

Population

The population of the study consists of 1.075.546 students who participated in the 8th Grade High School Entrance Exam in 2012. The study was carried out on the data of a total of 1.063.570 students, excluding the students whose gender information in the 2012 HSEE Mathematics subtest could not be accessed from the analysis. The students that were removed from the data set constituted approximately 1% of the data set. The analysis was carried out on the whole target population data to avoid sampling error. The distribution of students by gender for the mathematics subtest is provided in Table 1.

Table 1. The Distribution of the students according to gender

Gender	N	%
Female	523.939	50,7
Male	539.631	49,3
Total	1.063.570	100

When Table 1 is examined, it is seen that 523.939 (50,7%) of them are females and 539.631 (49,3%) of them are males.

Data Collection

Depending on the purpose of the study, the data collection process includes obtaining the item response data for the Transition to Secondary Education System (which is done via HSEE) 2012 8th Grade Mathematics subtest and creating the Q-matrix that defines the relationships between the items and the attributes. The data of the 8th grade mathematics subtest of the HSEE held in 2012 were provided by the Ministry of National Education, General Directorate of Assessment and Examination Services. As for the Q matrix, it was determined through the focus group discussion with the participation of 7 field experts.

According to the guide of the Transition to Secondary Education System (TSES) Placement test, 20 multiple choice mathematics questions with 4 options were directed to the students in the 8th grade. The descriptive statistics regarding the mathematics subtest used in the study were provided in Table 2.

Table 2. The descriptive statistics of the mathematics subtest

Statistics	Mathematics Subtest
Number of Item	20
Number of Students	1.063.570
Min. Score	0
Max. Score	20
Mean	7.17
Variance	22.60
Standard Deviation	4.75
Skewness	0.94
Kurtosis	0.07
KR-20	0.86
Standard Error of Measurement	1.79
Mean Difficulty ($\bar{p}$)	0.36
Mean Discrimination (r_{pb})	0.51

When Table 2 is examined, it is seen that the reliability coefficient (KR-20) for the mathematics subtest is 0.86. That the reliability coefficient calculated is higher than 0.70 in terms of internal consistency is generally considered sufficient for the reliability of the test scores (Büyüköztürk, 2012). In addition, a mean difficulty value of ($\overline{P}$) 0.36 indicates that the students who took the test answered 7.17 of 20 items on average in the test, and that skewness and kurtosis coefficients are positive indicates that the score distributions of the mathematics subtest are skewed to the right, which means that there is an accumulation in low scores.

The Formation of the Q-matrix

The quality of diagnostic evaluations is influenced by the correct identification of the attributes underlying test performance. It is stated that various sources such as test guides, learning domain theories, item content analysis, analysis of the respondent's test process, and related research results in the literature can be utilized to determine the attributes covered in a test (Embretson, 1991; Leighton & Gierl, 2007). Lee and Sawaki (2009a), on the other hand, stated that when cognitive models of task performance are not available and cognitive diagnostic models are used for non-diagnostic tests, it is a good starting point to brainstorm about possible attributes by examining the test content in detail. Accordingly, in this study considering that the HSEE, which is used for selection and placement purposes, was not developed for diagnostic purposes, the study aimed to determine the possible attributes to be measured with the HSEE mathematics subtest through focus group interviews.

The focus group discussion process, which was carried out to determine the Q-matrix that defines the relationships between items and attributes and shows whether a feature is necessary for an item, was completed in 4 stages. In the focus group interview, firstly, the possible attributes to be measured with the mathematics subtest and the gains associated with the items were examined and the boundaries, main topics and interview questions of the focus group interview were determined. In the second stage, the field experts who were going to participate in the research were identified and invited to the interview. In the third stage, the place and time for the focus group meeting were arranged, the necessary arrangements were made, and the interview was held. As for the last stage, the short notes taken during the interview were analyzed and the results were summarized.

A principle and 7 field experts participated in the focus group meeting held to determine the attributes required for answering the items correctly. Although there are different opinions about how many people the group size should consist of in focus group interviews, ideally 6-8 people are considered sufficient (Yıldırım & Şimşek, 2011). Since the identification of the attributes required for answering the items correctly and the definition of the relationships between the items and the attributes require expertise and experience both in the fields of mathematics education and measurement and evaluation, it was ensured that all experts graduated from mathematics education and held at least a master's degree in mathematics education or measurement and evaluation fields. Detailed information on the training areas of the experts participating in the focus group interview is given in Table 3.

Table 3. The distribution of the experts that took part in the focus group meeting

Educational Background	Total Number	In Total (%)
A teacher at MoNE		
➤ Ph.D. student in Mathematics Education	1	12,5
A research assistant	7	87,5
➤ Ph.D. student in Mathematics Education and MA student in Assessment	1	12,5
➤ MA degree from Primary School Mathematics Education and Ph.D. student in Assessment	2	25
➤ Ph.D. student in Assessment	3	37,5
Ph.D. student in assessment (a principle)	1	12,5
Total	8	100

In the focus group discussion, the aim was to create an environment where the participants could hear the opinions of others and think about their own opinions accordingly. In line with this, the environment was prepared in a round seating arrangement so that the experts could see each other. Care was taken to ensure that the environment was noise-free, and that the conversation was not interrupted. At the beginning of the focus group discussion, an explanation was made to the experts regarding the purpose and scope of the study, and a form containing the mathematics items that were the subject of the research and the pedagogic gains thought to be related to these items was distributed. In addition to this form, the classification of learning domain and cognitive skills covered within the scope of TIMSS 2015 8th Grade Mathematics Framework (Gronmo et al., 2014) was also utilized to examine the item contents, relevant learning areas, and the attributes to be measured with a specific item.

In the focus group interview, the acquisition related to the mathematics subtest items were evaluated in terms of the learning areas included in the Mathematics Lesson (the 6-8th Grades), the Curriculum, and TIMSS 2015 8th Grade Mathematics Framework. Additionally, the cognitive skills to be measured with items were investigated under the classifications of "knowing", "practicing" and "reasoning" determined within the scope of TIMSS 2015 8th Grade Mathematics Framework. However, that the strategies used in item solution could not be identified due to the multiple-choice nature of the test items prevented unearthing the relationship between the item and cognitive attributes to be made with full accuracy. Lee and Sawaki (2009a) emphasize that the

features defined in more detail in the Q matrix will provide richer diagnostic information and thus increase the instructional value of the diagnosis, but this will generally produce unreliable and inconsistent results in classifying respondents. Consequently, in the current study evaluating the attributes required for the correct answer of the items within the scope of learning areas was decided as the goal. Accordingly, in the Q-matrix, the relationship of the items with 4 attributes, namely "Numbers", "Geometry and Measurement ", "Algebra", and "Probability and Statistics" were defined. As a result of the focus group discussion, the Q-matrix provided in Table 4, which defines the relationships between the items and the attributes, was created.

Table 4. The Q-matrix

Item	Numbers	Geometry and Measurement	Algebra	Probability and Statistics
1	1	0	0	0
2	1	0	0	0
3	1	0	0	0
4	0	1	0	0
5	0	1	1	0
6	0	1	0	0
7	0	1	0	0
8	1	0	1	0
9	0	1	0	0
10	1	0	0	0
11	0	1	0	0
12	0	1	0	0
13	0	1	0	0
14	0	1	0	0
15	0	0	0	1
16	1	0	0	1
17	0	0	0	1
18	0	1	0	0
19	1	0	1	0
20	0	0	1	0
Total	7	10	4	3

When Table 4 is analyzed, it is observed that the Q-matrix consists of 1 entries that show that the relevant attribute is necessary for the item and 0 entries that show that relevant attribute is unnecessary for the item. Hartz et al. (2002) suggest that at least 3 items must be present for an attribute to obtain reliable diagnostic information. According to the created Q-matrix, it was determined that the attributes in the test were measured with at least 3 (Probability and Statistics) and at most 10 items (Geometry and Measurement).

Data Analysis

This study basically serves two purposes; The first one is to determine the model parameters and latent attribute profiles for the mathematics subtest via the G-DINA model, and the second is to examine whether the mathematics items show DIF by gender using the G-DINA model. In line with these purposes, based on the Q-matrix that defines the relationships between the "Numbers", "Geometry and Measurement", "Algebra", and "Probability and Statistics" attributes and the items, whether the probability of answering the items correctly differs between both the model parameters and the students with the same latent attribute profile was analyzed.

As with other statistical models, the significance and interpretability of the results obtained from cognitive diagnostic models depend on the extent to which model data fit is achieved. Model fit can be determined in two ways, in which the fit of the model to the data is checked (absolute fit) and the model is compared with other models (relative fit). In this study, both absolute fit indices (Mx2, MADcor, MADRESIDCOV, MADQ3, and SMRSR) and also relative fit indices (Loglik, AIC, and BIC) were examined in order to test the overall model fit.

Mx2 (Chen & Thissen, 1997), a global model fit test from absolute fit indices, is the average of χ^2 test statistics regarding the independence of item response frequencies across all item pairs. Mx2 represents the mean of the difference between the observed and predicted response frequencies by the model. Ravand (2016) stated that significant differences can be taken as evidence of inter-item dependence and that dependence is expected because respondents use the same cognitive processes to answer the items. If the cognitive diagnosis model fits the data well, the χ^2 test statistics is expected to be 0. In this case, the attribute profiles of the respondents, that is, each latent class, will be perfectly predicted from the observed response pattern (Rupp et al., 2010). MADcor (DiBello et al., 2007) is the average of the absolute differences between observed and predicted item pair correlations. The "mean residual covariance (MADRESIDCOV)" (McDonald & Mok, 1995) is the mean of the absolute

differences between the observed and reproduced item covariance matrices. The MADQ3 (Yen, 1984) is the average of the absolute values of the Q3 statistics describing the binary correlations for item residuals. The average of the RMSEA values at the item level compares the rates observed and predicted by the model for each response category weighted with the ratio of respondents in latent classes (Lei & Li, 2016). Classification consistency (Pc) and classification accuracy (Pa) express reliability and validity regarding classifying respondents into implicit classes. While Pc is the indicator of the extent to which respondents will be consistently classified into the same latent class when the same test or a parallel form of the test is applied, Pa is an indicator of how well the respondent's classification matches the correct latent class (Ravand, 2016).

In the study, within the scope of the G-DINA model, whether the 2012 HSEE Mathematics subtest items displayed item function variation according to gender was investigated via the Wald test (de la Torre, 2011; Hou et al., 2014). On the other hand, it is stated that Wald statistics (de la Torre & Lee, 2013) significantly determines even negligible DIF effects in large samples (George & Robitzsch, 2014). Hence, the unsigned area measurement based on the unmarked area (UA) originally introduced by Raju (1990) is presented as the DIF effect size. In the literature, it is seen that the effect size classification criteria set forth by Jodoin and Gierl (2001) are used for UA (George & Robitzsch, 2014; Ravand & Robitzsch, 2015). Jodoin and Gierl suggested a critical value of .059 for negligible DIF sizes and .088 to determine medium DIF sizes within the scope of three-parameter IRT models.

Data analysis was performed using the RStudio program "CDM" package version 4.99-11 (Robitzsch et al., 2016). The "CDM" package uses the marginal maximum likelihood method based on the EM (Expectation-Maximization) algorithm to obtain parameter estimations.

FINDINGS

The G-DINA Model Fit of 2012 HSEE Mathematics Test Data

The statistics of the G-DINA model fit of the 2012 HSEE Mathematics Test were provided in Table 5 and the values of classification consistency (P_c) and its accuracy (P_a) are presented in Table 6.

Table 5. The statistics of the G-DINA model fit of 2012 HSEE mathematics test

Model fit indices		p
Mx2	22603.7	0
MADcor	0.045	-
MADRESIDCOV	0.009	-
MADQ3	0.032	-
RMSEA	0.045	-
SRMSR	0.057	-

When Table 5 is examined, it is seen that the Mx2 statistic is significant (p < 0). Although the Mx2 statistic as an indicator of fit is not expected to be significant, it is sensitive to even minor model data mismatches. For this reason, it often yields results that indicate the lack of harmony. Consequently, it was stated that SRMSR (the Standardized Root Mean Squared Residual) values should also be reported for the Mx2 statistics. A SRMSR value close to zero indicates better model-data fit (De Ayala, 2009; Maydeu-Olivares & Joe, 2005, 2006; Maydeu-Olivares et al., 2011; Maydeu-Olivares & Joe, 2014). Maydeu-Olivares (2013) states that the SRMSR value should be less than 0.05 for the model to fit well. The fact that the obtained SRMSR value is very close to 0.05 indicates that the G-DINA model fits at a good level. MADcor was found to be 0.045 in the study. In their study, DiBello et al. (2007) considered the MADcor value of 0.049 as the indication of the fact that the cognitive diagnosis model fits well with the data. As seen in Table 5, MADRESIDCOV, MADQ3, and RMSEA values were found to be less than 0.05. Ravand (2016) evaluated MADRESIDCOV, MADQ3, and RMSEA values less than 0.05 as a good model fit. In this respect, it may be suggested that the G-DINA model used in the study fits well with the HSEE 2012 Mathematics subtest data.

Table 6. Classification Consistency (P_c) and Accuracy (P_a) for G-DINA Model

	Classification Consistency (P_c)	Classification Accuracy (P_a)
Atribute1	.94	.97
Atribute2	.99	.99
Atribute3	.57	.69
Atribute4	.72	.83
Pattern	.92	.89

When Table 6 is examined, it is seen that the P_a and P_c values for the whole latent class pattern in the study are .89 and .92, respectively. P_c and P_a values give the measure of classification consistency and accuracy regarding whether these attributes are owned by students for each attribute. Except for the third attribute (i.e., Algebra), these values for the attributes were found to be relatively high. Ravand (2016) states that although there is no definitive criterion for Pc and Pa values, C.Ying (2013)

recommends the values of .7 and .8 as acceptable classification rates. However, in Cui et al. (2012)'s study on Tatsuoka's (2002) subtraction data in fractions, P_a and P_c values were found to be .68 and .52, respectively. In the light of this information, it may be stated that the validity and reliability of the classification are at an acceptable level.

In addition, the DINA model, which is a "conjunctive" model that requires the student to have all the necessary attributes to be successful in the relevant item, and the G-DINA model, where each attribute's contribution to the probability of answering the item is different, were compared and which CDM model better fitted the data was also examined. Table 7 presents the relative fit statistics and likelihood ratio test results obtained from the 2012 HSEE Mathematics subtest according to the DINA and G-DINA models.

Table 7. The relative fit statistics and likelihood ratio test (LR) according to the DINA and G-DINA models

Model	Nobs	AIC	BIC	Npar	logLik	χ^2	df	*p*
DINA	1063570	22233810	22234464	55	-11116850	72939,27	4	.0
G-DINA	1063570	22160879	22161580	59	-11080380			

When Table 7 is examined, it is seen that there is a decrease in the Loglik, AIC, and BIC values regarding the G-DINA model. This can be interpreted as the fact that the G-DINA model fits the data better than the DINA model. The goodness-of-fit test (Bock & Lieberman, 1970) using LRT χ^2 values for DINA and G-DINA model comparison is seen to be significant (p = .0). Accordingly, the G-DINA model fits the data better than the DINA model. When the general model fit indices and comparison results were examined, it was concluded that G-DINA was the model that best explained the students' behavior of responding to the items in the 20-item form of the 2012 HSEE Mathematics subtest.

The Findings regarding the Parameters of the G-DINA Model

The difficulty levels of the attributions were examined within the scope of the study, and the results are given in Table 8.

Table 8. The probabilities regarding the attributes

Attributes	Attribute probabilities
Numbers	.28
Geometry and Measurement	.20
Algebra	.26
Probability and Statistics	.33

When Table 8 is examined, it is seen that 33% of the students have attributes related to the learning field of "probability and statistics". Accordingly, "probability and statistics" can be expressed as the easiest attribute. This attribute is followed by "numbers", "algebra", and "geometry and measurement" respectively.

In cognitive diagnostic models, respondents are classified into 2^K latent classes. In this study, students are divided into 16 latent classes, as 4 attribute areas are defined within the scope of the HSEE Mathematics subtest. In Table 9, possible student attribute profiles for the first two and the last two latent classes are presented.

Table 9. The probabilities regarding latent classes

Latent Classes	Attribute Profile (α_i)	Class Probabilities	Expected Class Frequencies
1	0000	.614	654049.7
2	1000	.026	27926.2
.			
.			
.			
15	0111	.00009	105.984
16	1111	.168	179120.2

In the current study, it was identified that the highest-class probability belonged to the latent attribute profile α_1= [0000]. According to this, approximately 61% of the students (nearly 654.050 students) took part in the first latent class where they were expected to have none of the four attributes. It was determined that the second highest class probability belonged to the latent attribute profile α_{16}= [1111]. Accordingly, approximately 16.8% of the students (nearly 179.120 students) were expected to have all the attributes. G-DINA parameter estimations for all items in the mathematics subtest are given in Table 10.

Table 10. G-DINA model parameter estimations

Items	0 00 000 0000	1 10 100 1000	01 010 0100	11 001 0010	0001	110 1100	101 1010	011 1001	111 0110	0101	0011	1110	1101	1011	0111	1111
1	0.19	0.54														
2	0.24	0.95														
3	0.27	0.95														
4	0.58	0.93														
5	0.13	0.00	0.11	0.53												
6	0.16	0.79														
7	0.37	0.73														
8	0.17	0.69	0.63	0.90												
9	0.23	0.87														
10	0.12	0.21														
11	0.15	0.84														
12	0.21	0.88														
13	0.14	0.73														
14	0.11	0.47														
15	0.40	0.92														
16	0.39	0.83	0.92	0.97												
17	0.19	0.79														
18	0.10	0.79														
19	0.27	0.80	0.85	0.96												
20	0.11	0.27														

The top spanning header reads "Attribute Profile".

Table 10 shows the probability of being successful in certain attribute profiles for all items in the mathematics subtest. The pattern of reduced attribute profiles to which the parameter estimates correspond is in the top row of the table. In the G-DINA model, the number of parameters for each item is a function of the number of attributes required for that item ($2^{K_j^*}$). Accordingly, four parameters are estimated for items that require two attributes, and two parameters are estimated for items that require one. When Table 10 is examined, it is observed that four parameters are obtained for items 5, 8, 16, and 19, which require two attributes. The point to be noted here is that the required attributes for these items are not the same, that is, the attributes represented in the reduced feature vector are different. Since items other than the items 5, 8, 16, and 19 require a single attribute, P(0) and P(1) can be interpreted as g and 1-s parameters respectively in the DINA model (de la Torre, 2011). According to this, it may be stated that the students who do not have the attribute of numbers guessed the third item correctly with a probability of 27%, while the students with the attributes in the field of learning numbers answered the item correctly with a probability of 95%. In addition to this, it was determined that none of the items requiring more than one attribute in the mathematics subtest met the "conjunctive" assumption of the DINA model, which means that the same probability of success is obtained in the absence of one of the required attributes.

It is seen that the students who have one of the two required attributes in items 8, 16, and 19 show higher success than the students who do not have any of these attributes. This finding indicates that the achievement in the related items changes depending on the presence of the attributes in the student, and therefore, correct definitions of the attributes are provided in the Q matrix. On the other hand, when the 5th item is taken into consideration, it is seen that the main effects of the "geometry and measurement" and "algebra" attributes required for the item are quite low; however, the interaction of these two attributes were observed to affect the probability of success in the item at a high level. When the 4th, 10th, and 20th items are examined, it is seen that there is not a significant difference between the success probability of the students who have the necessary attributes for the item and the success probability of those who do not. This indicates that other qualities may have been used to answer the item correctly, or that other characteristics unrelated to the test, apart from the attributes to be measured with the item, may have affected the answering process. In Table 11, the attribute pattern and probability of success for items 1 and 8 in the mathematics subtest are given, as well as the required attributes for the item.

Table 11. Attribute pattern and success probabilities for items 1 and 8

Item	Attributes Required for the Item	Attribute Pattern	Probabilities of Success
Item1	α_1	A0	.19
Item1	α_1	A1	.54
Item8	α_1 ve α_3	A00	.17
Item8	α_1 ve α_3	A10	.69
Item8	α_1 ve α_3	A01	.63
Item8	α_1 ve α_3	A11	.90

In Table 11, the second column shows the required attributes defined in the Q-matrix for items 1 and 8, the third column shows the patterns of whether the student has the necessary attributes for the item, and the last column shows the probability of answering the item correctly depending on whether the required attributes are present or not. When Table 11 is analyzed, it is seen that the probability of answering the item correctly (estimation probability) of the students who do not have the attributes related to the "numbers" learning area required for item 1 is .19. In Table 11, it is seen that the students who have the attributes related to the "numbers" learning field are more likely to answer item 1 correctly (54%) than those who do not. In the case that the student has the attributes related to the "numbers" learning domain, the probability of being successful in the item (probability of not making a shift) becomes .19+.54= .73. When Table 11 is examined, it is seen that 2 attributes are required for item 8, namely "numbers" and "algebra". It is seen that students who do not have the 2 attributes required for item 8 answered the item correctly with a probability of 16%. Accordingly, the probability of guessing the 8th item in the mathematics subtest is 16%. If the student has the attributes related to the "numbers" learning field, the probability of being successful in the item is .16+.69=.85. If the student has the attributes related to the "Algebra" learning field, the probability of being successful in the item becomes .16+.63= .79. Accordingly, the presence of the "Numbers" attribute for the 8th item affects the success of the item more than the "Algebra" attribute. As for the interaction of "Numbers" and "Algebra", it increased the probability of answering the item correctly to 90%. However, since it is a conditional probability, it is necessary to pay attention not to add up the probability of answering the item correctly, depending on whether the necessary attributes for any items are present or not (Ravand, 2016).

The Findings regarding DIF Analysis

The results of the DIF analysis within the scope of the G-DINA model for the mathematics subtest obtained using the Wald test are provided in Table 12.

Table 12. The results of DIF analysis

Madde	χ2	df	p	UA
1	495.47	2	.00	0.0269
2	2033.71	2	.00	0.0307
3	74.08	2	.00	0.0121
4	6162.23	2	.00	0.1086
5	603.98	4	.00	0.0198
6	399.49	2	.00	0.0113
7	86.35	2	.00	0.0133
8	144.71	4	.00	0.0314
9	20.31	2	.00	0.0061
10	2211.70	2	.00	0.0218
11	649.22	2	.00	0.0166
12	710.93	2	.00	0.0191
13	**3.35**	**2**	**.19**	**0.0032**
14	236.89	2	.00	0.0071
15	110.76	2	.00	0.0180
16	182.21	4	.00	0.0380
17	363.73	2	.00	0.0152
18	63.39	2	.00	0.0147
19	1205.55	4	.00	0.0775
20	488.66	2	.00	0.0151

When Table 12 is examined, it is seen that the item parameters differ significantly between male and female students in all the other items in the mathematics subtest, except for the 13th item ($p < .05$).

Table 13 presents the DIF status of the 2012 HSEE Mathematics subtest items according to the effect size classification determined by Jodoin and Gierl.

Table 13. The items showing DIF and their effect size

| The Group | The Items not Showing DIF | The Items Showing DIF | | |
		Negligible UA<.059	Medium Level .059 < UA < .088	Significant level UA >.088
Gender	13	1,2,3,5,6,7,8,9,10,11,12,14,15,16, 17,18,19,20	19	4

When Table 13 is examined, it is seen that item 19 shows DIF at a moderate level and item 4 shows DIF at a significant level in the mathematics subtest. It was determined that the 13th item did not show DIF ($p>.05$), and except for these three items, the other items in the test showed negligible DIF.

Within cognitive diagnostic models, uniform DIF is the case which poses consistently lower/higher correct answer probabilities for a group across all trait profiles. Non-uniform DIF, on the other hand, is that the probability of answering correctly is higher for a group in some latent profiles, while it is lower in some other attribute profiles in the same group (Li & Wang, 2015). The attribute profiles of male and female students regarding item 19 and their probability of answering correctly are given in Table 14.

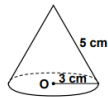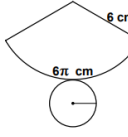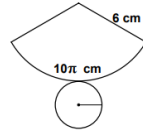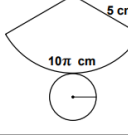**Table 14. Success probabilities according to gender for item 19**
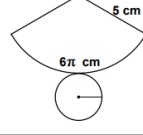
Item 19	The Group	Attributes Required for the Item	Attribute Pattern	Probabilities of Success
Bir yarışma programında, verilen her doğru cevaba +3 puan, her yanlış cevaba -2 puan verilmektedir. Bu yarışmaya katılan Aysun, sorulan 5 sorunun tümünü cevaplamıştır. Yarışma sonunda 10 puan aldığına göre, Aysun kaç soruyu doğru cevaplamıştır? A) 2 B) 3 C) 4 D) 5	Female	α_1 ve α_3	A00	0.22
		α_1 ve α_3	A10	0.72
		α_1 ve α_3	A01	0.74
		α_1 ve α_3	A11	0.94
	Male	α_1 ve α_3	A00	0.31
		α_1 ve α_3	A10	0.88
		α_1 ve α_3	A01	0.91
		α_1 ve α_3	A11	0.97

When Table 14 is examined, it is seen that the probability of answering the item correctly in item 19, which was determined to show moderate DIF, is higher for male students than for female students in all reduced attribute profiles. In this case, it can be stated that item 19 shows a uniform DIF in favor of male students.

As only one attribute is required for item 4, which was determined to show significant DIF, the success probability of students who do not have this attribute P(0) and those who have it P(1), can be thought of as the g and 1-s parameters in the DINA model, respectively (de la Torre, 2011). Hou et al. (2014) demonstrate that if the shift parameter (s) is small and the estimation parameter (g) is large for the focus group, the item shows uniform DIF, and as a result, they state that the probability of answering the item correctly in the focus group compared to the reference group, regardless of its implicit qualities is higher.

The attribute profiles and correct answer probabilities for item 4, which was determined to show significant DIF according to gender, are given in Table 15.

Table 15. Success probabilities according to gender for item 4

Item 4	The Group	Attributes Required for the Item	Attribute Pattern	Probabilities of Success
	Female	α_2	A0	0.64
		α_2	A1	0.94
	Male	α_2	A0	0.51
		α_2	A1	0.91

In Table 15, when the success probabilities P(0) and P(1) are considered as the g and 1-s parameters in the DINA model respectively, it is seen that the estimation parameter (g) is higher and the shift parameter (s) is smaller for female students. Considering this, the results revealed that the probability of female students to answer the item correctly is higher than male students. In this case, it can be stated that item 4 shows a uniform DIF in favor of female students.

CONCLUSION, DISCUSSION AND SUGGESTIONS

This current study was carried out on the item answers of the 2012 HSEE 8th Grade Mathematics subtest. In the study, estimations of item parameters and student attribute profiles were obtained using the G-DINA model, and whether mathematics items showed DIF according to the gender variable within the scope of cognitive diagnosis models was examined.

General cognitive diagnostic models, such as the G-DINA model, control model fit at both test and item levels (Ravand, 2016). When the absolute and relative fit indices were examined in the current study, it was determined that the G-DINA model was compatible with the data at the test level. This indicates that there are "compensatory" relationships for some items and "non-compensatory" relationships for some other items among the attributes. General cognitive diagnostic models do not allow relationships between test-level attributes to be seen but allow different CDMs for different items within the same test. It is stated that the G-DINA model is particularly suitable in situations where the relationships between attributes may change depending on cognitive difficulties (Ravand, 2016). In the current study, the model fit was evaluated at the test level since the relationships between the "numbers", "geometry and measurement", "algebra", and "probability and statistics" attributes identified related to mathematics items were changeable and the cognitive structures of the items could not be understood, and the G-DINA model was observed to fit well at a high level. The G-DINA model, which is a saturated model, provides better model-data fit compared to other reduced models (de la Torre et al., 2015). However, reduced models are preferred under some conditions due to the principle of parsimony, which allows for more clear and understandable interpretations, requires small samples to obtain accurate estimations, and if it is not possible to distinguish between them, simpler models are preferred to complex models. Rojas et al., (2012) state that, unlike general models at the item level, reduced models such as DINA, DINO, ACDM, and NC-RUM are more interpretable in terms of the relationships between attributes. De la Torre (2011) suggests the Wald test as a statistical method to determine model fit at the item level, in other words, whether one of the reduced models can be used instead of the G-DINA model in the item. Accordingly, item-level model selection for items determined to require more than one attribute may be examined using the Wald test.

When the G-DINA model parameters are examined in the study, it is seen that the $\alpha_1 = [0000]$ attribute profile (61%) in which none of the four qualities defined is found in the student, and the $\alpha_{16} = [1111]$ attribute profile (17%) in which all the four attributes are present in the student (17%) are the most common attribute profiles. This finding is in line with other cognitive diagnosis studies (Lee & Sawaki, 2009b; Li, 2011; Ravand, 2016). In the study, it was determined that the tetrachoric correlation coefficients between the "Numbers", "Geometry and Measurement", "Algebra", and "Probability and Statistics" attributes varied between 0.69 and 0.99. High levels of positive correlations between attributes may be the reason for the backlog in the $\alpha_1 = [0000]$ and $\alpha_{16} = [1111]$ attribute profiles. Rupp et al. (2010) stated that the skewness in these attribute profiles may be due to the high positive correlation between attributes or the one-dimensionality of the measurements (Lee & Sawaki, 2009b). Here, what is meant by the one-dimensionality of the measurements is that if one of the required attributes is found, another attribute tends to be present or on the contrary, if one of the necessary attributes is lacking, the other attribute is also missing.

In the study, it was seen that 33% of the students have attributes related to the learning field of "probability and statistics". Accordingly, "probability and statistics" might be expressed as the easiest attribute. This quality was followed by "numbers" (28%), "algebra" (26%), and "geometry and measurement" (20%) relatively. Similarly, in the Turkish sample TIMSS 2011 study, it was found that 8th grade students found the questions in the fields of "algebra", "numbers", and "geometry" more difficult than the questions in the field of "data and probability" (Büyüköztürk et al., 2014). In his study, Atar (2011) applied descriptive and explanatory item response models to TIMSS 2007 Türkiye 8th grade mathematics data and created a linear logistic model with cognitive domain and subject domain variables to explain the differences in item difficulties. As a result of the analysis of this model, the cognitive domain and the subject area were found to influence item difficulty. When the subject area variable was examined, it was found that the items related to geometry were more difficult than the items related to "algebra" and "data and probability", and there was no statistically significant difference between the items related to "geometry" and the items related to numbers in terms of item difficulty. It may be misleading to consider these findings regarding the ease and difficulty of learning areas alone. Because while an item in the field of "geometry and measurement" requires routine algorithmic operations, another item in the field of "probability and statistics" may make estimation and comparison skills necessary. Hence, it is thought that the item difficulty level should be examined together with the cognitive skills, item structure and type, as well as the learning domain skills. In studies on cognitive diagnosis models, it is seen that the Q matrix is formed by combining the learning domain and cognitive domain skills (George & Robitzsch, 2014). However, although the alternative Q-matrix based on the combination of attributes in the two domains solves the methodological problem of not defining the model, this practice also changes the attributes used in the models. It is thought that the alternative Q-matrix creation method based on the combination of the two-level attributes may be preferred in cases where the cognitive areas and achievements that are desired to be measured with the items can be clearly defined. Additionally, instead of Bloom's taxonomy and the classifications that take it into account, the Math

taxonomy (Smith et al., 1996) developed specifically for mathematics can be used in the classification of cognitive attributes related to mathematics. However, the fact that HSEE mathematics items are complex items to measure multiple acquisitions and that cognitive skills vary depending on the possible strategies used in the item make it difficult to consider the cognitive domain in cognitive diagnosis studies.

In the study, using the Wald test (de la Torre, 2011; Hou et al., 2014) within the scope of the G-DINA model, whether the 2012 HSEE Mathematics subtest items showed a gender-varying item function was examined. Accordingly, DIF analyses were carried out within the scope of CDM, in which latent attribute profiles were taken instead of total scores as matching criteria, and the 4th item showed a uniform DIF in favor of female students. On the other hand, it was found that item 19 showed a uniform DIF in favor of middle-level male students. In his study where Yıldırım (2015) examined whether the 2012 HSEE Mathematics subtest items showed DIF according to gender using MH and logistic regression (LR) methods, he determined that the 4th item showed moderate DIF in favor of female students and the 19th item in favor of male students in line with the current study. When the findings are compared with Yıldırım's (2015) study, it is seen that they overlap to a large extent, and the only difference is in the effect size classification of the 4th item. This difference is thought to be due to the use of different criteria (Zieky, 1993; Zumbo & Thomas, 1997; Jodoin & Gierl, 2001) for effect size classification. In addition, it may be suggested that the DIF determination approaches, in which the latent attribute profile is used as the matching criterion as a part of CDM, are similar to the traditional DIF determination approaches that use the total score as the matching criterion. A review of the literature reveals similar research findings (Zhang, 2006; Hou et al., 2014). Hou et al. in their study, in which they compared the DIF detection performance of the Wald test and traditional MH and SIBTEST methods, reported that the DIF detection performance of the Wald test was similar or superior to the MH and SIBTEST methods. In this study, it was stated that the Wald test is a promising approach in determining DIF within the scope of cognitive diagnostic models. Similarly, Zhang investigated the effectiveness of MH and SIBTEST methods together with two matching criteria (total score and attribute profile score) to determine DIF within the scope of CDM, and they were found to perform at the same level or better than the MH and SIBTEST methods (according to the total score approach) that utilize attribute profile score as a matching variable. However, as the use of different criteria for effect size classification (Zieky, 1993; Zumbo & Thomas, 1997; Jodoin & Gierl, 2001) leads to different DIF levels, it makes it difficult to decide on the compatibility between the methods.

Camilli and Shepard (1994) stated that there are two reasons for the emergence of DIF: item bias and item effect. Item effect indicates the actual differences between the groups on the characteristics to be measured with the item, while item bias indicates the differences unrelated to the measured construct resulting from the characteristics of the test items or the test conditions that are not fit for the purpose of the test (Zumbo, 1999). In his study examining the bias status of the 2012 HSEE Mathematics subtest items, Yıldırım (2015) investigated whether the DIF sources of the items 4 and 19 showing DIF that were found to have a strong consensus via the Delphi technique were related to the measured construct, and he found that the DIF in the 4th item was determined as item effect, and the DIF in item 19 as item bias. However, in the current study, which was carried out within the scope of cognitive diagnosis models, it was thought that the difference in the probability of correct answers to the 4th item, which was determined to show DIF according to gender as a result of DIF analysis, led to item bias while it was item effect in item 19.

In the Q-matrix, where the relationships between items and attributes were defined, a single attribute (geometry and measurement) was defined for item 4, and two attribute fields (numbers and algebra) were defined for item 19. Experts stated that the 4th item was prepared for the acquisition of "determines the basic elements of the cone, constructs it and draws the surface angles" in the geometric objects sub-learning area. They stated that item 19 was prepared for the acquisition of "solves linear equation systems with algebraic methods" in the field of algebra learning, but that the negative integers included in the item content required the attributes in the field of learning numbers. It was determined that the probability of answering the item correctly was quite high (58%) for the students who did not have the "geometry and measurement" field attribute, which was determined to be necessary for the 4th item in the Q-matrix. This indicates that other qualities or variables other than the "geometry and measurement" field attribute may have been effective for the solution of the item. Therefore, it may be assumed that DIF in item 4, which was determined to show a significant level of DIF, arises from a situation unrelated to the measured structure. In this case, the DIF in item 4 indicates item bias, not item effect resulting from real differences on the item and the attribute to be measured. When the success probabilities of item 19 depending on the latent attribute pattern were examined, it was determined that the success probability of the students who did not have the necessary attributes was relatively lower, while the "numbers" and "algebra" field attributes required for the item provided significant increases in the probability of answering correctly. When the success probabilities of male and female students according to the implicit attribute pattern were compared, there was a striking difference in the success probabilities. This indicates that the differentiation in item 19, which was determined to show a medium level of DIF, is due to the real differences in the attributes that are intended to be measured with the item. Therefore, the DIF in item 19 does not show the item bias arising from a situation unrelated to the construct measured by the item, but rather the item effect resulting from the actual differences in the item and the attribute to be measured. It is thought that with the DIF analyses considered within the scope of cognitive diagnosis models, the relationships between the sources of DIF and the attributes to be measured with the item can be defined more clearly, thus forming a statistical basis for item bias decisions. Moreover, DIF studies that will be carried out considering item attributes and multi-level data structure will provide richer information on DIF resources. Especially since the data in the field of education show multilevel data structure, it is thought that it would be interesting to consider multilevel DIF studies as a part of IRT within the scope of cognitive diagnosis models. In

addition, it can be mentioned that there is an increasing interest in the use of machine learning methods in identifying potential DIF sources.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship and publication of this article.

Statements of publication ethics

We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The study was conducted and reported with equal collaboration of the researchers.

Ethics Committee Approval Information

All stages of the study were carried out in accordance with ethical principles. Ready-made data were used within the scope of the study. The data were provided by the Ministry of National Education General Directorate of Measurement, Evaluation and Examination Services (Date: 09/11/2022-Number: E-57750415-622.03-63110119). The authors declare that they have no conflict of interest.

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| Research Article / Araştırma Makalesi|

Mediating Role of the Laissez-faire Leadership Practices between Transformational Leadership and Job Satisfaction

Dönüşümcü Liderlik ile İş Doyumu Arasında Serbestlik Tanıyan Liderlik Uygulamalarının Aracılık Rolü

Dursun Eğriboyun [1]

Abstract

Purpose: This research aims to determine the mediating role of the laissez-faire leadership practices between the perceptions of transformational leadership practices and job satisfaction of the school administrators and teachers.

Design/Methodology/Approach: The research is a quantitative study. The participants of the research were composed of 200 administrators and teachers. The purposive sampling method has been used. This research is a study in the survey model. The data were collected through the Multifactor Leadership Questionnaire and the Minnesota Satisfaction Questionnaire. The estimating is made with the simple linear regression analysis, Spearman analysis, mediating (Bootstrap) test, and Sobel test.

Findings: It was found a statistically meaningful relationship between leadership practices and job satisfaction perceptions. Also, it could state that the laissez-faire leadership practices had a mediating role between transformational leadership and job satisfaction.

Highlights: The Multifactor Leadership Questionnaire (MLQ) was developed by Avolio and Bass and the Minnesota Satisfaction Questionnaire (MSQ) was developed by Weiss, Dawis, England, and Lofquist. A total of 200 data collection tools were evaluated. Cronbach Alpha values are used for the reliability. The LISREL program is used for confirmatory factor analysis.

Öz

Çalışmanın amacı: Günümüzde özel ve devlet okullarında görev alan bireylerin, özellikle de yöneticilerin, tüm öğretmenlerle sağlıklı ilişkilerinin gerekliliğinden yola çıkarak yapılan literatür taraması ve çok faktörlü liderlik uygulamaları ile iş doyumunun ilişkisini ortaya koyan araştırma sonuçlarının ışığı altında; bu araştırmada özel ve devlet okullarında görev alan yönetici ve öğretmenlerin algıladıkları serbestlik tanıyan liderlik uygulamaları ile dönüşümcü liderlik ve iş doyumu ilişkisinin belirlenmesi amaçlanmıştır.

Materyal ve Yöntem: Araştırma nicel bir çalışmadır. Araştırmanın katılımcılarını 200 yönetici ve öğretmen oluşturmaktadır. Amaçlı örneklem yönteminden faydalanılmıştır. Bu araştırma bir survey modelidir. Veriler Çok Faktörlü Liderlik Ölçeği ve Minnesota Doyum Ölçeği vasıtasıyla toplanmıştır. Hesaplamalar basit doğrusal regresyon analizi, Spearman analizi, Bootstrap ve Sobel testleri ile yapılmıştır.

Bulgular: Liderlik uygulamaları ile iş doyumu algıları arasında istatistiksel olarak anlamlı bir ilişki bulunmuştur. Ayrıca, serbestlik tanıyan liderlik uygulamalarının dönüşümsel liderlik ve iş doyumu arasında arabulucu bir role sahip olduğu belirtilebilir.

Önemli Vurgular: Çok Faktörlü Liderlik Ölçeği (MLQ) Avolio ve Bass tarafından, Minnesota Doyum Ölçeği (MSQ) Weiss, Dawis, England ve Lofquist tarafından geliştirilmiştir. Toplam 200 veri toplama aracı değerlendirilmiş, güvenilirlik için Cronbach Alpha değerleri kullanılmıştır. Doğrulayıcı faktör analizi için LISREL program kullanılmıştır.

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INTRODUCTION

Nowadays, transformational leadership practices, laissez-faire leadership, and job satisfaction are the concepts that are known by educational institutions and especially the public administration and used there. However, it has become an issue in today's management approach that should be examined and discussed whether both the administrators and employees use these concepts superficially or if they are very competent on the theoretical foundations of the subject. The main problem of this research is to analyze the transformational and laissez-faire leadership practices and job satisfaction perceptions that are perceived by the administrators and teachers in the schools, to present the existence of the relationship between them, and to introduce if there is a mediation role of the laissez-faire leadership practices in this relationship.

The main purpose of the research on this problem which is the basis for the formation of the theoretical framework and research hypotheses is to reveal how the evaluations of job satisfaction in educational institutions differ according to transformational leadership and laissez-faire leadership practices. In this context, it was evaluated that there should be meaningful relationships between the perceptions of the administrators and teachers towards the subjects investigated, the opportunities provided to them in their institutions, their relationship with each other, and their assessment of their job satisfaction. For this reason, the various domestic and foreign sources and theoretical and empirical research results were evaluated and research model and inter-concepts relations were determined.

The laissez-faire leadership practices that are mediating variables, transformational leadership, and job satisfaction are important management concepts that can be extended to the organization, and even to the international organizations, starting between two people. Therefore, the problem discussed in the research should be addressed in fact within the integrity of the organization. When the concept of organization is expressed in the research, it means a system in which the activities of two or more people are coordinated (Kaya, 1999, p. 111).

To date, a wide range of research has been carried out in the organization and management and is still being carried out. Considering that the organization is a structure, in a nutshell, the display of the leadership practices within this structure and the positive increase of the job satisfaction of this consisted environment is an issue that should be emphasized. Here, too, the managers have important duties because when it is evaluated that the management is a process, it is the managers who will continue the process smartly and positively. In this sense, the managers are at the forefront, what the leadership skills are, how they can be provided and improved, what the job satisfaction or motivators are and how they should be developed are critical issues that need to be examined in today's management approach because the healthier the relations in this regard, the more efficient the organization will be by providing job satisfaction.

Here, naturally, administrative behavior plays an important role. In many kinds of research, the management activity requires working with others on the one hand, while on the other hand, it requires achieving the objectives, making the most use of scarce resources, ensuring efficiency and effectiveness, and operating in the changing environments (Paşaoğlu, 2013, p. 3). If it is accepted that management is also a social activity, it can be understood how much the concepts investigated are related to each other and intertwined concepts. As the definition of management shows, positive leadership techniques should be used to work with others. To realize the objectives of the organization, the employees must be well directed because to provide efficiency against effectiveness, satisfied employees are needed. In addition, to use the limited resources rationally, the theories of job satisfaction must be fully utilized.

The changing environment also affects job satisfaction. Therefore, intrinsic and extrinsic job satisfaction should be balanced very well. Of course, it is required to use the appropriate leadership skills when these are carried out because one of the management functions that can be effective is accepted as the leadership practices when it comes to the management functions in a broad sense. As Gudanowski (1995; as cited in Efeoğlu, 2006, p. 27) emphasizes, job satisfaction is defined in different ways as a happy and positive mood based on the job of the employee or his experiences at the work, his pleasure from the work which varies according to the values he has, the harmony between the expectations of his work and the rewards he provides from his job, his attitude towards his work, a result of his attitude towards his work, and his emotional reactions to his work.

In recent years, the behaviors aimed at increasing the effectiveness and efficiency in organizations have been widely examined in the literature. Especially the topic of leadership has been one of the issues that have gained great importance due to the environments created by competition, chaos, and uncertainty in the business world of the 21st Century. Therefore, organizations should focus on the needs of their employees and try to satisfy them, it makes employees feel valued, talented, useful, and necessary.

In the light of these evaluations, it is thought that there should be a balanced relationship between the realization of the objectives of the individual and the realization of the objectives of an organization and that the leadership behaviors exhibited for this purpose should be an active and effective leadership style in the context to satisfy both administrators and teachers. In this context, the leadership skills and job satisfaction concepts in management have become a subject worth examining for both administrators and teachers with all their dimensions, scopes effects, and results. Also, in the literature scan, it is seen that not enough studies have been done on this subject in Turkey. The above-mentioned thoughts and reasons reveal the necessity of research on this subject, too. Therefore, it has created the problem that is the subject of the research whether the perceptions of the administrators and teachers working in the schools regarding the leadership skills of their managers are a meaningful predictor of the perceptions of their job satisfaction.

According to all these reasons, education managers can develop the educational institutions they serve and their employees to the extent that they can demonstrate leadership behaviors in their professions. So the manager has to be a leader at the same time to make his organization work most efficiently and procedurally. Also, Vural et al. (1999; as cited in Tengilimoğlu, 2005) stated that the most important of the basic factors affecting the job satisfaction of the employees is the leadership behaviors exhibited by the managers. Ferik (1997; as cited in Tengilimoğlu, 2005) found in his research that the employee's job satisfaction was higher when they perceived that the unit managers were applying a human-oriented style, not work-oriented. These assessments reveal a relationship between leadership practices and job satisfaction.

It is evaluated that this research conducted in the light of these thoughts will shed light on the current system and the management performances within this system of the education managers, and on the educators about their perspectives and stances against these innovative movements in the education. According to the findings obtained as a result of the examination of the studies carried out in this context, it was also evaluated that leadership practices are one of the most important factors affecting job satisfaction. Leadership practices and job satisfaction are not newly discovered phenomena in educational institutions. Leadership practices are the approaches that have long been known, believed, and implemented. However, these applications are limited to individuals and cannot be institutionalized enough. In the literature, different researches were also carried out on leadership practices and job satisfaction in different fields such as psychology, business, health, tourism, etc. But, in these studies, especially in the official educational institutions in Turkey, the frequency at which application is encountered in leadership practices and job satisfaction is quite limited.

Purpose of the research

Today, in this context of the literature review and research results that reveal the relationship between the multi-factor leadership practices and job satisfaction based on the necessity of healthy relationships of individuals working in private and public schools, especially managers, with all teachers, it is aimed in this research to determine the relationship between the transformational leadership, job satisfaction and laissez-faire leadership practices that recognize the perception of managers and teachers working in private and public schools.

In the light of thoughts on leadership practices and job satisfaction, it is evaluated that this research will shed light on the current system and management performances of education managers within this system and the perspectives and stances of teachers against these innovative movements in education. According to the findings obtained as a result of the examination of the studies carried out in this context, it is also evaluated that leadership practices are one of the most important factors affecting job satisfaction. In this context, this research aims to determine the role of laissez-faire leadership practices between transformational leadership perceptions and the job satisfaction of the school administrators and teachers.

Importance of the research

The efforts to reorganize the organizations have led to a shift in the key management roles of managers towards transformational leadership. This struggle includes eliminating uncertainty about methods and objectives, not only changing the technological dimension of activities, but also designing an organizational structure to support this change, and leadership behaviors expected from the manager to realize a more professionalized working environment. In this context, the transformational leadership style defies confusion. Because through providing a high level of identification, recreating the ambiguous agenda, and continuously improving the organization's personnel, the transformational leader creates an effective agenda.

Başaran (1996, p. 168) stated that the satisfaction from the job is the felt pleasure or the enriched positive emotional case in consequence of the employees' consideration related to their job or job life. In this manner, the system has three basic obligations against its employees as the preparing of the opportunity for the using growing rights of the employees, the meeting of the needs to ensure the lives of the employees in a way that accords with professionalism, and the constituting of the conditions to increase the satisfaction level from their job. If the system ensures these three obligations on the required level, it will be caused the employees to attach to the system, and they release their power to the system for the effectiveness of the system. Also, this can be realized with a good leader. In this context, Başaran (1996, p. 168-169) expresses the obligations that can increase the satisfaction level of the job are the meaningful becoming of the duty to the employees, the gaining of the organizational and social position, the presenting a transformational leadership to the employees by performing their duties, the creating an interaction to support the employees which are working in the organization, and the combination of employees' values and the duties' values with each other.

Also, the findings of the research which is done by Liebman et al. (2005) show that the administrators who display the transformational leadership behaviors have the skills about understanding the leadership quality between other employees, the correlating the mission and vision of the organization with the learning of the employees, the supporting and protecting the professional learning communities by the leadership teams, the coaching and monitoring for the development of the administrators, the authorizing of the others in case that they can take a role in the leadership, the providing of the growth for the learning organization, and the authorization for all opportunities. As a result, the transformational leaders do this by restructuring and renewing the organization, focusing to constitute the vision, promoting collaborative participation, and increasing the employees' role to the leader's role (Silins, 1994; as cited in Barnett, 2003).

With the realization that the most important element in organizations is humans, management has also started to be defined as the art of directing people by humans towards human and humanistic purposes. In this context, it is emphasized that all managers, regardless of the institution

and at what level, should strive to increase productivity within their authority, duties, and responsibilities, to ensure the job satisfaction of employees, to resolve conflicts between them, to resolve incompatibilities, to develop team spirit, to adopt innovations and to direct development, and to change their behavior when necessary (Ayhan, 2006, p. 66).

Most of the theories described in the basic approaches to job satisfaction have a strong predictive value. If you're a manager who wants to motivate your employees, how do you apply these theories? There is no simple and all-encompassing answer to this. What is known about the motivation of employees in organizations shows in the following recommendations; recognize the personal differences, match people to the jobs, use objectives, ensure that goals are perceived as achievable, individualize the rewards, link the rewards and performance, review the fairness of the system and do not ignore money. These recommendations take into account and integrate personal variables, job variables, and system variables (Robbins & Judge, 2013).

In the light of these evaluations, it is thought that there should be a balanced relationship between the realization of the objectives of the individual and the realization of the objectives of the organization, and the leadership behaviors to be exhibited for this purpose should be within the scope of ensuring the job satisfaction of the managers and employees. In this context, the leadership behaviors and job satisfaction concepts in management have become a subject worth examining for both managers and employees with all their dimensions, scopes, effects, and consequences. Also, in the literature scan of this area, it is seen that not enough studies have been done in Turkey. The above-mentioned thoughts and reasons also reveal the necessity of a study on this subject. Therefore, the perceptions of managers and teachers working in the private and public schools regarding laissez-faire leadership practices have created the problem that is the subject of the research to investigate, whether it is a meaningful predictor of their perceptions about transformational leadership and job satisfaction.

METHOD

Research model and research questions

In this sense, the research will be a study in the relational scanning model, which aims to determine the presence and degree of change together between two or more variables from the scanning models. In addition, it is thought to be both descriptive and explanatory in terms of the purpose of the research. For this purpose, the conceptual relationship between the dependent (job satisfaction), independent (transformational leadership), and intermediary (laissez-faire leadership) variables in the research are expressed in the following model and will be examined during the research process. Within the scope of the research, the research model on transformational leadership, laissez-faire leadership, and job satisfaction are stated in Figure-1.
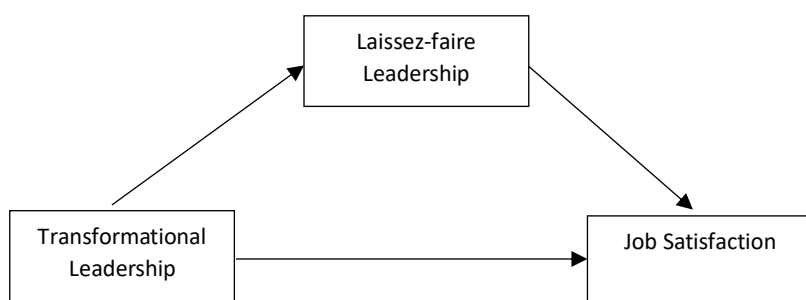

Figure 1. Research Model

The necessity of this research is important due to the inadequate research carried out so far, especially in the field of education, regarding transformational leadership, laissez-faire leadership, and perceptions of job satisfaction in the literature in Turkey. Therefore, if the laissez-faire leadership perceptions of managers and employees are examined together during the analysis phase, it will be considered to produce important findings as a result of the analysis of the data collected in this context and a method that tries to explain which areas of transformational leadership and job satisfaction are more related.

In line with the research model, it is aimed to determine the relationship between leadership practices and job satisfaction, according to the perceptions of administrators and teachers working in private and public schools, and to evaluate whether laissez-faire leadership practices have an intermediary role in the relationship between transformational leadership and job satisfaction. To achieve this goal, the following questions have been searched for answers.

- What are the perceptions of administrators and teachers in private and public schools about transformational leadership, laissez-faire leadership practices, and job satisfaction?

- Is there a meaningful relationship between the perceptions of administrators and teachers in private and public schools regarding transformational leadership and their perceptions of laissez-faire leadership, and job satisfaction?

- Does the laissez-faire leadership practices have an intermediary effect between the transformational leadership and job satisfaction perceptions of administrators and teachers in private and public schools?

Research group

The participants of the research are the administrators and teachers working in the schools in the central districts of İzmir province. However, it hasn't taken the samples and because the participants and schools to be included in the sampling were determined by their judgment under the purpose of the research based on the knowledge, experience, and observations of the researcher, the purposive sampling method was used.

Within the scope of the research, the data collection tool was distributed to a total of 350 educators, 50 of whom were administrators and 300 teachers on a voluntary basis. 220 of the data collection tools were retrieved and checked, examined within the scope of the purposeful sampling method, and a total of 200 data collection tools, 28 of which belonged to administrators and 172 teachers, were deemed suitable for research and evaluation.

Data collection tools

In the research, the data were collected from the administrators and teachers by scale. For this purpose, a data collection tool was prepared to measure the variables to be used in the research and applied to the entire research group. In the research, the data on leadership practices and job satisfaction were obtained by scanning the literature and applying the data collection tool (scale). In this context, firstly, the theoretical framework of the research was established, and subsequently, the questionnaire used within the scope of the research was created as a result of combining and compiling the sub-dimension scales of the research variables. The transformational leadership scale consists of 20 questions, and the laissez-faire leadership scale consists of four questions. The Multifactor Leadership Questionnaire-MLQ Version 5x developed by Avolio and Bass (1995) was used for the sub-dimensions of the leadership scale, which recognizes both transformational leadership and laissez-faire leadership. The scale was adapted to Turkish by Akdogan (2002). The reliability analysis, explanatory factor analysis, and validity tests of the measuring instrument were conducted by Avolio and Bass and the internal coefficient of consistency (Cronbach Alpha) was calculated α= 0.740-0.940 (Felfe, 2002; cited in Luksic, 2004).

The job satisfaction scale consists of 20 items, too. The Minnesota Satisfaction Questionnaire-MSQ developed by Weiss, Dawis, England, and Lofquist (1967) was used for the sub-dimensions of the job satisfaction scale. The scale was translated into Turkish by Gökçora and Gökçora (1985; as cited in Akdogan, 2002). Reliability, explanatory factor analysis and validity tests of the measuring instrument were conducted by Weiss et al. (1967). The internal coefficient of consistency of the scale (Cronbach Alpha) was found to be α=.869 in Akdogan's study.

The Leadership Scale has a 5-type Likert rating in the form of 1 (I strongly disagree), 2 (I disagree), 3 (I am undecided), 4 (I agree), and 5 (I totally agree), and the Job Satisfaction Scale has a rating of 1 (I am not satisfied at all), 2 (I am not satisfied), 3 (I am undecided), 4 (I am satisfied), and 5 (I am very satisfied).

Data analysis

In this research, Cronbach Alpha values are used for the reliability, the corrected item-total correlations are analyzed by estimating the results of the research, and the distinctiveness of each item is examined, too. In this research, due to the receipt of the opinions and recommendations of the experts in the subject field regarding the scale items and the lack of any problems with the content and comprehensibility of the scale, it was evaluated that the measuring instruments have content validity.

The Cronbach alpha intrinsic consistency test was used to test the reliability of the scales used in the research. Alpha coefficients were α=.941 of transformational leadership applications, α=.768 of laissez-faire leadership (LFL) and α=.881 of job satisfaction. In this case, it can be said that the scales are reliable. The confirmatory factor analysis (CFA) was applied using the LISREL program for obtaining data to test whether the scale items in the research had homogeneous distribution. As a result of the CFA, all variables have passed reliability. The CFA result is stated in Table 1.

Table 1. Compatibility Index Values of the Investigated Relationship after Evaluation

MEASURE OF COMPLIANCE	GOOD FIT	ACCEPTABLE FIT	VALUE	COMPLIANCE STATUS
x^2/DF	0<x^2/DF<2	2<x^2/DF<3	2.315	ACCEPTABLE
RMSEA	.00<RMSEA<.05	.05<RMSEA<.08	.08	ACCEPTABLE
RMR	.95 <RMR <1.00	.90 <RMR <.95	.09	ACCEPTABLE
SRMR	.00 <SRMR<.05	.05 <SRMR<.10	.09	ACCEPTABLE
NNFI (TLI)	.95 <NNFI<1.00	.90 <NNFI<.95	.95	GOOD
CFI	.95 <CFI<1.00	.90 <CFI<.95	.96	GOOD
RFI	.95 <RFI<1.00	.90 <RFI<.95	.92	ACCEPTABLE

In the research, the compliance of data with the measurement model tested through chi-square (x^2), degree of freedom (DF), root mean square error of approximation (RMSEA), root mean square residual (RMR), standardized root mean square residual

(SRMR), non-normed fit index (NNFI), Tucker_Lewis index (TLI), comparative fit index (CFI), relative fit index (RFI), relative chi-square (x^2/DF) indices. These values indicate that this model has generally acceptable compliance.

In the research, the mean, standard deviation, structural reliability, and variance values of the variables are presented in Table 2. Because the level of structural reliability is higher than the values of 0.70 for the data obtained from the relevant scale in the research, it is seen that the measurement questions are reliable. Transformational leadership is distributed into two factors. The standardized factor loads of scale items range from 0.518-0.821.

Table 2. Mean, Standard Deviation, Structural Reliability, and Variance Values of the Variables

Variables	M	sd	r	ADV	1	2	3
1. Job Satisfaction	3.920	.539	.881	.291	1	.530**	-.490**
2. Transformational Leadership	3.752	.659	.941	.435	.530**	1	-.710**
3. Laissez-faire Leadership	2.225	.905	.768	.818	-.490**	-.710**	1

Note: Mean (M), standard deviation (sd), reliability (r), the average described variance (ADV), ** $p<0.01$

LFL has a single factor and job satisfaction has two factors. The standardized factor loads of LFL scale items range from 0.797-0.830, and standardized factor loads of job satisfaction range from 0.466-0.785. The fact that these loads are generally greater than 0.5 indicates that the validity criteria of the research model have been met. In addition, it can be indicated that the model is meaningful because t-values are 9.38 for the transformational leadership-job satisfaction, -6.88 for job satisfaction-LFL, and -13.90 for transformational leadership-LFL, during parametric testing of factor values.

All statistical analysis performed in the research was carried out with a confidence of 0.95. The findings obtained as a result of the analysis were interpreted by converting them into Tables under the purpose of the research and the questions it seeks answers to. In the research, when interpreting the analyses (descriptive statistical results) obtained from all three measurement instruments, the class range method was used under the Likert rating scale for average scores and rating.

FINDINGS

In the first phase of the research, the perceptions of administrators and teachers in schools regarding leadership practices and sub-dimensions were examined. According to the results in Table 3, administrators and teachers' views on transformational leadership practices in the institution where they work is evaluated such as "I agree (M=3.752; sd=.659)", on laissez-faire leadership practices is, such as "I don't agree (M=2.225; sd=.905)". It has been observed that the most perceived practice of transformational leadership relates to the sub-dimension of behavior-inspiration (I agree; M=3.911, sd= .598).

Table 3. Scores for Leadership Practices

LEADERSHIP BEHAVIOURS	n	M	sd
Transformational Leadership		3.752	.659
Behavior-Inspiration	200	3.911	.598
Stimulation-Understanding		3.650	.735
Laissez-Faire Leadership		2.225	.905

This result is similar to those of other researchers using the MLQ5x-Short Form of Avolio and Bass (1995). According to the results obtained, it is seen that transformational leadership practices are perceived at a higher level by the administrators and teachers. This result is consistent with the findings of Akdoğan (2002), Barnett (2003), Barnett, Marsh & Craven (2007), Cemaloğlu (2007), Locke (1999), Nir & Kronot (2006), Rowold (2007), and Srevenson & Warn (2001).

In the second phase of the research, the perceptions of administrators and teachers in schools regarding job satisfaction and sub-dimensions were examined. It is seen as the result of the review in Table 4 that the administrators and teachers perceive the overall job satisfaction in order of importance such as intrinsic satisfaction (M=3.962; sd=.537), general job satisfaction (M=3.920; sd=.539), and extrinsic satisfaction (M=3.835; sd=.681). Accordingly, their opinions on job satisfaction and sub-dimensions in the institution they work in appear as "I am satisfied".

Table 4. Scores for Job Satisfaction Practices

PERCEIVED JOB SATISFACTION	n	M	sd
Overall Job Satisfaction		3.920	. 539
Intrinsic Satisfaction	200	3.962	.537
Extrinsic Satisfaction		3.835	.681

The result of this research also shows that the administrators and teachers perceived intrinsic satisfaction at a higher level. The using their skills more than the factors evaluated, and the attaching importance to values such as effectiveness, success, authority, independence, moral values, responsibility, security, creativity, providing a social service, social status, i.e. internal factors show that the administrators and teachers do their work willingly, provide the necessary satisfaction from their work, and still respect ethical values. This result also supports the research of Adonisi (2003), Akdoğan (2002), Ayhan (2006), Billings et al. (2003), Eren (2000), Feinstein & Vondrasek (2007), and Toplu (1998).

In the third phase of the research, whether there is a meaningful relationship between the perceptions of leadership practices and job satisfaction of administrators and teachers in schools, and transformational leadership and laissez-faire leadership. In this sub-problem, One-Sample Kolmogorov-Smirnow normal distribution test was performed to determine the level and direction of perceptions related to leadership practices and job satisfaction and transformational leadership and laissez-faire leadership practices. According to the results, Spearman Analysis was used in calculations made because leadership practices and perceptions of job satisfaction did not match the normal distribution (p<0.05) (see Table 5 and 6).

Table 5. Spearman Analysis on Leadership Practices and Job Satisfaction

VariableTypes			Job Satisfaction	Intrinsic Satisfaction	Extrinsic Satisfaction
Spearman's rho	Transformational Lead.	r	.532**	.554**	.423**
		p	.000	.000	.000
	Behavior-Inspiration	r	.505**	.527**	.386**
		p	.000	.000	.000
	Stimulation-Understanding	r	.540**	.561**	.433**
		p	.000	.000	.000
	LFL	r	-.416**	-.392**	-.347**
		p	.000	.000	.000

** $p<0.01$

When the values obtained in Table 5 are examined, the following results are reached.

1. Moderate positively (p<0,01) between administrators and teachers' perception of transformational leadership practices and overall perceptions of job satisfaction and intrinsic satisfaction, and there is a sufficient positive relationship (p<0,01) between extrinsic satisfaction perceptions. As perceptions of transformational leadership practices increase, so do the perceptions of overall job satisfaction, intrinsic and extrinsic satisfaction.

2. There is also a sufficient negatively significant relationship (p<0,01) between the perceptions of the administrators and teachers regarding the laissez-faire leadership practices and the perceptions of overall job satisfaction, intrinsic satisfaction, and extrinsic satisfaction. As the perceptions of the laissez-faire leadership practices increase, overall perceptions of job satisfaction, intrinsic satisfaction, and extrinsic satisfaction decrease.

Table 6. Spearman Analysis of Transformational Leadership and Laissez-faire Leadership

VariableTypes			LFL
Spearman's rho	Transformational Lead.	r	-.559**
		p	.000
	Behavior-Inspiration	r	-.542**
		p	.000
	Stimulation-Understanding	r	-.547**
		p	.000

** p <0.01

The conclusion that has also been reached regarding transformational leadership and laissez-faire leadership perceptions in Table 6 is that there is a moderate negatively significant relationship (p<0,01) between the perceptions of the administrators and teachers regarding transformational leadership and the perceptions of laissez-faire leadership practices. As the perceptions of transformational leadership practices increase, the perceptions of laissez-faire leadership decrease. When the literature is examined, there can be many findings that there is a meaningful relationship between leadership practices and job satisfaction. For example, Bass & Avolio (2006) emphasized that one of the outcomes of leadership in their research is job satisfaction. As Barnett, Marsh & Craven (2007), Cemaloğlu (2007), Koçak (2006), and Usta (2020) stated, transformational leadership behaviors increase the overall and the intrinsic satisfaction level of the administrators and teachers from the findings of the research. Regarding the results of the literature study, this is an expected result. According to quoting of Muenjohn & Amstrong (2008, p. 5) from Ingram (1997), Kırkbride (2006), and Medley & Larochelle (1995), transformational leaders generally have a higher correlation in terms of the satisfaction, extra effort, and effectiveness of their employees than other leadership styles, and therefore have a higher relationship in terms of leadership success.

In the research, it was determined that laissez-faire leadership practices that were recognized have a negative significant relationship with job satisfaction. This result supports the research result of Çelebi (2012) because he also states that school principals often exhibit transformational leadership, and that job satisfaction has a negative significant relationship with the laissez-faire dimension while having a positive meaningful relationship with transformational leadership behavior.

In the final step of the research, the role of laissez-faire leadership as a mediator between transformational leadership practices and job satisfaction perceptions is investigated. It is stated by many researchers that the mediator variable can show all or only one part of the observed relationship between the dependent and independent variables. In addition, the state of the reflection of the entire relationship is defined as full mediation, and the reflective state of some of it is defined as partial mediation. To talk about the mediation effect, certain conditions must be met. These conditions called the steps of Baron and Kenny (1986) are listed as follows.

1. The independent variable must affect the mediating variable.
2. The independent variable must affect the dependent variable.
3. If a non-meaningful relationship occurs between the independent and dependent variable when the mediating variable is included in the regression analysis in the second step, the full mediation effect can be mentioned, and the partial mediation effect can be mentioned if the relationship between the independent and the dependent variable decreases.

In general, this three-step method of Baron and Kenny (1986, p. 1176) is used in academic research and is decided according to the results of the analysis. The model of the research was created in this context as shown in Figure 1. In the model investigated, the transformational leadership practices (TLP) were defined as the independent variables, job satisfaction as the dependent variable, and the laissez-faire leadership (LFL) practices as the mediating value. In this context, the relationship between TLP and job satisfaction, TLP and LFL practices, and the LFL practices and job satisfaction have been tested with sample linear regression analysis (see Table 7).

Table 7. Simple Linear Regression Analyses

Independent Variables	R^2	Cor. R^2	β	Stn. Error	F	t	p
TLP (a, b)	.266	.262	.422	.050	71.769	8.472	.000
TLP (a, c)	.338	.335	-.798	.079	101.108	-10.055	.000
LFL (a, b)	.159	-.155	-.238	.039	37.453	-6.127	.000
TLP-LFL (a, b)	.281	.274	-.238	.039	38.486	-6.127	.000
TLP			.351	.061		5.771	.000
LFL			-.089	.044		-2.021	.000

Note: (a) Estimated: (costant), (b) Dependent Variable: Job Satisfaction, (c) Dependent Variable: Laissez-Faire Leadership

When Table 7 is examined, it is seen that the transformational leadership practices (TLP) meaningfully predict job satisfaction (β =.422, t =8.472, p =.000), TLP predicts the laissez-faire leadership (LFL) practices (β = -.798, t = -10.055, p =.000), LFL practices predict the job satisfaction (β = -.238, t = -6.127, p =.000), and TLP with the LFL practices predict together the job satisfaction (TLP: β =.351, t =5.771, p =.000; LFL: β = -.089, t = -2.021, p =.000).

After the correlational and regressive relationship is achieved between all variables, the results of the mediation test are summarized in a single table (Table 8). In addition, as well as to the conditions that must be met to talk about the mediation effect, the Sobel test and Bootstrap method were also used, whether the indirect effect of the independent variable is meaningful on the dependent variable through the mediator variable. When examining the mediation effect with the Bootstrap method, a three-way evaluation is made.

Tablo.5 The Mediating Role of LFL in the Relationship between Transformational Leadership and Job Satisfaction

Outcome Variables

LFL	R	R²	MSE	F	df1	df2	p
Model Summary	.581	.338	.545	101.108	1.000	198.000	.000
Model	β	se	t	p	LLCI	ULCI	Standard. β
constant	5.218	.302	17.267	.000	4.622	5.814	-
Transformational Leadership	-.798	.079	-10.055	.000	-.954	-.641	-.581

Job Satisfaction	R	R²	MSE	F	df1	df2	p
Model Summary	.530	.281	.211	38.427	2.000	197.000	.000
Model	β	se	t	p	LLCI	ULCI	Stand. β
constant	2.804	.298	9.409	.000	2.216	3.391	-
Transformational Leadership	.351	.061	5.771	.000	.231	.470	.429
LFL	-.090	.044	-2.021	.044	-.177	-.002	-.150

TOTAL EFFECT MODEL

Job Satisfaction	R	R²	MSE	F	df1	df2	p
Model Summary	.516	.266	.215	71.770	1.000	198.000	.000
Model	β	se	t	p	LLCI	ULCI	Stand. β
constant	2.337	.190	12.319	.000	1.963	2.711	-
Transformational Leadership	.422	.050	8.472	.000	.324	.520	.516

TOTAL, DIRECT AND INDIRECT EFFECT OF TRANSFORMATIONAL LEADERSHİP ON JOB SATISFACTION

LFL	β	SE	t	p	LLCI	ULCI	c_cs
Total Effect of X on Y	.422	.050	8.472	.000	.324	.520	.516
Direct Effect of X on Y	.351	.061	5.771	.000	.231	.470	.429

Indirect Effect of X on Y

LFL	β	BootSE	BootLLCI	BootULCI
	.071	.035	.004	.193

Completely Standardized Indirect Effect of X on Y

LFL	β	BootSE	BootLLCI	BootULCI
	.087	.044	.005	.179

Note: Level of confidence for all confidence intervals in output= 95.000

Additionally, the collinearity is examined to determine whether there are multiple linear connectivity problems in the model within the scope of the analysis of the data (T>.200; VIF<10). The tolerance and VIF (variance width factor) values obtained in this research gave results that confirmed that there are no multiple connections between the independent variable and mediator variable (T of TLP =.662, VIF =1.511; T of LFL =.662, VIF =1.511). After this process, by calculating the VAF value (Variance Account For), it is determined that the value is 83.175 (.351/.422x100). Since VAF>80% is, it can be stated that the full mediation effect was detected in this research (Preacher and Hayer, 2008).

Another method used to determine the mediation effect is the Sobel test. For this, a simple and fast program is used. The values (a =.422; b = .087; SE$_a$=.050; SE$_b$ =.044) are respectively entered into the Sobel test program and 1.925 (p=.027) is found as a result of the procedure. Since the significance value obtained (p) is less than .05, it can be said that there is a mediating effect in the research.

DISCUSSION AND CONCLUSION

In the research, the high level of realization of the transformational leadership dimension (factor) is in line with the expectations. Because it is a natural management behavior for the managers to talk optimistically about the future, to inform their employees about what needs to be achieved, to put forward their visions, and express their confidence that the goals will be achieved. Additionally, the ability of the managers to realize the transformational and laissez-faire leadership traits together shows also that the managers are a source of morale, motivate their employees using the emotional elements, and create a common vision.

When the results are evaluated in general, it can be considered as an important development in terms of the management that the managers exhibit the most transformational leadership behaviors. Today, all institutions, including the education system, especially of the USA and European countries, are undergoing a rapid change within a dynamic structure. The effects of the globalization movement in this change are undeniable. Therefore, in an environment where such a process of change prevails, the managers will also need the change. In this context, it is believed that transformational managers are required. This is also the necessity of the Information Age.

The managers of the future are expected to build trust in their institutions, act with integrity, inspire their employees, encourage innovative thinking and guide their employees. This means that managers become transformational leaders. As a result of the research, it was stated that the managers show these characteristics. This result is a sign that managers are open to change and innovation. Further improvement of these features of the managers will lead them to demonstrate more effective management.

In addition, within the scope of today's developments, managers need to be constantly trained and manage changes according to the conditions of the age to maintain their transformational characteristics. For this purpose, the goal should be to focus on transformational leadership behaviors and to remove them from transactional leadership characteristics that are seen as more compatible with the bureaucratic structure and status quo practices. According to the findings of the research, the perceptions of both administrators and teachers support this assessment.

The results obtained for the job satisfaction in this research also support other research findings that relate to this subject in the literature. In many kinds of research, the perceptions of job satisfaction are sorted according to the values obtained and the order of importance and first the intrinsic job satisfaction, just after the extrinsic job satisfaction perceptions are explained. It can be said that intrinsic job satisfaction is an important and positive form of perception, especially for the schools. It can be evaluated that the managers and teachers who perceive the intrinsic satisfaction more will also have positive feelings towards their school, administrators, and colleagues. In addition, it can be said that the expectations of the employees in the organizations with high intrinsic satisfaction are generally met.

Besides, many researchers stated that job satisfaction is perceived at different levels in the institutions, evaluated as an effective factor positively, and has a decisive and positive relationship when evaluated together with other organizational factors. As Hughes (2006) points out, one of the best ways to make instructiveness strong is to improve the job satisfaction of trainers. Job satisfaction can also do more than keep qualified trainers in the profession and improve their educational function.

The organizational effectiveness in schools of the Information Age is based on both leadership behavior and employee job satisfaction, and administrators play an important role in ensuring teachers' job satisfaction. For this purpose, administrators have to demonstrate management in a way that ensures job satisfaction in their schools. In this context, the transformational leadership behavior of managers as long as possible can increase the job satisfaction of teachers. In this way, the desired effect can be achieved from the schools.

As Dilek (2005) noted, the main factor that improves the effectiveness of the leader is to know the typical characteristics of employees, work, and organization. Many researchers believe that these characteristics increase the relationship between leader behavior and job satisfaction. However, it is not enough for school principals to consider transformational leadership elements important. It is also important that they are effective in achieving transformation and turning it into action. In addition, at a time when development and change are so rapid, the school administrators need to demonstrate transformational leadership as well as other leadership behaviors (Altun, 2003).

From the research results presented examples above to determine the relationship between leadership and job satisfaction, it can be said that there is a positive relationship between different leadership approaches and job satisfaction and that the derived result of research conducted supports other research findings. Additionally, according to many authors, it is evaluated that transformational leadership is likely to shape business situations that provide individual satisfaction and thus allow personal effectiveness to flourish. According to the researchers examined and the findings of the research, it can be concluded that transformational leadership practices are an influential factor in the job satisfaction of administrators and teachers and positively affect job satisfaction.

Therefore, the organizations should adopt a leadership approach that gives the necessary importance to the employees if they want to increase the effectiveness of the employees and ensure job satisfaction. The managers should accept a transformational management idea that directs, inspires them, provides individual support, and encourages the employees to be their leaders, instead of managing their employees. Today, it is evaluated that a successful leadership approach requires the leadership behaviors that determine the vision for the future, guide their employees in line with this vision, create a business environment that allows them to bring out their creativity with intellectual stimulation, trust them, and can communicate well with them. This can be achieved with transformational leadership practices, as highlighted above.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author received no financial support for the research, authorship, and/or publication of this article.

Statements of publication ethics

I hereby declare that the study has no unethical issues and that research and publication ethics have been observed carefully.

Ethics Committee Approval Information

Ethical permission of the research

In this research, all the rules specified to be followed within the scope of "Higher Education Institution Scientific research and Publication Ethics Directive" were complied with. None of the actions specified under the heading "Actions Contrary to Scientific Research and Publications Ethics", which is the second part of the directive, have been taken.

Ethics committee permission information

Name of the committee that made the ethical evaluation: Bolu İzzet Baysal University Human Research Ethics Committee in Social sciences

Date of ethical evaluation decision: 04.11.2021

Ethics assessment document issue number: 2021/396

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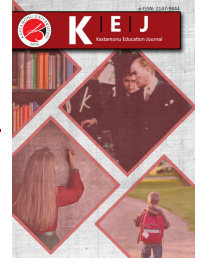
| Research Article / Araştırma Makalesi|

Sustainable Leadership And Learning Organization Relationship in Schools: A Mixed Method Research

Okullarda sürdürülebilir liderlik ve öğrenen örgüt ilişkisi: Bir karma yöntem araştırması

Behiye DAĞDEVİREN ERTAŞ[1], **Murat ÖZDEMİR**[2]

Abstract

Purpose: The purpose of this research is to determine, according to the views of primary school teacher, the sustainable leadership behaviors of school principals and the relationship between sustainable leadership and the formation of schools as learning organizations.

Methodology: This study aimed to determine the relationship between the sustainable leadership behaviors of school principals and the formation of schools as learning organizations in public primary schools located in Yozgat, Turkey. A mixed-methods approach, was employed in the study, which utilized both quantitative and qualitative methods. The quantitative portion of the study utilized a "predictive correlational design," while the qualitative portion utilized a "phenomenological design" to examine the research question.

Findings: The research findings indicate that school principals exhibit high levels of sustainable leadership behavior based on the average scores given by teachers. In terms of dimensions, the highest average scores were obtained for deep learning. According to teachers opinions, the average scores for a learning organization were also found to be high. The highest average score in terms of dimensions was for team learning. A positive relationship was discovered between sustainable leadership and organizational learning. Qualitative results indicated that school principals who scored high in all dimensions of sustainable leadership provided more answers. Similarly, when examining qualitative results related to organizational learning, it was discovered that school principals who scored high in all dimensions of sustainable leadership also provided more answers.

Highlights: The literature on sustainable leadership in educational organizations is very limited. Therefore, sustainable leadership perceptions in educational organizations can be examined by considering different concepts together. The relationships between these concepts and their impact can also be examined. Based on the views of primary school teachers, this study suggests that sustainable leadership has an impact on the learning organization. New studies can be conducted on other samples to compare the results of this study, and to investigate the impact of sustainable leadership on educational organizations further.

Öz

Çalışmanın amacı: Bu araştırmanın amacı, sınıf öğretmenlerinin görüşlerine dayanarak okul müdürlerinin sürdürülebilir liderlik davranışları ile öğrenen örgüt arasındaki ilişkiyi belirlemektir.

Materyal ve Yöntem: Bu araştırma, Yozgat'taki kamu ilkokullarındaki okul müdürlerinin sürdürülebilir liderlik davranışları ile okulların öğrenen örgüt olmaları arasındaki ilişkiyi belirlemeyi amaçlamaktadır. Bu amaçla, araştırmada hem nicel hem de nitel yöntemlerin birlikte kullanıldığı "karma model" kullanılmıştır. Nicel bölümde, "yordayıcı ilişkisel desen" kullanılırken, nitel bölümde ise "olgu bilim deseni (fenomenoloji)" kullanılmıştır.

Bulgular: Araştırma sonuçlarına göre, okul müdürlerinin sürdürülebilir liderlik davranışları, öğretmen görüşlerine göre yüksektir. Boyutlar arasında en yüksek puan derin öğrenmeye yönelik olarak belirlenmiştir. Analizler, öğretmen görüşlerine göre öğrenen örgüte yönelik puan ortalamalarının yüksek olduğunu ortaya koymuştur. Takım halinde öğrenme boyutunda en yüksek puan saptanmıştır. Araştırma sonucunda sürdürülebilir liderlik ile öğrenen örgüt arasında pozitif bir ilişki olduğu bulunmuştur. Sürdürülebilir liderlik ile ilgili nitel bulgular, bütün boyutlarda yüksek sürdürülebilir liderlik puanı olan okul müdürlerinin verdiği yanıtların daha fazla olduğunu göstermektedir. Öğrenen örgüt ile ilgili nitel bulgular incelendiğinde bütün boyutlarda yüksek sürdürülebilir liderlik puanına sahip okul müdürlerinin verdiği yanıtların daha fazla olduğu tespit edilmiştir.

Önemli Vurgular: Literatürde, eğitim örgütlerinde sürdürülebilir liderlik ile ilgili yapılan çalışmalar oldukça sınırlıdır. Bu nedenle, farklı kavramların birlikte ele alındığı bir yaklaşımla sürdürülebilir liderlik algıları eğitim örgütleri bağlamında incelenebilir. Bu çalışmada, sınıf öğretmenlerinin görüşlerine dayalı olarak yürütülen araştırma sonucunda elde edilen bulgular, sürdürülebilir liderliğin öğrenen örgüt üzerinde etkili olduğunu göstermektedir. Bu sonuçlara dayanarak, ileride yapılacak yeni çalışmalar, farklı örneklemler üzerinde elde edilen sonuçlarla karşılaştırılarak, sürdürülebilir liderliğin eğitim örgütleri için önemi ve etki gücü hakkında daha kapsamlı bilgiler sağlayabilir.

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INTRODUCTION

In today's world, schools are influenced by political, economic, political, sociological, and technological factors. These factors influence a school-related situation, such as the quality of instruction, student achievement, student learning, and teacher productivity. After school administrators evaluate these conditions, they can use the available resources to make schools effective and efficient organizations. For this reason, school administrators should leave the traditional management approach aside and adopt leadership. Sustainable, a concept that has entered the leadership literature in recent years, attracts the attention of researchers as a type of leadership that can balance moral, educational, political, managerial, and social needs.

Previous studies have focused on definitions of sustainable leadership (Davies, 2009; Hargreaves, 2009; Hargreaves & Fink, 2012); its principles (Hargreaves & Fink, 2003a); focus on the contributions of sustainable leadership to the organization (Armani et al., 2020) and organizational change (Carter et al., 2012). In addition, studies emphasize the importance of sustainable leadership for forming organizational culture (Morsing & Oswald, 2009) and effective strategic decisions in organizations (Peterlin et al., 2015). In addition, previous literature has shown that sustainable leadership is a critical predictor of organizational cynicism (Gaan, 2015). In addition, in the literature, sustainable leadership mediates the relationship between active participation in organizational decision-making and creative work behavior (Wang et al., 2021).

Studies on sustainable leadership in educational organizations have begun to be carried out, albeit limited (Lambert, 2012; Lee & Louis, 2019). Researchers focused on the relationship of sustainable leadership with lifelong learning in educational organizations (Taşçı & Titrek, 2019), its impact on social innovation (Iqbal & Piwowar-Sulej, 2022), and the methods of realizing reflective instructional practices (Ayers et al., 2020). In addition, its results on the contribution of sustainable leadership to school success (Goolamally & Ahmad, 2014), improving school capacity (Conway, 2015), school effectiveness (Nartgün et al., 2020), and positive student outcomes (Mohd Yaakob et al., 2020) are remarkable.

Although a significant amount of research has been conducted in educational organizations on sustainable leadership in recent years, most previous research has focused on sustainable leadership in university-level education (Leal Filho et al., 2020; Segovia-Pérez et al., 2019). Therefore, it is possible to say that research on sustainable leadership in primary school education is not sufficiently included in the literature. However, primary schools are seen as the most crucial education step in Turkey and the world. Researching sustainable leadership at this level will bring a new perspective to the literature. As a result, primary school principals' sustainable leadership may have unique factors that are not yet fully explored and need to be explored. In addition, although few studies focus on the relationship between school effectiveness and sustainable leadership (Nartgün et al., 2020), more research on sustainable leadership is needed. First, research on sustainable leadership and its various organizational effects **have** increased (Çayak, 2021). However, there is limited empirical research on the relationship between sustainable leadership and learning organization (Iqbal & Ahmad, 2021). Therefore, it can be said that there is a gap in the literature about how these two variables appear in schools.

This research was carried out on teachers, one of the most critical stakeholders of the education-teaching processes. Within the scope of the research, a relationship to be determined between the sustainable leadership behaviors of school principals and learning organizations will bring a new perspective to the literature. In addition, the sustainable leadership behaviors of school principals are considered necessary in our age to develop lifelong learning practices that ensure the continuity of society and the organization. Considering sustainable leadership practices in school policies and structuring schools as learning organizations can mobilize policymakers to ensure permanent and sustainable success. As practitioners, school principals can contribute to structuring schools as learning organizations by giving more importance to the sustainable leadership element. Suppose learning organizations are perceived as an output of sustainable leadership. In that case, school administrators may emphasize the importance of learning and more willingly realize their school's effort to become a learning organization. Therefore, school principals can ensure the permanence of student success and make their school a learning school as sustainable leader who develops and supports the strengths of the stakeholders in their schools and ensures the effective and efficient use of resources. In this direction, the current research aims to determine the sustainable leadership behaviors of school principals and the **relationships** between sustainable leadership and learning organization according to the views of primary school teachers. In this context, answers to the following questions were aimed.

1. Is sustainable leadership in primary schools a significant predictor of teachers' views on the learning organization?
2. What is the experience of school principals on sustainable leadership and learning organization?

Conceptual Framework

Sustainable Leadership

Due to the leader's influence on the organization and employee behavior, sustainable leadership has recently drawn the interest of organizational and management scientists. According to Hallinger and Suriyankietkaew (2018), the notion known as "Rhineland management" is the foundation of sustainable leadership. According to Shrivastava (1995), sustainable leadership is "an approach based on the idea that the organization is a natural part of the world." Social, physical, ethical, and business factors all support the premise that organizations produce value based on sustainable knowing, developing, and producing knowledge. This strategy highlights managers' varied values and behaviors, which emphasizes a long-term perspective of sustainable

leadership, balanced results, ethical behavior, and corporate social responsibility (Hallinger & Suriyankietkaew, 2018). When making present-day and long-term decisions for a company, sustainable leadership enhances the lives of all stakeholders (McCann & Holt, 2010). An atmosphere where the organization shares its vision and objective can be developed through the sustainable leadership approach. Through agreement, communication, and persuasion, the leader may foster a vision and encourage cooperation among the organization's members to achieve the goals of the organization. The foundation of sustainable leadership is the notion that the organization is an organic component of the environment. According to Shrivastava (1995), organizations can produce lasting value by generating knowledge that advances social, physical, ethical, and commercial causes. Hargreaves and Fink (2003) emphasize learning to live sustainably. Learning to live sustainably means learning to respect and protect the world that gives us life. In order to provide long-term benefits for economic and ecological life, it is necessary to coexist and live together without harming the natural environment by working with other people. Sustainable leadership increases diversity within an organization and enhances people's abilities, enabling individuals to adapt and succeed in increasingly complex work and other environments. This requires the leadership to build sustainable relationships with all stakeholders inside and outside the organization (Hargreaves, 2006).

Hargreaves and Fink (2003) introduced the idea of sustainable leadership to education for the first time. According to researchers, the educational environment in sustainable leadership is diverse, there is a common commitment to good ideas, and active engagement in effective practices where learning and development are shared. The characteristics of sustainable leadership in educational institutions were defined by Hargreaves and Fink as "depth, organizational survival, inclusiveness, justice, diversity, resourcefulness, and protection." After that, Davies (2009) presented a different sustainable leadership framework. According to Davies, effective leadership creates a culture of leadership founded on moral principles that promote the school's long-term growth and guarantee everyone access to achievement. The components of sustainable leadership, according to Davies' model, are "outcomes are not just outputs; balancing short- and long-term goals; processes are not plans; passion for making a difference; humility and will; strategic timing and strategic abandonment; capacity building and participation; they described it as "building sustainability." The six fundamental elements of Lambert's (2011) sustainable leadership model are "diversity and protection," "personnel capacity building," strategic distribution, and consolidation, as well as "creating long-term goals from short-term goals." A vision that reveals and develops the potential of each member of the business is one of the common characteristics of the models of sustainable leadership that have been put forth. Courage is also passion and resolve to take on a unifying and integrating function. In this context, individuals and schools continue to develop their abilities and cope with difficulties, even in complex situations with sustainable leadership practices. This creates the ability and capacity to succeed in new and challenging situations (Davies, 2007). Furthermore, sustainable leadership increases diversity within a school and enhances human ability, enabling individuals to adapt and succeed in increasingly complex work and other environments. This requires the leadership to build sustainable relationships with all stakeholders inside and outside the organization (Hargreaves, 2006).

Researchers mostly examine sustainable leadership in higher education institutions when looking at the literature on sustainable leadership in education (Leal Filho et al., 2020; Segovia-Pérez et al., 2019). For instance, Dalati (2017) investigated the connection between enduring leadership and organizational trust in the setting of Syrian universities. In addition, Mohd Yaakob et al. (2020) determined the critical factors of sustainable leadership in their study in K12 schools and stated that student outcomes are the most important. In addition, Nieto (2007) contributed to the sustainable leadership literature by examining the contributions of sustainable leadership to students and society in depth.

Schools as Learning Organizations

The learning organization has attracted the attention of organizations and management scientists for a long time because of its impact on employee behavior. The concept of learning organization was first used by Senge (1990). According to Senge (1990), learning organizations are organizations in which employees encourage learning and restructure knowledge. These are "organizations that adapt to constantly changing working conditions and produce the information they need to meet the needs of stakeholders." The intellectual basis of the concept belongs to Argyris and Schön (1978). According to the theory, they emphasized the importance of "single-loop" and "double-loop" learning in increasing the learning capacity of organizations. While single-loop learning minimizes organizations' existing policies and procedures, double-loop learning allows radical changes to be made by inquiring about the organization itself. Based on this theory, according to Senge (2018), the learning organization is built on five basic disciplines. These; It is expressed by the author as "personal mastery" "mental models" "shared vision" "team learning" and the fifth discipline, "system thinking." In learning organizations, these disciplines develop about each other. Learning organizations are organizations where people aim to achieve the success they want, they constantly improve their skills, new and developing ideas are supported, common goals are released, learning methods are constantly learned (Bozkurt, 2003), and they are those that facilitate the learning of all their members and constantly transform themselves to achieve their strategic goals. Organizations (Pedler et al., 1989). Organizations must acquire and use new information to ensure their continuity in the competitive conditions required by the age and adapt to changes and developments. Therefore, organizations have to eliminate traditional organization formations, renew themselves by learning, and ensure their effectiveness to realize their goals (Bozkurt, 2003). The most effective way of coping with the innovations that the age of technology has brought and will bring is to try to achieve learning by determining the need for learning (Braham, 1998).

One of the other models associated with the learning organization is the Bui and Baruch (2010) systems approach. Researchers state that they developed a model for this approach based on Senge's five disciplines (Bui & Baruch, 2010). Another model,

Örtenblad (2004), argues that the learning organization consists of four dimensions: organizational learning, learning in the work environment, learning environment, and learning structure. All dimensions are interrelated. Four dimensions must come together to form a learning organization (Örtenblad, 2004). Another model is Watkins and Marsick's (2003) model. In the model, the necessity of seven conditions is expressed in creating a learning organization. These; include creating continuous learning opportunities, encouraging communication and asking questions, creating a desire for cooperation and learning as a team, systematizing learning and information sharing, delegation of authority to create a common vision, encouraging the organization to cooperate with its environment, the leader's learning from an individual level to an individual -to bring them to the team-organization level (Marsick & Watkins, 2003).

Senge et al. (2012) employed the idea of learning organization for the first time in the context of education. According to Senge et al. (2012), a learning school is one in which everyone associated with it—both internal and external stakeholders—constantly improves and broadens their awareness and skills while realizing their shared responsibility for the future of both themselves and their societies. Self-renewal, which has become essential for the success of a school, is strongly associated with the development of the learning capacity of the staff and their taking responsibility for each other's professional learning. Schools that foster learning capacity present the conditions and traits of learning schools as well as aid in understanding how schools learn (Southworth, 2000). In order to achieve self-renewal through continuous learning, promote learning at any time and in any setting, give improving human resources first priority, be acceptable to all members of the school community, and prevent the school from going into crisis. Teams of teachers work together to benefit children (DuFour, 2004). As a result, the school should be viewed as a professional learning community where instructors can collaborate and learn from one another. There is no such thing as a non-learner because everyone, from the servant who works in the learning school to the student, parent, instructor, and school principal, is a learner.

Researchers related to the definition of learning schools and their characteristics (David & Lazarus, 2002; Töremen, 2001; Senge et al., 2012), the characteristics of learning and non-learning schools (Illeris, 2007), barriers to learning schools (Çam-Tosun & Altunay, 2017) conducted researches. In addition, studies examining the roles of leader teachers in creating a learning organization (Taylor et al., 2011) and the perceptions of teachers and school principals regarding the learning school (Banoğlu & Peker, 2012; Metin & Bahat, 2019) draw attention. In addition, Korkmaz (2009) contributed to the leadership literature by examining school principals' leadership styles and learning school characteristics.

Sustainable Leadership and Learning Organization Relationship

Innovation is encouraged in schools with sustainable leaders. Schools are structured as organizations that learn fast and seek change. The arrow of change only moves forward (Hargreaves, 2007). Glickman (2002) highlights the need to exchange information with teachers, students, families, and support staff to understand student learning better and foster more incredible academic progress. Innovation is encouraged in schools with sustainable leaders. Schools are structured as organizations that learn fast and advocate change-seeking. The change arrow only moves forward. (Hargreaves, 2007). Thus, sustainable leadership may require schools to be structured as learning organizations.

In an organizational culture that values lifelong learning, acknowledges teachers as architects of the school culture, and promotes a supportive and collaborative culture, the best examples of leadership behaviors can be found (Silva et al., 2000). Organizational leaders create a shared mission, motivate staff, and foster a culture where everyone can support one another's lifelong learning. In this approach, the leader fosters intellectual growth among all members of the organization and guarantees its ongoing development (Buzan et al., 1999). As a result, improving the learning capacity of top schools contributes to our understanding of how students learn as well as our ability to communicate the requirements and traits of learning institutions (Southworth, 2000). To prepare a school culture that constantly renews itself via learning and encourages learning, the learning school does this.

METHOD

Model of the Research

This study tried to determine the relationship between the sustainable leadership behaviors of school principals in public primary schools in Yozgat and the schools being learning organizations, and the "mixed model" in which quantitative and qualitative methods were used together was used in the research. In mixed studies, quantitative and qualitative data collection techniques are applied simultaneously or one after the other. For example, in the quantitative part of the study, "predictive correlational design" and "phenomenology" was used in the qualitative part.

Research Sample and Study Group

In this section, while the population and sample information and demographic characteristics of the quantitative research are included, the information about the study group of the qualitative research is presented

Sample of Quantitative Research

The target population of the research is 1685 primary school teachers working in primary schools in Yozgat; The sample consists of 313 primary school teachers. Because it was impossible to reach the entire target population in the research, the applications

were carried out on the sample selected from the population. This sample size was determined based on the assumption (Erkuş, 2017) that 313 teachers could represent 1685 teachers with α = .05 significance and a 5% margin of error. It was determined that 385 of the scales distributed and collected personally by the researcher were suitable for analysis, and the analyzes were carried out on these data. In addition, "outlier (extreme) case sampling" one of the purposive sampling methods, was used in the qualitative phase of the research. The outlier sampling technique is used when searching for case studies that differ from other case studies by their predominant features. Extreme or outlier situations reveal richer data for the researcher. Thus, it helps to examine the research problem in a more in-depth and multidimensional way (Özmantar, 2018; Yıldırım & Şimşek, 2016). Sustainable leadership scale average scores of the schools included in the research sample were listed, with ten school principals who got the highest score from the scale and ten school principals who got the lowest score from the scale; A total of 20 school principals were interviewed.

Table 1. Demographic Characteristics of the Teachers

Variable	N	Percentage (%)
Gender		
Female	164	42.6
Male	221	57.4
Age		
22-26 between	34	8.8
27-31 between	61	15.8
32-36 between	87	22.6
37-41 between	71	18.4
42-46 between	46	11.9
47 +	86	22.3
Experience		
1-5 years	65	16.9
6-10 years	82	21.3
11-15 years	67	17.4
16-20 years	64	16.6
21 and over	107	27.8
Year of Study at School		
1-5 years	239	62.1
6-10 years	76	19.7
11-15 years	44	11.4
16-20 years	11	2.9
21 and over	15	3.9
Number of Teachers in the School		
10 and less	65	16.9
between 11-20	139	36.1
between 21-30	61	15.8
30 and over	120	31.2
Total	385	100

As seen in Table 1, while the majority of the teachers who voluntarily participated in the research were male (*f*=221) and aged 32-36 (*f*=87), most of the teachers had more than 21 years of teaching experience (*f*=107). In addition, while most teachers have been working in their current schools for 1-5 years (*f*=239), there are 11-20 teachers (*f*=139) in their schools.

Working Group of the Qualitative Stage. In the qualitative phase of the research, "outlier (extreme) case sampling" one of the purposive sampling methods, was used. The outlier sampling technique is used when searching for case studies that differ from other case studies by their predominant features. Extreme or outlier situations reveal richer data for the researcher. Thus, it helps to examine the research problem in a more in-depth and multidimensional way (Özmantar, 2018; Yıldırım & Şimşek, 2016). Sustainable leadership scale average scores of the schools included in the research sample were listed, with ten school principals who got the highest score from the scale and ten school principals who got the lowest score from the scale; A total of 20 school

principals were interviewed. Table 3 presents the characteristics of the ten school principals who got the highest average from the sustainable leadership scale in the qualitative study group. All of the school principals who received high scores from the sustainable leadership scale interviewed in the study are male. The age of school principals varies between 42 and 61. Management experience ranges from 5 years to 32 years. According to the teachers' opinions, the average score they got from the SLS varies between 3.80 and 4.10.

Data Collection Tools

In the study, the Sustainable Leadership Scale in Schools (SLS), developed by Dağdeviren-Ertaş and Özdemir (2020), was utilized to examine the sustainability behaviors of school principals as perceived by teachers. Additionally, the "Learning Organizations Questionnaire" developed by Güçlü and Türkoğlu (2002) was employed to determine teachers' opinions regarding their schools being a learning organization. Finally, in the qualitative part of the research, the researchers developed a semi-structured interview guide to identify the activities carried out within the scope of sustainable leadership.

Sustainable Leadership Scale (ASLÖ). Firstly, SLS was used to evaluate school principals' sustainable leadership characteristics according to teachers' perceptions. OSLS includes four dimensions and 26 items. The dimensions of SLS are human resource development, strategic deployment, deep learning, and environmental-social responsibility. ASLS is a 5-point Likert-type scale ranging from strongly disagree (1) to agree (5) completely. The sample item is as follows; "It encourages teachers to work for the benefit of all people, not just for the benefit of their school." We performed CFA to test the construct validity of the SLS. The results showed that the four-factor structure ($χ2/sd$ =2.16, RMSEA=0.03, CFI=0.99, GFI=0.92, IFI=0.99) showed a perfect fit. The Cronbach alpha coefficient of this scale is 0.90.

Learning Organizations Questionnaire (LOQ). Developed by Güçlü and Türkoğlu (2002) for the first time, TCA was used to determine teachers' opinions about their schools being a learning organization. SCA consists of 42 items from 5 dimensions. The dimensions of SCA are personal mastery, mental models, shared vision, systems thinking, and team learning. SCA is a 5-point Likert-type scale ranging from never (1) to always (5). We performed CFA to test the construct validity of the TCA. The results showed a good fit for the four-factor structure ($χ2/sd$= 2.04, RMSEA=0.06, CFI=0.98, GFI=0.80, IFI=0.98). The Cronbach's alpha coefficient of this scale is 0.97

Procedures and Data Analysis

Processing and Analysis of Quantitative Data

Quantitative data for the research were collected by administering the SLS and LOQ to primary school teachers in primary schools across 14 districts of the Yozgat province.

The qualitative research data was collected from the school principals who work in the schools included in the research universe and whose sustainable leadership scores were evaluated by the teachers. The qualitative study group of the research consists of 10 school principals who got the highest score from the sustainable leadership scale scored by the teachers and ten school principals who got the lowest score from the sustainable leadership scale. The interviews were carried out by the researcher voluntarily, with the semi-structured interview form prepared by the researcher. All interviews were recorded (via the researcher's mobile phone with a voice recording feature) with the permission of each participant. While the most extended interview lasted 1 hour and 20 minutes, the shortest was 20 minutes. A total of 9 hours and 25 minutes of interviews were recorded. Written transcripts of each audio recording were taken and converted into text, and then the participants were read, and their consent was obtained. Interview transcripts were analyzed one by one.

Before starting the analysis of quantitative data in the research, data control needed to be carried out. Afterwards, outlier analysis of the data, normality, covariance (homogeneity), and linearity assumptions were examined. In order to determine which of the parametric or non-parametric (non-parametric) analysis methods of the data obtained in the research will be analyzed, the normal distribution characteristics were examined. The assumption of normality can be examined in different ways. In this study, the values of "skewness" and "kurtosis" were taken into account. The skewness and kurtosis values of ASLÖ and SCA are presented in Table 2.

Table 2. Skewness And Kurtosis Values Of SLS And LOQ

	N	Sd	Min	Max	Mean	Variance	Skewness	Kurtosis
Sustainable Leadership	385	.44	1	5	3.57	.20	1.09	1.93
Learning Organizations	385	.49	1	5	4.10	.24	-.601	.565

The values of skewness and kurtosis for each dimension of the SLQ and LOQ are between 3, as shown in Table 2. Therefore, if the skewness and kurtosis coefficients are below or equal to 3, the scores are considered to not deviate significantly from the normal distribution (Kline, 2011). In light of this, it was considered that employing parametric tests to analyze the research's data would not be harmful. Additionally, methods for multiple regression analysis were used to see if teachers' opinions of the learning

organization were significantly predicted by school administrators' sustainable leadership behaviors. It investigated whether the data produced a multicollinearity issue in order to apply the analysis. Regression analysis was carried out after it was established that there was no multicollinearity issue because the tolerance value of the data was above.20, the VIF value was under four, and the CI (Condition Index) value did not exceed 30 (Hair et al., 2010). The SPSS 22.0 program was used in this study to conduct analyses pertaining to sustainable leadership and learning organizations. Confirmatory factor analysis (CFA) was also carried out using the LISREL 8.7 program to make sure the scales' construct validity.

Qualitative data process and analysis. The transcripts of the interviews with the school principals interviewed according to the order of the sustainable leadership scale mean scores were analyzed using the "descriptive analysis" technique for sustainable leadership and learning organizations. In addition, the participants' views from the interview transcripts were presented with direct quotations. SM code is given for each school principal, and numbers from SM1 to SM20 are given**.**

The four elements of sustainable leadership, which were produced by the researchers and exposed as a theme, were determined in order to determine the activities performed within the scope of sustainable leadership. Each feature's corresponding data is listed under the appropriate theme. The "credibility" criterion was ensured through the preparation of the semi-structured interview form with the help of expert opinions, the research participants' voluntary participation, their signing of the voluntary participation form for this purpose, the face-to-face interviews, and the audio recordings with their permission. The deliberate sampling strategy was chosen to ensure that the data were transmitted by remaining true to their nature in order to meet the "transferability" criterion in the research. In order to provide the "consistency" criterion in the research, it was ensured that the researchers worked together continuously in the process, from the creation of the data collection tool to the data analysis, and tried to reach a consensus when necessary. The coding was done separately by the researchers. In order to provide the "confirmability" criterion, the codings for the themes were reviewed with the researchers, and the codes that were thought to be unrelated were re-evaluated. Later, the same data were analyzed by a faculty member. Then, the researchers came together, re-evaluated the coding, and reached a consensus when different opinions emerged. The same procedures were carried out for the five dimensions of the learning organization.

FINDINGS

This section examines the research findings under two separate headings: quantitative and qualitative.

Quantitative Findings

In this study, which focuses on the relationship between sustainable leadership and learning organization, first of all, the participant's views on the two variables and whether there is a statistically significant relationship between the sub-dimensions of SLS and LOQ were analyzed based on descriptive statistics. The results are in Table 1. Then, according to the opinions of primary school teachers working in official primary schools in Yozgat province and its districts, the relationship between sustainable leadership perceptions and learning organization is calculated with the Pearson correlation coefficient. The results are expressed in Table 3.

Table 3. The Relationship Between Learning Organization Sub-Dimensions and Sustainable Leadership

	X̄	Sd	1	2	3	4	5	6	7	8	9
1. Human Resources Development	2.72	.74	1								
2. Strategic Distribution	3.86	.86	.288**	1							
3. Deep Learning	4.42	.59	.059	.141**	1						
4. Environmental Social Responsibility	3.26	.60	.499**	.370**	.152**	1					
5. Personal Mastery	3.95	.65	.293**	.373**	.168**	.286**	1				
6. Mental Models	4.07	.64	.270**	.464**	.185**	.239**	.661**	1			
7. Shared Vision	4.12	.63	.307**	.449**	.077	.312**	.583**	.735**	1		
8. Systems Thinking	3.95	.59	.307**	.415**	.091**	.277**	.605**	.669**	.745**	1	
9. Team Learning	4.31	.57	.207**	.092*	.056	.196**	.325**	.324**	.409**	.450**	1

*p<.05. ** p<.01

Table 3 displays the average sustainable leadership scores for school principals across all SLS criteria, which vary from 2.72 to 4.42. These findings show that teachers think principals of schools exercise highly effective sustainable leadership. The average

scores of learning organizations range from 3.95 to 4.31, as demonstrated in Table 3. These findings indicate that teachers view their institutions as learning environments. On the other hand, there is a statistically significant and positive association between the sub-dimensions of SLS and LOQ. The "strategic distribution" and "mental models" sub-dimensions of SLS and LOQ had the strongest association (r =.46, p.01). As a result, there is a slight but substantial correlation between participants' perceptions of social intelligence and their perceptions of the HRF. However, "deep learning" and "shared vision" had the lowest connection (r =.07, p.01) between the sub-dimensions of SLS and LOQ. As a result, there is a weak but substantial correlation between instructors' perspectives on deep learning and their ideas regarding the development of a common vision. The four SLS sub-dimensions were tested for their ability to predict LOQ using multiple regression analysis.

Table 4. Regression Analysis Results on the Prediction of Learning Organization Perception by Sustainable Leadership Dimensions

Dependent Variable = Learning Organization	B	Std. Hata	β	t	p
Human Resources Development	.131	.035	.194	3.772	.000*
Strategic Distribution	.213	.030	.344	7.129	.000*
Deep Learning	.051	.040	.057	1.261	.208
Environmental Social Responsibility	.080	.045	.094	1.771	.077

R =.507; *R²*= .257; *F*= 32.887; *p*=.000

Table 4 shows a moderate and significant relationship between sustainable leadership dimensions and learning organization (R = .507; R2 = .257; p<.05). According to these findings, 26% of the learning organization can be explained by sustainable leadership dimensions. Based on the standardized regression coefficient (β), "human resource development" (t = 3.772, p< .05) and "strategic distribution" (t = 7.129, p< .05) dimensions of sustainable leadership are significant predictors of the learning organization. However, the "deep learning" (t = 1.261, p> .05) and "environmental social responsibility" (t = 1.771, p> .05) dimensions are not significant predictors of the learning organization. In other words, sustainable leadership does not significantly affect the learning organization through the dimensions of "deep learning" and "environmental social responsibility.

Qualitative Findings

Qualitative findings obtained from the research were thematized according to the scale dimensions of the SPLS. Within the scope of the research, the school principals who got the highest score (*n*=10) and the lowest score (*n*=10) from the SLS scale were interviewed. The data obtained as a result of the interviews were examined with the descriptive analysis technique, and the direct statements of the participants were included from time to time. In Table 5, qualitative findings on sustainable leadership are presented.

Table 5. Opinions of School Principals with High and Low Scores on Sustainable Leadership

Theme	Codes	Frequency of Those with Low SLS Scores	Scores Frequency of Those with High SLS Scores
Human Resources Development	Reading hours	6	7
	Book discussion		1
	(Scientific activities) Seminar-Symposium, TUBITAK Projects		4
	Directing to in-service training	1	4
	Promoting and supporting different methods		4
	Providing guidance services	1	2
	Inviting experts		3
	Listening to teachers at all times	1	4

Strategic Distribution	Participation in decision-making	8	9
	Evaluating the past	2	5
	Encouraging collaboration	7	8
	Openness to diverse ideas - creating a democratic environment	8	8
	Sharing experiences	2	4
	Trying to create a school culture	2	4
	Establishing strong communication	8	10
	Delegating authority	1	3
	Being integrative	1	5
Deep Learning	Physical environment arrangements	1	6
	Setting goals for success	1	6
	Meetings with successful school principals		5
	Providing materials	1	6
Environmental Social Responsibility	Excursions	6	6
	Collective events	5	5
	Breakfast-Lunch Organizations	4	9
	Taking environmental precautions		
	Not leaving employees alone on their special days	1	4
	supporting students with poor financial situation		

When the opinions obtained from the participants are examined, as shown in Table 5, it can be evaluated that activities such as "scientific activities" "directing to in-service training" "promoting and supporting different methods" "providing guidance services" "inviting experts" and "listening to teachers at all times" are the activities carried out by sustainable leaders in the dimension of *human resources development*. According to Table 5, conducting "reading hours" in the school is carried out by low and high sustainable leadership score (*f*=7) school principals. However, supporting teachers' development through discussion groups rather than reading hours can be evaluated as an activity sustainable leaders can undertake. The opinion of the school principal, who expressed his views and had the highest sustainable leadership average score about human resources development, is quite remarkable. His view on "book discussions" in this regard is noteworthy. In this regard, he stated the following opinion:

> *When we created a book reading group with volunteer teachers before the seminar period, we have been implementing this practice for two years. This year, we decided on the books we would read together by making a joint decision, aiming for engaging and enlightening choices. We selected three books a month before the seminar period, and I placed the order. One was Zweig's Chess, a world classic, the other was Animal Farm, and the last was Nurettin Topçu's Maarif Davası in Turkey. Everyone had read at least two of them within a month. We had extensive discussions on Animal Farm and Chess. Some did not read the books but still participated in the discussions. At least they listened. It was gratifying and satisfying. I love reading books, and discussing what we read and evaluating different perspectives was also very informative. We have also decided on the books we will discuss when school starts. We are reading Blindness, What is Man Living For, and In the Land of White Lilies during the holiday break to prepare our*

minds for the upcoming semester. We had a seminar on films as well, but discussing books was much more enjoyable (SM1).

> *In-service training is very beneficial for administrators. However, of course, they are also beneficial according to the teachers' subject that is useful for us. When in-service training is opened, I immediately inform the teachers and direct them to apply. Even if it is unavailable now, I tell them their turn will come someday. It is nice because these training (SM10) ... Ayşe Hanım and Fatma Hanım think they are helpful for teachers if they have different applications in the classroom, communication with parents, or any achievement. If you have projects like this, let us share and implement them together (SM6).*

According to the findings presented in Table 5, the statements of "participation decision-making" "openness to diverse ideas-creating a democratic environment" "encouraging collaboration" and "establishing strong communication" were expressed by both high and low sustainability score principals in the *strategic distribution* theme. Therefore, these statements may not be seen as distinguishing features for sustainability leadership. However, based on the findings, the opinions reported by school principals with high leadership scores, such as "evaluating the past" " Sharing experiences" "trying to create a school culture" "delegating authority" and "acting in an integrative manner" could be considered as distinguishing characteristics of sustainability leaders. One participant expressed their view on this issue as follows:

> *At the beginning of each semester, we have meetings with our colleagues to evaluate the previous year and discuss what we can do in the upcoming semester. Based on the decisions we made in the first meeting of the previous year, we talked about what we could accomplish and whether we took any measures to address any issues that arose. We discuss any shortcomings and document them through decisions. At the beginning of the next semester, we revisit these decisions and remind ourselves that we made them in a previous meeting and review them again (SM2).*

As can be seen from Table 5, the behaviors related to "physical environment arrangements" "goal setting for success" "meetings with successful school principals" and "providing materials" are more frequently expressed by the managers who received high scores in the *deep learning* theme. Participants' views on this issue are as follows:

> *School principals often come together with each other. We either meet at the Ministry of Education meetings or bump into each other because we are friends. We talk about anything related to education. A successful school principal's school is always a topic of discussion. I ask them without hesitation or embarrassment, 'How did you achieve this?' If a teacher is successful, I even visit their school and meet with them. I take notes on what I hear and share it with my teacher friends at my school (SM5).*
>
> *Recently, I visited the M.A.E. Primary School and saw that a lady was painting on the walls. I liked it. When I came back to my school, I looked at our walls and thought about teaching concepts and values through such paintings. I asked my vice principals and teacher friends about it, and they said it would be nice. So, I called the principal of that school and got the lady's number. I asked her if she could also do it for us. It is necessary to evaluate good practices of other schools and share ideas for success (SM7).*
>
> *We identify the shortcomings and then talk to someone for resources accordingly. Sometimes we do it with the support of the Ministry of Education, and sometimes we ask for help from a supporter (SM3).*

In Table 5, "excursions ", and " collective events " in the theme of *environmental and social responsibility* are the behaviors expressed by both high and school principals with low scores. Behaviors that are expressed more by principals with higher scores, such as "taking environmental precautions" "not leaving employees alone on their special days" and "supporting students with poor financial situations" are considered behaviors of sustainable leaders.

> *… We organize excursions with our teachers and students. We made a trip to Çanakkale with our teachers. Not all of our teachers folded. Some had children. However, we traveled very well with those who had time and did not have a job and experienced a national spirit consciousness together. And we got together better (SM1)*
>
> *We organize a bazaar every year. These bazaars bring a small income to our school. Parents are more connected to the school with such an application. They also*

know each other among themselves. In this way, the ice melts between the teacher and the parents (SM5).

If an employee is getting married in our school, we have a social committee immediately; they get their gold and gifts. We will immediately receive our gift for the one whose son gets married and has a child. We are organizing a farewell to our outgoing teacher. For this, while collecting money for tea every month, we get an extra 5 TL and save that money. We use it when necessary. No one has objected to this situation so far (SM5)

We put a waste battery box in our school. Students bring waste batteries here and throw them away. They come first and show us. As the administration, we give them prizes such as candy and chocolate. This encourages them a lot. They exaggerate and ask the neighbors, too (SM10)

As can be seen from the qualitative findings, the answers of the school principals with a low sustainable leadership score and a high sustainable leadership score were thematized under the dimensions of sustainable leadership. When the findings are examined, the answers given by the school principals with high sustainable leadership scores for all dimensions are higher. Based on this finding, school principals working in Yozgat province carry out more activities than those with high sustainable leadership scores.

In this part of the research, the opinions of school principals about the learning organization are given. The dimensions in the LOQ questionnaire were handled as a theme, and the data obtained from the participants' opinions were analyzed and coded with the descriptive analysis technique. The findings obtained from the analysis of the collected data are given in Table 6.

Table 6. School Principals' Views On Learning Organization

Theme	Codes	Frequency of Principles with Low SLS Scores	Frequency of Principals with High SLS Scores
Personal Mastery	Holding meetings	2	3
	Taking individual needs and desires into account	1	
	Arranging the program of teachers who want to pursue a master's degree		1
	Utilizing expertise	1	1
	Promoting education opportunities		1
	Discussing different methods and techniques		1
	Setting up a library		1
Mental Models	Critical evaluation		3
	Immediate intervention to problems		3
	Always being open to innovations and change, and discussing every idea		5
	Discussions on values		1
Shared Vision	Taking teachers' opinions into consideration in planning		4
	Exchange of ideas	2	4
	Active participation of all teachers in every process		6
	Making decisions together	3	5
Systems Thinking	Setting goals for success		4
	Producing long-term solutions instead of temporary ones		2
	Using communication channels constantly and effectively		6
	Creating active learning environments		3

	Forming teams	1	5
	Book discussion group		1
Team Learning	Social activities	3	10
	Organizing reading hours	3	3
	School-parent-family cooperation	3	5

When the qualitative data obtained from the participants was examined in Table 6, the behaviors of the principals who scored high on the sustainable leadership scale in the theme of "personal mastery" included "holding meetings" "arranging the program of teachers who want to pursue a master's degree" " promoting training opportunities" "discussing different methods and techniques" and "setting up a library." One of the participants expressed their opinion as follows:

> He met with the teachers almost every 15 days and said, "What did we do new? What innovations brought us? Let's continue?" We talk about questions like If there are different methods that teachers use in the classroom, we talk about them and discuss whether they provide success or not. Then, we make decisions as a result of brainstorming with the teachers. "How do we achieve lasting success? Whose methods work best?" we argue (SM8).

As can be seen in Table 6, in the findings obtained from the qualitative data obtained from the participants, the expressions related to the *mental models* theme "always open to innovations and change and discussing every idea" " critical evaluation" "immediate intervention to problems" and" "discussions on values" is a behavior shown by principals with high scores on the sustainable leadership scale. One of the participants commented as follows:

> If it is for the benefit of both the student and the teacher, I try to put new and different ideas into practice to the extent permitted by the legislation. Contrasting opinions are also crucial for me, and I ask thoroughly why, maybe the first time, another idea makes sense, but other words may make sense (SM4).

As can be seen from Table 6, "exchange of ideas" in expressions related to the theme of *shared vision* in the qualitative data obtained from the participants is a behavior displayed by both the principals with high scores from the sustainable leadership scale and the principals with low average scores. However, "active participation of all teachers in every process" and "taking teachers opinions into consideration in planning" are behaviors only shown by principals who have received high scores from the sustainable leadership scale. Participant opinions are as follows:

> I strive to gather everyone's opinions for all kinds of situations that may arise in the school, whether it's related to education, work, physical space, or student discipline issues (SM2)
> As I mentioned before, we have formed a book discussion group. Everyone is invited to this group, and I always consider different ideas without discrimination (SM1).

As seen in Table 6, in the qualitative data obtained from the participants, the behavior of "using communication channels constantly and effectively" is shown by the principals who scored high on the sustainable leadership scale in the *systems thinking* theme. Indeed, the opinions of the participants are as follows.

> I always keep my door open to teachers, students, and parents. I am always ready to listen to their problems, no matter what they may be. They can call me on my cell phone anytime regarding school or student-related issues (SM9).
> Every teacher is very valuable to us. Their words and opinions are taken into consideration. I also let them know that I am ready to listen to them even if they have a personal problem. If they want to talk about it, I listen and try to find a solution. If they don't want to talk about it, I say something to boost their morale and motivation (SM8).

As it can be seen from Table 6, "forming teams" and "social activities" in expressions related to the theme of *team learning* in the qualitative data obtained from the participants are the behaviors of the principals who received high scores from the sustainable leadership scale. As a matter of fact, the participants commented as follows:

Every class in the school has a group. These groups work in cooperation with
each other, and they cooperate with other groups (SM5).
We did a project last year. Our project team worked very well there. As I said,
they were very surprised if such an institution existed in Yozgat (SM9).

As can be seen from the qualitative findings on learning organizations, the responses of school principals with low and high sustainable leadership scores were thematized under the dimensions of the LOQ. When the findings are examined, the answers given by the school principals with high sustainable leadership scores for all dimensions are higher. Based on this finding, it can be said that the opinions of school principals with higher SLS scores about the learning organization have higher frequencies.

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

In the quantitative part of this research, the relationship between school principals' sustainable leadership and learning organization was examined based on the opinions of 385 teachers. In the qualitative part, interviews were conducted with 20 school principals. In the research, first of all, an answer was sought to the question of how the school principals' sustainable leadership of participating teachers was. As a result of the analysis, it was observed that the school principals' sustainable leadership scores were higher than the teachers' opinions. In terms of dimensions, it was determined that the average score for deep learning was the highest. According to Hargreaves and Fink (2003), profound teaching and learning, essential in education and lasting a lifetime, continue the natural processes. Supporting and sustaining teaching and learning issues that promote deep learning and lifelong learning is the foundation of sustainable education. Therefore, the answers given by the participants to the deep learning dimension can be considered a critical situation for sustainable leadership.

As a result of the analysis, it was observed that the average score for the learning organization was high according to the teachers' opinions. In terms of dimensions, the highest score is team learning. The literature review found that the dimension of team learning is high in learning organization scales (Savaş, 2013; Thompson et al., 2004). The high score may be because team learning includes the learning organization process and the ability to achieve more significant and permanent results than individual results.

As a result of the research, a positive relationship was discovered between sustainable leadership and the learner relationship. In the literature review, studies focusing on the relationships between schools being learning organizations and sustainable leadership have found a positive relationship between sustainable leadership and learning organization (Iqbal & Ahmad, 2021). In addition, the study of Akan and Sezer (2014) found a positive and significant relationship between transformational leadership and the level of learning organization in schools. The study by Bilir (2014) found that structural leadership, human resources leadership, political leadership, and symbolic leadership were related to teachers' perceptions of their institutions. Oluremi (2008) found a significant relationship between the principal's leadership style and the school's learning culture and stated that the principal should have a transformative leadership style. On the other hand, it has been determined that deep learning of sustainable leadership does not affect the learning organization. In addition, it has been determined that school principals' environmental-social responsibility behaviors do not affect school learning organizations.

In the results obtained from the qualitative data within the scope of the research, in the theme of the development of human resources of school principals who exhibit sustainable leadership behavior, school principals support teachers' participation in scientific activities, direct them to scientific activities, direct them to in-service training, support different method and -technical applications, provide guidance services, provide specialists to their schools. It was determined that they invited the teachers and listened to the teachers at all times. According to Hoy (2003), teachers are more successful in a safe environment. In Altınkurt's (2007) study, human resources development practices in schools were found to be generally successful by teachers. According to the research findings of Short et al. (1999), teachers feel more empowered in schools of school administrators with a high aptitude for the human resources framework. Therefore, human resource development practices in schools are practices that contribute to the professional development of teachers.

As a result of the research, it was determined that school principals who exhibit sustainable leadership behavior evaluate the past in the theme of strategic distribution, share their own experiences with teachers, try to create a school culture, distribute their authority, and exhibit integrative behavior. On the other hand, it has been determined that school principals who exhibit or do not exhibit sustainable leadership behavior participates in the decision, be open to different opinions, create a democratic environment, encourage working in cooperation, and establish strong communication in their schools. According to Ferdig and Ludema (2005), leaders should make plans for the future within the organization they lead to understand the rapidly changing economic, social, and political environments and create the right strategies.

As another result of the research, school principals who exhibit sustainable leadership behavior care about deep learning in their schools, and in this context, they care about the physical environment arrangements of the schools; they set goals to ensure success and make it permanent, they exchange ideas with the principals of successful schools, and they find different ways to meet the material needs of their schools. Experiments were determined. According to Hargreaves and Fink (2003), student learning is the basis of all learning. Therefore, everyone's learning in schools is geared towards supporting student learning. According to Borko (2004), leaders should allow teachers to build trust, create an environment for critical communication, and

show respect for each other. Glasser (1999) states that while a leader manager keeps expectations hişk, encouraging his stakeholders and frequently reminding them of this expectation is a sign of success.

According to the results obtained from the research, school principals who exhibit sustainable leadership behavior are sensitive to the environment and social responsibility activities; In this context, it has been determined that they take measures to protect the environment, support their employees outside of school, and seek different ways to help students with weak economic conditions. It has been determined that school principals who exhibit and do not exhibit sustainable leadership behavior do some collective activities at school. Gummerson (2015) stated that it is crucial for those who are committed to sustainable leadership to base their work on a moral purpose. Therefore, sustainable leaders are environmentally committed and sensitive to the environment. According to Jahanshahi and Brem (2017), cooperative behaviors provide a positive atmosphere among organizational members, which is seen as sustainable leadership behavior. Bilateral relations with all stakeholders and how this affects organizational effectiveness and goal achievement are vital for organizations (Gerard, McMillan & D'Annunzio-Green, 2017). Sustainable leadership advocates stakeholder participation, emphasizes the social element of the relationship, and does not focus solely on results (Hargreaves & Fink, 2006).

Limitations and Future Research

This research was carried out with the opinions of primary school teachers working in Yozgat province and its districts, and it can be suggested that the same study be carried out in other provinces. The quantitative part of this study was conducted as a cross-sectional survey, and it may be indicated that researchers conduct longitudinal studies in the future. The quantitative data collection for this research was carried out only with teachers working at the public primary school level. According to the opinions of teachers working in private schools or other public schools, research can be conducted to examine the sustainable leadership behaviors of school principals. Very few studies on sustainable leadership exist in the literature on educational organizations. For this reason, perceptions of sustainable leadership in educational organizations can be examined by considering different concepts together. The relationships between the concepts in question as well as the impact power of these concepts, can be examined. Based on the opinions of primary school teachers, this study can compare current research results with new studies to be conducted on other samples, based on the conclusion that sustainable leadership affects the learning organization. In addition, analyses were made at a single level in this study, and since this study is leadership research, it can be suggested to be done at school and teacher levels and at a multi-level. The findings of this study will help to understand the relationship between sustainable leadership and learning organization.

Implications of the Research

This study was conducted based on the views of teachers and school principals, who are among the most critical stakeholders in educational management processes. The current research findings have revealed the relationship between sustainable leadership and a learning organization. The findings presented in this study can guide policymakers to consider sustainable leadership practices in school policies and structure schools as learning organizations to achieve sustainable and lasting success. In order to provide students with a better quality education environment, policymakers at the education ministry level should take steps to promote the concept of a learning organization and sustainable leadership practices. Additionally, the study has shown that as practitioners, school principals can contribute to forming their schools as learning organizations by placing greater emphasis on the element of sustainable leadership. Suppose learning organizations are perceived as an outcome of sustainable leadership. In that case, school administrators may be more willing to strive for their schools to become learning organizations by emphasizing the importance of learning.

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