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Determination of the Opinions of Prospective Science Teachers About Biology Lessons Taught Through Distance Education

Emrah Özbuğutu (Assistant Professor)
Faculty of Education, Siirt University, Turkey

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Abstract

This paper aims to determine the opinions of prospective teachers about biology lessons conducted through distance education during the pandemic. In the study, the focus group study technique was applied as one of the qualitative research methods. 15 prospective teachers from the Department of Science Education, studying in the 2nd, 3rd, and 4th-grades in Siirt University, participated in this study. Questions were presented to the prospective teachers in the form of a semi-structured form and interviews were conducted separately for each grade and recorded. The data collected were analyzed via content analysis. Based on the findings of the study, the prospective teachers stated that they had internet-related and technical problems and they also failed to follow biology lessons due to their unsuitable home environment and ineffective communication processes. It was understood that the vast majority of prospective teachers preferred face-to-face evaluation rather than e-evaluation. To make biology lessons more efficient, it was recommended that prospective teachers should be obliged to attend classes, YouTube videos and animations should be added, classroom or laboratory lessons should be organized, WhatsApp groups should be created and question section should be added through these groups, and lessons should be synchronous rather than asynchronous.

Keywords: Biology lessons, synchronous lessons, asynchronous lessons, distance education, face-to-face education

Introduction

Since December 29, 2019, the world is faced with the threat of a virus thought to break out in China. Following the rapid spread of this virus that has turned into a global pandemic affecting the whole world, regulations have been made regarding travel bans, quarantine, and extraordinary measures to reduce the rate of spread of the pandemic and ensure social distancing. However, the pandemic had a significant influence on many fields including education in particular (Üstün & Özçiftçi, 2020; Genç & Gümrükçüoğlu 2020). In parallel with its effects on schools and the education system, educational environments have been reformulated and, thus, distance education has been the leading environment.

Distance education refers to all education and training activities carried out to increase the relationship and communication between students, teachers, and teaching-related documents with the help of information and communication technologies (ICT). It can be defined as a system based

on the principle of student self-learning which aims to bring preconditions and limits to access to educational environments (Allen & Seaman, 2013; Yüksekdağ, 2020). Based on this definition, distance education can be considered as one of the measures taken in terms of activities related to education and training.

Considering the processing of internet-based distance education, what stands out is information exchange between students and teachers. During the implementation stage, lessons can be conducted in two ways: synchronous and asynchronous. While synchronous education allows teachers and students to communicate in different ways, it also provides the opportunity to create an environment of face-to-face education. However, it is not a requirement for anyone involved in face-to-face education to be present in the same environment (Çetin & Özdemir, 2018a). Asynchronous education provides the learner with the opportunity of individual learning independent from the teacher (Karatepe, Küçükgençay & Peker, 2020). Asynchronous learning also contributes to the learning of students by uploading the necessary documents related to the lesson and the lecture as video recording if necessary.

It is a known fact that distance education avails lifelong learning, individual development, and the national economy. However, education and training activities may be interrupted from time to time, causing failure to reach the expected success. To improve this success, teaching activities must be carried out effectively (Çetin & Özdemir, 2018b). In this process, although students benefit from the educational opportunity remotely and without the need to go to school, they receive an education without face-to-face interaction, group work, classroom activities, and social development. Students and institutions mainly face problems regarding the implementation stage (Çığlık & Bayrak, 2015).

Biology is an important subject in science and will continue to be. Therefore, more attention should be paid to biology in terms of scientific lesson planning. This is because the current position of biology, especially the issues in genetics, biotechnology and ecology, has reached such a level that it can help humanity much more than expected (Kiziroğlu, 1988).

Objective

The fall term program of science teaching involves biology-related lessons such as Biology II, Environmental Education, Social Effects of Gene Technology, and Genetics and Biotechnology lessons, as elective courses in the previous curriculum. Researches show that the main focus is on the evaluation of the opinions of prospective teachers regarding distance education. Hence, this study has been designed to determine the opinions of prospective science teachers related to distance education of the above-mentioned lessons during the pandemic. Since there are no studies on biology lessons tought with distance education subject in the literature, this research is supposed to be of capital importance.

Method

As the opinions of prospective science teachers about biology lessons conducted with distance education were examined, the focus group technique, which is one of the qualitative research methods, was used. The aim of this technique is to obtain in-depth, detailed, and multidimensional qualitative information about the participants' perspectives, experiences, interests, experiences, tendencies, thoughts, perceptions, feelings, attitudes, and habits in relation to a certain subject (Tanhan, 2017).

Research Sample

Prospective teachers are the students studying at education faculties to be a teacher after graduation in Turkey. This study was carried out with 15 prospective science teachers enrolled in the 2nd, 3rd, and 4th grades of the Science Teaching Department of Siirt University who take biology-related lessons. Participants were determined via simple random sampling techniques.

Table 1. *Grade levels, lessons, and number of prospective teachers*

Grade levels	Number of prospective teachers	Lessons
2nd-grade	5(3F-2M)*	Biology 2
3rd-grade	5(3F-2M)*	Environmental Education
4th-grade	5(3F-2M)*	Social Effects of Gene Technology

*(3F-2M) means, there are 3 females and 2 Males Prospective Science Teachers.

Grade levels, lessons, and number of prospective teachers are shown in Table 1.Five (5) prospective teachers from each grade participated in the interviews. Totally, nine (9) of the participants were male and six (6) were female.

Data Collection Tool and Data Collection

The focus group interview technique, in which interview questions were in the form of a semi-structured interview form, was used in this study. Prior to the main interview, the pilot scheme of the study was carried out along with measures taken for the problems that might arise during the actual implementation. The same number of prospective teachers participated in the pilot interview. After the pilot scheme, the number of questions, which was 11 in the semi-structured interview form, was rearranged and was reduced to 6. During the actual implementation, prospective teachers were informed about the purpose of the study and asked to answer the questions sincerely and correctly. As in the pilot scheme, the interviews were made via the zoom program and recorded. These interviews were conducted separately for each grade level. The last interview was made with 5 prospective teachers from the 2nd-grade, 5 prospective teachers from the 3rd-grade, and 5 prospective teachers from the 4th-grade. Each meeting took an average of 1 hour 20 minutes.

During the focus interview, prospective teachers were asked the following questions in a semi-structured format:

1. What are the positive and negative aspects of teaching biology lessons with distance education?
2. To what extent and how have your note-taking habits and studying methods changed in relation to biology lessons during distance education?
3. How has the exams through distance education affected your preparation for the exam of the biology lesson?
4. In relation to the evaluation of the exams, would you prefer e-evaluation or face-to-face evaluation? Why?
5. Which of the biology lessons have you found more efficient: synchronous or asynchronous? Why?
6. What are your recommendations for more efficient lessons regarding biology lessons during

distance education?

Data Analysis

While interviewing the prospective teachers, small interventions were made to ensure participants give more answers. The answers recorded via the Zoom program were converted into a written document. Focus group interview data were analyzed descriptively along with content analysis. A descriptive analysis approach was also used in the study. In the descriptive analysis approach, data can be summarized and interpreted according to pre-determined themes. Furthermore, the data can be arranged according to the themes that emerge in the analysis of the research questions or by considering the interview questions (Yıldırım & Şimşek, 2008; Baş & Akturan, 2008; Cabı, 2016).

The reliability of the study was determined by comparing the number of agreement and disagreement. Also, it was calculated using Miles and Huberman's (1994) Reliability = agreement/(agreement + disagreement) * 100 formula. Agreement among coders is expected to be at least 80%. The study is reliable as an agreement of 88% (71/71 + 10)*100 was reached among the coders in the study (Bakioğlu & Çevik, 2020). In a study where descriptive analysis is used, it is important for the sake of validity to express the statements of individuals whose opinions are directly quoted and to explain the results based on them (Yıldırım & Şimşek, 2008). To ensure validity, direct quotations were included and the data were interpreted. Direct quotations were made from the answers given by the prospective teachers to indicate the expressions of the question. On the other hand, prospective teachers were numbered with the grade level (2.S, 3.S, 4.S). The number given to the prospective teachers (Ö1-Ö2-Ö3…) as grade means “sınıf” and prospective teachers means “öğrenci” in Turkish.

Findings

In the study, the findings obtained as a result of the analysis of the data collected from the semi-structured interview form were presented to the prospective teacher in turn. Firstly, the prospective teachers were asked, "What are the positive and negative aspects of teaching biology lessons with distance education?". The frequency distribution of the findings regarding the answers given is shown in Table 2 below.

Table 2. *Opinions of prospective teachers regarding positive and negative aspects of biology lessons during distance education*

Positive Aspects	f	Negative Aspects	f
No compulsory attendance	3	Internet-and-technical problems	9
Video recording and being able to watch again	3	The home environment being inconvenient	6
Using technology better	2	Being unable to ask questions	3
Uploading PDF and documents	2	Extreme comfort and laziness	3

		No lab	3
Saving time	1	No feedback and correction	2
		Inefficient	2
		Boring videos	1
		Poor communication	1
Total	11		30

Table 2 reveals that in line with the answers, 30 (73.2%) and 11 (26.8%) of the prospective teachers stated their opinions about the negative and positive aspects, respectively.

Considering the negative opinions, they stated that they mostly experience internet-related problems, such as internet disconnections and technical problems. As a result, they are not able to follow the lessons due to inconvenience at home and frequent guests, and they have to spare time for housework. In addition, they also stated that they are unable to easily ask the lecturer questions like in the classroom environment, resulting to a poor feedback system and lack of correction. Furthermore, there is no effective and healthy communication. Failure to benefit from the laboratory facilities especially in relation to the Biology II lesson and related problems, extreme comfort and laziness as well as boring and inefficient lessons were also enumerated as negative aspects.

Among the most positive opinions are the non-necessity of attendance, the opportunity of saving videos and watching them over and over again, learning how to use technology better thanks to distance education, as well as benefiting from uploaded and downloadable PDFs and documents related to the biology lesson and spending more time on biology lessons.

Some statements of the prospective teachers regarding the relevant category are as follows: *I think it is negative since I have problems with the internet. Also, if education were face to face, the only thing I would do would be to go to school, but now I have a lot of different things to do. I have time-related problems as well, no positive aspects. (2.S-Ö1)*

I think it would be more efficient if it was face to face. The anatomy lesson should be taught in the classroom, but circumstances did not allow it. If it was in the classroom, we would be able to visually examine the muscles, bones, organs, and body structures, but I was negatively affected by this situation. (3.S-Ö2)

I think I fell behind because of technical problems or because I couldn't attend the class when guests came home. This situation made it difficult to follow the lesson (gene technology and society). (4.S-Ö3)

Secondly, the prospective teachers were asked the question: “To what extent and how have your note-taking habits and studying methods changed in relation to biology lessons during distance education?". The frequency distribution of the findings regarding the answers given is shown in Table 3 below.

Table 3. *Opinions of prospective teachers regarding changes in note-taking habits and studying methods*

Face to Face	Frequency	Distance Education	Frequency	No Change	Frequency
I was studying by taking notes	7	I do not take notes	6	No change	3
I was studying harder	2	I study via PDF documents	3		
I was studying by writing	1	I do not study as before	2		
I was revising books	1	I study by watching videos	2		
I was reviewing the subjects	1	I study harder than before	1		
		I study only for exams	1		
		I do not study at all	1		
		I take notes if I hardly understand subjects	1		

Table 3 reveals that most of the prospective teachers stated that they study by taking notes while some used to study harder by writing during face-to-face education. Besides, one of them stated that s/he made up his deficiencies by revising books, while another one of them studied by reviewing subjects. On the other hand, during distance education, 6 prospective teachers stated that they no longer take notes, while some prospective teachers study via PDFs and by watching videos. Finally, one of them stated that s/he studies only for exams or does not work at all, studies more than before, and takes notes if subjects are hardly understood.

Some of the statements of prospective teachers regarding the relevant category are as follows:

Since I know more or less the subjects of Biology II, I do not take any extra notes. There was no change in my studying style. I study now just as I studied in the previous Biology I lesson. (2S-Ö4)

I am currently taking notes as well because the anatomy lesson is based on rote learning, at which I am bad, I cannot learn the lesson without taking notes. Not much has changed for me. (3S-Ö1)

Since we were in the classroom before, I was also taking notes during all the lessons related to biology lessons (Genetics, Anatomy, Environmental Education, and Biology I-II) and I could also review the topic. I am currently not doing it, and I cannot study because I am in quarantine. (4S-Ö2)

Thirdly, the prospective teachers were asked, "How has the exams with distance education affected your preparation for the exam of the biology lesson?". The frequency distribution of the findings regarding the answers given is shown in Table 4 below.

Table 4. *Frequency distribution of prospective teachers' opinions on the exams of the biology lesson during distance education*

Face-to-face Education	f	Distance Education	f
I was well-prepared for the lesson	55		
		PDF and video	5
I studied more	4	I studied less and was more comfortable	4
I elaborated on subjects	2	I studied only on exam day	2
I studied the course book	2	I used books when studying	2
I summarized subjects	1	I did not study at all	1
I studied based on notes I took during the lesson	1	I study harder now	1

Table 4 shows that during face-to-face education, prospective teachers studied long before the exam and harder, while some of them studied more detail based on the course book. Besides, it has been observed that one student studied through summarization while another one studied based through note taking. On the other hand, during distance education, a majority of the prospective teachers studied through PDFs and videos and were more comfortable but studied less. In addition, some prospective teachers stated that they only study on exam day and benefit from the internet and books during the exam, while some did not study at all or studied harder.

Some of the statements of prospective teachers regarding the relevant category are as follows:

I was studying by summarizing during face-to-face education. I have been studying for Biology I by summarizing the subjects of the previous semester, but this semester I did not summarize subjects but studied from the PDFs uploaded to the system. (2S-Ö1)

I was negatively affected as I could not study due to housework and lack of enough time for both Anatomy and other lessons. At the same time, I had difficulty preparing for the exam because there were children at home. I would have studied better if I could be provided with face-to-face education. (3S-Ö2)

I never studied for the exam of gene technology and society during distance education. I used to study for the exams of the biology-related lessons long before taking the exams. (4S-Ö1)

Fourthly, the prospective teachers were asked, "In relation to the evaluation of the exams, would you prefer e-evaluation or face-to-face evaluation? Why?". The frequency distribution of the findings regarding the answers given is shown in Table 5.

Table 5. *The frequencies of student opinions regarding the e-evaluation and face-to-face evaluation of the exams*

E-evaluation	Frequency	Face to face	Frequency
High grades	4	Fairer	5
Too much homework	2	We answered questions in exams	5

		on our own	
I am stressed	2	Not that easy to pass exams	2
I had difficulty uploading the answer sheet	2	More sensitive evaluation	2
		We knew what we learned	2
		We were able to provide missing information	1

Table 5 reveals that most of the prospective teachers prefer face-to-face evaluation with only three prospective teachers stating that they prefer e-evaluation to get higher grades in exams. Others stated that they are subjected to too much homework, stress, or problems regarding uploading. They further added that face-to-face evaluations allow them to answer the questions of exams without the assistance of others and that exams would not be that easy to pass with a better method of evaluation to ensure they understand what they learn and provide the missing information.

Some of the statements of prospective teachers regarding the relevant category are as follows:

A face-to-face evaluation would be better. Exams as I believe it would allow us to at least take the exam with our own knowledge. (2S-Ö1)

I would prefer face to face as I believe the face-to-face evaluation is fairer, which is why everyone is responsible for his or her answers. Yet e-evaluation made it easier for us to get higher grades. (3S-1Ö)

I would prefer a face-to-face evaluation in all lessons, not just in this lesson (gene technology and society). I think it would be fairer. I wish we could do an internship and get our scores based on that. (4S-Ö1)

I do not believe that e-evaluation is efficient. Those who attend classes and those who do not attend get roughly the same score, so I don't think it's fair. We got higher scores by studying less, so I would prefer e-evaluation. (4S-Ö5)

Fourthly, the prospective teachers were asked, "Which of the lessons have you found more efficient: synchronous or asynchronous? Why?". The frequency distribution of the findings regarding the answers given is shown in Table 6.

Table 6. *Prospective teachers' opinions on synchronous or asynchronous methods used in biology lessons*

Asynchronous	Frequency	Synchronous	Frequency
Time-independent	5	Question and answer, feedback, discussion, communication	8
Easier to study for exams	2	Waste of time	4
Fewer technical	1	More efficient	2

problems		
	failure to participate	2
	Little information	1
	Active participation	1
	Distractibility	1

Table 6 reveals that being time-independent is what makes asynchronous lessons mainly advantageous apart from being easier to study for exams and having fewer technical problems. Participants find asynchronous lessons better in terms of some advantages such as question and answer, discussion, or better communication. The disadvantage is that they found such lessons to be inefficient or a waste of time.

Some of the statements of prospective teachers regarding the relevant category are as follows:

Having a discussion environment in synchronous lessons enhanced my adaptation. I think that learning is more permanent even though there is little information in synchronous lessons. (2S-Ö2)

I have a hard time studying for the exam (Biology II) in synchronous lessons. Studying for the exam is easier in asynchronous lessons, but synchronous lessons are more efficient. (2S-Ö3)

I think that asynchronous lessons are better. I have the advantage of watching whenever I want because it is independent of time. (4S-Ö2)

Finally, the prospective teachers were asked "What are your recommendations for more efficient lessons regarding biology lessons during distance education?". The frequency distribution of the findings regarding the answers given is shown in Table 7.

Table 7. *Suggestions for more efficient biology lessons during distance education*

Suggestions	Frequency	Suggestions	Frequency
Technical infrastructure and conditions should be improved	4	There should be WhatsApp groups and question-solving hours	2
Compulsory attendance	2	Lessons should be synchronous	1
Video and animation should be added	2	Tablet computers should be distributed	1
Additional marks can be given to attendees	2	The time of the lesson should be appropriate	1
Internet support	2	Weekly homework	1
The number of PDFs and documents can be increased	2	Meetings should be held	1
Lessons can be taught in a classroom or lab	2		

Table 7 reveals that there is a consensus among the participants related to the improvement of technical infrastructure and conditions, compulsory attendance, additional YouTube videos and

animations, and an increase in the number of PDFs and other documents. It shows that biology lessons should be taught in classrooms or labs, WhatsApp groups should be created along with question-solving hours, lessons should be synchronous with an appropriate schedule, weekly homework should be assigned, and meetings should be periodically held with prospective teachers.

Some of the statements of prospective teachers regarding the relevant category are as follows:

In order to ensure the permanent and meaningful learning of the Biology II lesson, weekly homework may be given by being uploaded to the system at specified times. (2S-Ö1)

The application phase of the Biology II lesson, which is related to the biology laboratory, can be given in the biology laboratory through distance learning, or the experiments and applications related to the subject can be conducted in this way. (2S-Ö2)

I do not believe that distance education will ever replace the school. I lost my hope; if the student conditions are improved, the solution can be provided by imposing compulsory attendance. It is also good for increasing students' motivation. (4S-Ö1)

More PDFs and documents should be added to the system. In addition, tablets were distributed to schools other than the university and thus, tablets can be distributed to us as well. (4S-Ö5)

Conclusion

This study took into consideration the opinions of prospective teachers about the biology lesson taught during distance education. The opinions were taken from various aspects regarding the biology lessons conducted with distance education. Determining the positive and negative aspects of the system and how the habits of studying and taking notes on biology during the pandemic process have changed, as well as the changes in prospective teachers' style of studying for the exam of the lesson and the positive and negative aspects of e-evaluation, play a crucial role in identifying the advantages and disadvantages of asynchronous or synchronous. Such a study may also be crucial in terms of suggesting solution that future teachers should set to ensure biology lessons that have to be taught with distance education are more efficient. The ideas and opinions put forward may also help shape and improve the system, the biology lesson, and other lessons. Thus, it would help to enhance the efficiency of the process.

In this study, prospective teachers were asked 6 questions in total through a semi-structured form, and the interviews were recorded on zoom along with a content analysis made according to the answers. First of all, they were asked "What are the positive and negative aspects of teaching biology lessons with distance education?". In line with the responses, it was understood that they mostly experienced internet-related problems, could not log into the system due to technical problems or ask the instructor questions as though they are in a classroom environment, and were also deprived of the necessary feedback and correction due to poor communication. One may also notice that they could not benefit from the laboratory facilities especially in relation to the Biology
II lesson. Furthermore, they are likely to experience problems in the future due to lack of studies in laboratories. In addition, they feel comfortable and become lazy since an already difficult lesson like biology is boring and inefficient. On the other hand, the fact that there was a requirement of attending lessons was regarded as a positive side of distance education. Similarly, they stated that it is advantageous to save videos into the system and watch them over and over again, to learn the technology through distance education, to have uploaded PDFs and documents related to biology lessons that may be useful in the future, and to be able to download these documents at any time. The general advantages of online courses are ease of use, flexibility, and convenience (Harris,

Hardy, Agunloye Hearrington,2014). Additionally, Eygü and Karaman (2013) suggested that the models used in distance education impose more responsibility for learning than classical education models. Also, distance education is more effective in learning to ensure prospective teachers reach their desired goals. Additionally, distance education has some advantages for students who cannot access traditional face to face courses while maintaining direct contact with faculty, increased student mastery of course content, provided the ability to ask questions in real time, and increased student engagement (Viola, Saeki & Hendricker, 2019). In this study porospective teachers mainly concerns the challenges of the distance education simlar to a previous research (Song, Singleton, Hill & Hwa Koh, 2004), the results indicated that numerous disadvantages for fully online courses, including limited interaction with other students and faculty, feelings of isolation, difficulty maintaining motivation and self-discipline, and a perception of a lower quality of instruction.

Secondly, prospective teachers were asked, “To what extent and how have your note-taking habits and studying methods changed in relation to biology lessons during distance education?". It was understood from the responses that the studying systems of the prospective teachers have completely changed. Female prospective teachers spend a lot of time on housework and male prospective teachers cannot find the opportunity to study as much as they used to as they help their families. It has been determined that some prospective teachers sometimes feel hopeless, lose hope, and do not study as before. Also, some prospective teachers do not take notes in both biology and other lessons or do not study at all, and they miss days when they ought to study hard and attend school.

Thirdly, prospective teachers were asked, “How has the exams with distance education affected your preparation for the exam of the biology lesson?”. It is understood from the responses that during face-to-face education, they studied long before exams and harder, in detail and from the course book or through summarization and note-taking. On the other hand, some of them study less or did not study at all. Besides, the styles and habits regarding studying for the biology lesson seem to have changed, and as a result of an incorrect evaluation of exams, statements such as “We easily pass exams as subjects are mainly those we have already learned throughout face-to-face education” reveal that prospective teachers do not feel obliged to study at all. A possible reason for this situation has been associated with exams being considered as perfunctory and lacking the ability to be determinative (Eroğlu & Kalaycı, 2020).

Fourthly, the prospective teachers were asked, “In relation to the evaluation of the exams, would you prefer e-evaluation or face-to-face evaluation? Why?". A majority of the participants preferred face-to-face education, while 3 participants preferred distance education for getting higher marks. The prospective teachers expressed that they have much homework, get stressed, and have problems when uploading documents to the system during e-evaluation. Regarding the face-to-face evaluation, the prospective teachers stated that it would be fairer if there were a face-to-face evaluation. This is because they believe that it would solve the questions of exams without any help, it would not be so easy to pass, the measurement would be more precise, they would learn what they know and do not know, and they will satisfy a need. Başaran, Doğan, Karaoğlu, and Şahin (2020) found that the questions faced by prospective teachers, who do not have the habit of self-study or the ability to do so, outweigh in the distance education system.

Fifthly, the prospective teachers were asked, "Which of the biology lessons have you found more efficient: synchronous or asynchronous? Why?". A majority of the participants agree that though some technical issues occur, lessons should be synchronous for reasons including question and answer sessions, feedback, discussion, and effective communication. Similarly, Çakır and Arslan (2020) found that the synchronous classroom environment is more beneficial, adding that

synchronous classroom lessons are important though technical problems occur occasionally. Additionally, Wagner, Enders, and Pirie (2016) discussed best practices for incorporating live or synchronous video conferences into an online course. However, in literature there are some studies that mentions the appropriate interactions could be supplied between students and instructors by distance educational environments (Cho & Kim, 2013; Fedynich, Bradley, & Bradley, 2015).

Finally, the prospective teachers were asked, "What are your recommendations for more efficient lessons regarding biology lessons during distance education?". A majority of the participants agreed that the technical infrastructure and conditions should be improved. For a better process and higher satisfaction, compulsory attendance should be imposed, additional YouTube videos and animations should be added, the number of PDFs and other documents should be increased, biology lessons should be taught in classrooms or labs, WhatsApp groups should be created along with question-solving hours, lessons should be synchronous with an appropriate schedule, weekly homework should be assigned, and meetings should be periodically held with prospective teachers. They also agreed that these recommendations would improve students' motivations towards the lesson. This result is also supported by other studies in the literature (Goulımarıs, 2015; Aytaç, 2020).

Recommendations

Lessons should be taught more synchronously to increase participation. Therefore, it is important to ensure student-teacher interaction especially in lessons based on rote learning and in lessons that are difficult to understand certain subjects like biology. In addition, it is important to hold meetings with prospective teachers at certain periods, to create WhatsApp and similar groups, and to solve questions related to biology lessons, if any, to ensure communication with prospective teachers. Similar to the recommendation, Park (2013) highlights the features of many instructional technologies, along with examples of how these can be incorporated into coursework.

Regarding biology lessons given asynchronously or synchronously, it is thought that adding more visual media applications, videos, and animations to the system will increase the permanence and concretize the learning environment. It is also vital to teach biology lessons as if they are being lectured in the classroom and to teach the laboratory-related lessons as much as possible by means of experiments in the laboratory.

Most of the prospective teachers complain about technical problems. Thus, developing the technical infrastructure is among the primary works that should be done to enhance the efficiency of the lessons. In addition, an internet package should be given to students to increase their participation in classes, as in EBA (Education Information Network).

Based on the results obtained in the research, the recommendations for future researches are as follows:

1. The opinions of prospective teachers about other lessons or field lessons should be taken into consideration.
2. The data related to the subject were collected through a semi-structured interview form via zoom. By increasing the number of participants, data can be collected with the help of a questionnaire along with a quantitative evaluation.
3. Similar studies can be done with prospective teachers studying in different departments.

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Investigation of EBA Digital Education Platform Used as the Medium of Distance Education in Turkey During COVID-19 Pandemic Process in Terms of Critical Thinking Skills

Dr. Pelin Kosece
Çukurova University, Turkey
Lutfi Uredi (Assoc., Prof., Dr.)
Mersin University, Turkey
Prof. Dr. Sait Akbasli (Prof. Dr.)
Hacettepe University, Turkey
Dr. Serkan Gokalp
Mersin University, Turkey

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Abstract

This paper focuses on investigating whether the contents of 6th grade math lesson in the digital education platform (EBA) used in distance education in Turkey during the COVID-19 pandemic period are appropriate to the critical thinking standards. The contents of the math lesson, which are in the digital education platform (EBA) in 2020-2021 academic years, constitute the population of the study. The course contents, which belong to "Data Collection" and "Data Analysis" subtopics of 6th grade math lesson used in Turkey's digital education platform (EBA) in 2020-2021 academic years, constitute the sample of the study. In the study, document analysis method is used. Based on the analysis conducted, it is concluded that the learning contents, which belong to "Data Collection and Evaluation" and "Data Analysis" subtopics of 6th grade math lesson, are appropriate to clearness, accuracy, importance, sufficiency, depth, and precision standards of critical thinking. In accordance with the findings discovered, some suggestions are made on the process of distance education.

Keywords: Distance education and online learning, Elementary education, Mathematical learning, Critical thinking skills

Introduction

An event that happens anywhere in the world can have an influence all over the world or the failure occurring in one subsystem of the system can cause all of the subsystems to experience failure also. The pandemic, which is one of the events deeply influencing humanity, is defined by the Ministry of Health (2020) as "a disease or an infection occurring worldwide, or over a very large area, crossing the boundaries of countries, continents and usually affecting a large number of people". The COVID-19 pandemic, which started at the end of 2019 and has rapidly affected

people all over the world, was declared as a pandemic by World Health Organization (WHO) in 11th March 2020. COVID-19 pandemic still affected countries and systems adversely even at the end of 2020. The World Health Organization (WHO) defines health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity". Health is the basic component for the continuance of human life in every aspect, and basic needs for human life are at the first stage of Maslow's hierarchy of needs (Maslow, 1943). Within this context, it is possible to say that COVID-19 pandemic is an obstacle to human health. The fact that the pandemic has influenced the whole world in socio-cultural, political, economic dimensions, and in a great deal of other dimensions in addition to its obvious results can possibly be seen in our lives (Bozkurt, 2020). The time left behind has shown that humans should be ready to change their normal lifestyle after the pandemic period and adapt to the new normal (Budak & Korkmaz, 2020). Within this context, education is unquestionably one of the fields affected by COVID-19 pandemic. This situation forced educational institutions to carry out distance education and thus the process of using digital teaching-learning began (Bozkurt & Sharma, 2020; Mulenga & Marban, 2020). Formation of a new world order has been accompanied by a new educational paradigm. Perienen (2020) also stated that the educational sector has witnessed a paradigm shift. Due to the appearance of the first case of COVID-19 in Turkey on 11th March 2020, face-to-face education and training activities were suspended by the Ministry of National Education (MEB, 2020) on 16th March 2020. In addition, distance education also started on 23rd March 2020. Turkey showed great importance, which it attached to human health, by taking measures urgently as soon as the first case of the virus was recorded. Furthermore, all the ministerial units took measures and made decisions for the purpose of preventing the possible negative effects of the pandemic and enabling the country to develop. Within this context, the Ministry of National Education has enabled the education and training activities for the students to continue in the process of distance education by using TRT-EBA TV channels and EBA, which is the digital education platform of Turkey. Education Information Network, simply EBA, is an online social education platform provided to students free of charge by the General Directorate of Innovation and Educational Technologies, which is a unit of the Ministry of National Education (Tüysüz & Çümen, 2016). EBA also began to provide services in Turkish educational system in 2012. The works which were carried out to enrich the platform in terms of contents and other aspects continued during the pandemic period. The digital learning contents such as videos, sounds, animations, enriched books, and educational games exist for all the grades in EBA. Additionally, academic support system, which was added to the platform in 2020, has provided the students preparing for university entrance exam with a medium which is run by artificial intelligence and machine learning technology (MEB, 2020). Furthermore, the live lessons, which are carried out via EBA, enable the teachers and students to meet online and interact with each other. This platform, which holds seminars for teachers to develop professionally, has become the 1st educational website of the world and has been visited the most (MEB, 2020).

Just as the COVID-19 pandemic has influenced schools, teachers, and students, it has also influenced the researches in the field of education. Also, the researches, which have studied COVID-19 and distance education in the context of different disciplines, were conducted abroad. According to Burke and Dempsey's (2020) research, it was reported that distance education had both advantages and disadvantages. Iwai (2020) stated that the educators who were ill-equipped in terms of internet and computer had difficulty and this situation caused them to hurry and feel anxious. In Turkey, the number of researches increases day by day. This involves the viewpoints of teachers and students in relation to distance education activities, which is carried out via distance

education media. In the research conducted by Başaran et al. (2020), the students, the teachers, and the parents said that distance education had useful aspects. However, they had difficulties due to the fact that interaction was limited and the students could not participate in the lesson actively. This resulted to technical problems. In the study conducted by Karakuş et al. (2020), it was observed that the teacher candidates stated that skill based lessons could not be carried out by means of distance education. In the study, EBA platform was used as a medium of instruction, and it was concluded that the students who used Education Information Network (EBA) got better scores in the academic achievement tests than the ones who did not use it (Geçer, 2020). Nevertheless, the findings gained from the studies showed that face-to-face education was the first choice of the participants and EBA was useful in distance education activities.

Although face-to-face education and distance education differ in a great deal of dimensions, they are both used to improve important skills such as critical thinking skills. The concept of critical thinking skill has alot of definitions in the literature. For example, Nosich defined critical thinking as "objective and in-depth thinking without obsession" and referred to it as "the most developed and advanced way of thinking" (Aybek, 2015). According to Ennis (2004), the individual who has critical thinking skills, makes right decisions. In addition, the individuals who have critical thinking skill can motivate themselves and are more successful in school subjects (Karbalaei, 2012; Villavicencio, 2011). The people who are able to manage the process of thinking are the ones whose high level thinking skill is also developed (Aybek & Yolcu, 2018). Ferret (1997) stated that critical thinking is a process which continues for a life time. Accordingly, the need to develop critical thinking skills is continuously growing. Therefore, critical thinking skill is an important thinking skill which should be focused on during the pandemic period, since the face-to-face education has been suspended. Thus, this study focuses on investigating EBA, which is used as a distance education platform during the pandemic period in Turkey and its contents in developing the students' critical thinking skills. This study further contributes to the literature in terms of the development of the students' critical thinking skills. Furthermore, it is possible to see alot of expressions related to critical thinking when the curricula, which were developed from the foundation of the Republic to 2020, are examined (Aydoğdu, 2020). This study also provides important insights into the studies on curriculum development that will be conducted in relation to distance education. Based on the research question "Are the EBA learning contents, which belong to "Data Collection and Evaluation" and "Data Analysis" subtopics of 6^{th} grade math lesson, appropriate to the standards of critical thinking?" the answers to the sub-problems are sought below: Clearness, Accuracy, Importance, Sufficiency, Depth, and Precision.

Method

This study was designed according to qualitative research and document analysis method was used. Document analysis is the detailed analysis of the sources including written information about the target event or phenomena (Nergiz, 2014). "Qualitative researches have a variety and different patterns requires that the data collected at the end of the qualitative research should be analysed by means of creative, flexible, and various techniques." (Balcı, 2013, p.40). In this study, the data was analysed by means of descriptive analysis technique, which is used for analysing the data in qualitative research. "According to this technique, the data collected are summarized according to the themes, which are determined previously, and then they are interpreted" (Yıldırım & Şimşek, 2013, p.156). The themes, which were determined in the study previously, are the standards of critical thinking, which Nosich (2012) introduced. The data of the study was collected by means of document analysis method. "The document analysis method involves the analysis of

the written materials, including information about phenomenon or phenomena that are to be researched" (Yıldırım & Şimşek, 2013, p.217). The documents analysed in this study are the learning contents, which belong to "Data Collection and Evaluation" and "Data Analysis" subtopics of 6th grade math lesson, which are in Turkey's digital education platform, EBA.

Study Group

The population of the study is made up of learning contents from a 6th grade math lesson on Turkey's interactive education site, EBA. The learning contents, which belong to "Data Collection and Evaluation" and "Data Analysis" subtopics of 6th grade math lesson which are used in Turkey's digital education platform, EBA in 2020-2021 academic years constitute the sample of the study. These subtopics were analysed to determine whether they were appropriate to the standards of clearness, accuracy, importance, sufficiency, depth, breadth, and precision, which were Nosich's standards of critical thinking (2012).

Process of Data Collection

In this study, "Data Collection and Evaluation" and "Data Analysis" subtopics were chosen from the learning contents of EBA math lesson, which were used in 6th grade of middle schools during the period of distance education in 2020-2021 academic years so that they could be analyzed. Purposeful sampling method was used in the study. Furthermore, these subtopics are interdisciplinary, and the acquirements and objectives that belong to these subtopics are found in every grade level in the middle school. Also, these subtopics are appropriate for having connection with real life, and the researchers who are domain experts on this field were the determining factors in selecting the subtopics of the unit for analysis. According to Yetim (2014), high-quality thinking should occur in authentic learning situations. It should also be open to improvement and should be transferable to other contexts and situations. Furthermore, critical thinking skill, which is an important high level thinking skill, is required for in-depth analysis and is a determining factor in the study of "Data Collection" and "Data Analysis" subtopics.

Analysis of the Data

The criteria were formed according to the critical thinking standards, which Nosich (2012) introduced for data analysis. The *Checklist of Standards of Critical Thinking* was made by preparing sub-questions for each criterion. Two domain experts were consulted for the validity of the criteria and for the *Checklist of Standards of Critical Thinking*. Thereafter, the criteria were reorganized into their final forms according to the feedbacks provided by the domain experts. The data acquired from EBA learning contents were thus analyzed according to these criteria. These analyses were performed according to the standards of clearness, accuracy, importance, sufficiency, depth, and precision, which are the critical thinking standards. The authors, who were domain experts, also performed analysis on the EBA learning contents independently of each other according to the criteria determined in order to ensure reliability.

Findings

The findings reveal whether the learning contents in EBA were appropriate to the standards of critical thinking. This was introduced by Nosich (2012) and explained with examples.

Clearness

Positive answers should be provided to the questions below for an expression to be appropriate to the standard of clearness:

- Is the thought expressed clearly?
- Are there counterexamples disproving the expression?
- Is an eye-catching example presented? (Aybek, 2015)

It can be stated that the language used in digital course books, lectures, exercises, and multiple choice tests of EBA learning contents is appropriate to 6th grade students' language level. The points to take into consideration while drawing a bar chart and the definitions of arithmetic mean and range are expressed clearly.

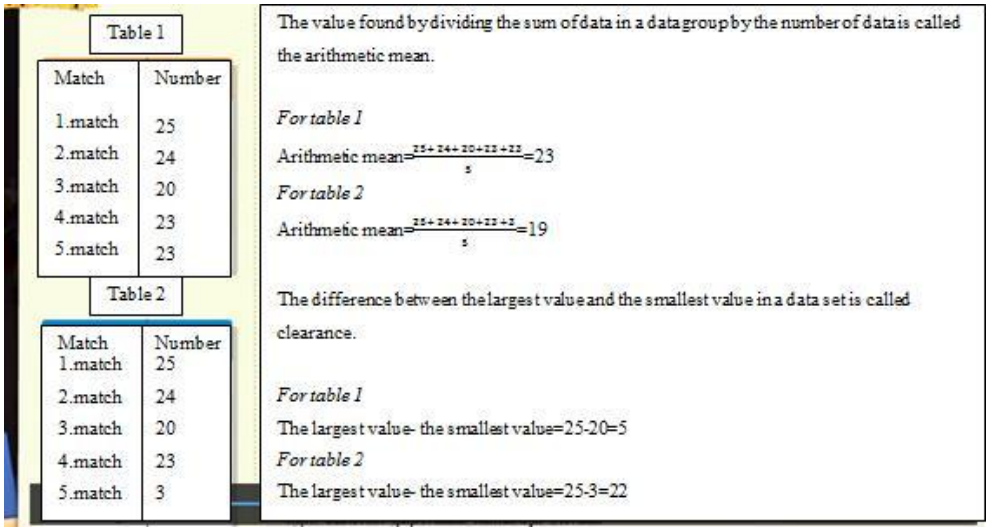

Figure 1. Example of sufficiently clear and understandable information

As shown in Figure 1, the information related to range is sufficiently clear and understandable in the video lecture related to "arithmetic mean and range" subtopic in EBA. Additionally, the definition of range, its examples, its aims, and its contributions to the study have been mentioned in the learning contents. However, the instructions of example activity in the interactive video lecture on the subject related to the comparison of two data sets were not sufficiently clear. More so, the data which needed to be used for the solution of the problem in the activity were not available in the video. In the chapters of 6th grade "Data Collection and Evaluation" and "Data Analysis", appropriate examples related to the concepts were provided, while the counterexamples were not sufficiently used. As a result, it is possible to say that the chapters of "Data Collection and Evaluation" and "Data Analysis" that exist in the digital course book are mostly appropriate to the standard of clearness.

Accuracy

Positive answers should be provided to the questions below for an expression to be appropriate to the standard of accuracy:

- Is the reasoning accurate?
- Is the accuracy of the claims supported?

It is seen that the information that exists in digital course book, lecture on subject, exercises, and multiple choice tests of EBA learning contents is mostly accurate and the information provided are supported by examples. Additionally, the fact that the questions used as exercises in the learning contents are related to real life contributes to the accuracy of the information.

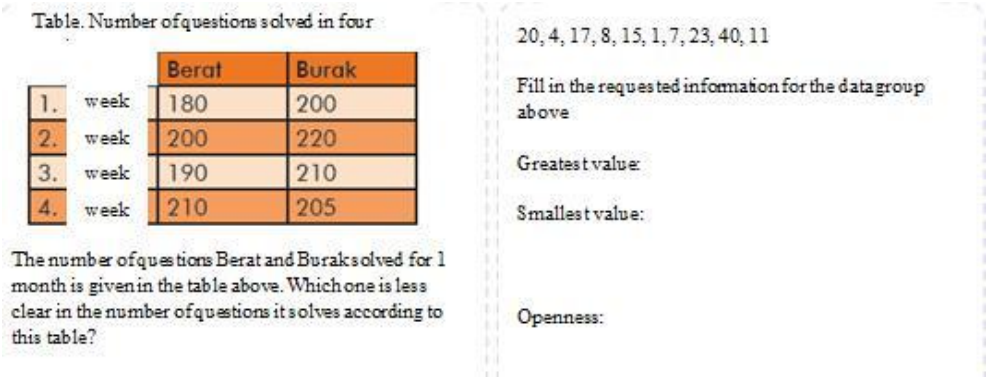

Figure 2. The expression whose accuracy is not supported sufficiently

The effect of the range being small or large due to the differences between the data is mentioned in the expression on page 147 of digital course book. However, based on question 9, using the values in which the differences between data sets is more explicit can be very useful in terms of making the expression concrete and supporting its accuracy. When the information, which belongs to the subtopics of "Data Collection and Evaluation" and "Data Analysis" existing in digital course book, lecture on subject, exercises, and multiple choice tests of EBA learning contents is analyzed in terms of the standard of accuracy, it can be stated that this information is appropriate to this standard.

Importance

Positive answers should be provided to the questions below for an expression to be appropriate to the standard of importance:

- Is the most important thing focused on in the reasoning used?
- Can the reasoning used be summarized? (Aybek, 2015)

According to 6^{th} grade math teaching curriculum (MEB, 2018), the ability to do research, produce information, and use the information which is produced is one of the special objectives of math teaching curriculum. When EBA learning contents, which belong to the subtopics of "Data Collection and Evaluation" and "Data Analysis" were analysed, it was shown that the examples in these contents could be used in different disciplines or in daily life with similarities based on the examples in the learning contents. This is because the graphics are one of the subjects which can be seen in different disciplines such as daily life, advertisements, banks, news, and science and technology.

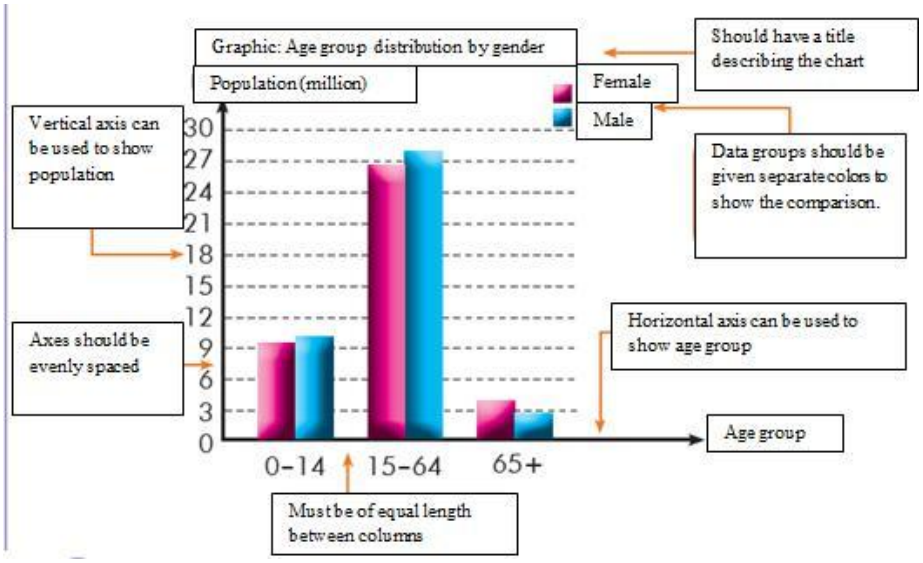

Figure 3. The example of providing important information conspicuously

Based on these examples, it can be stated that the information which belongs to the subtopics of "Data Collection and Evaluation" and "Data Analysis" existing in digital course book, lecture on subject, exercises, and multiple choice tests of EBA learning content is appropriate to the standard of importance.

Sufficiency

Positive answers should be provided to the questions below for an expression to be appropriate to the standard of sufficiency:

- Are the expressions considered sufficiently?
- Are there any other necessary points to pay attention to?

It was shown that the information was sufficient for the achievement of the objectives. Also, the number of examples and activities related to the subject that exists in EBA learning contents are sufficient. The multiple choice tests and skill based tests, which are components of EBA learning contents, enable the things that are learned to be reinforced and are appropriate to the standard of sufficiency. Furthermore, the fact that the questions that exist in these tests have the quality of providing connection with real life helps the results to be achieved by making the learners think about the expressions sufficiently.

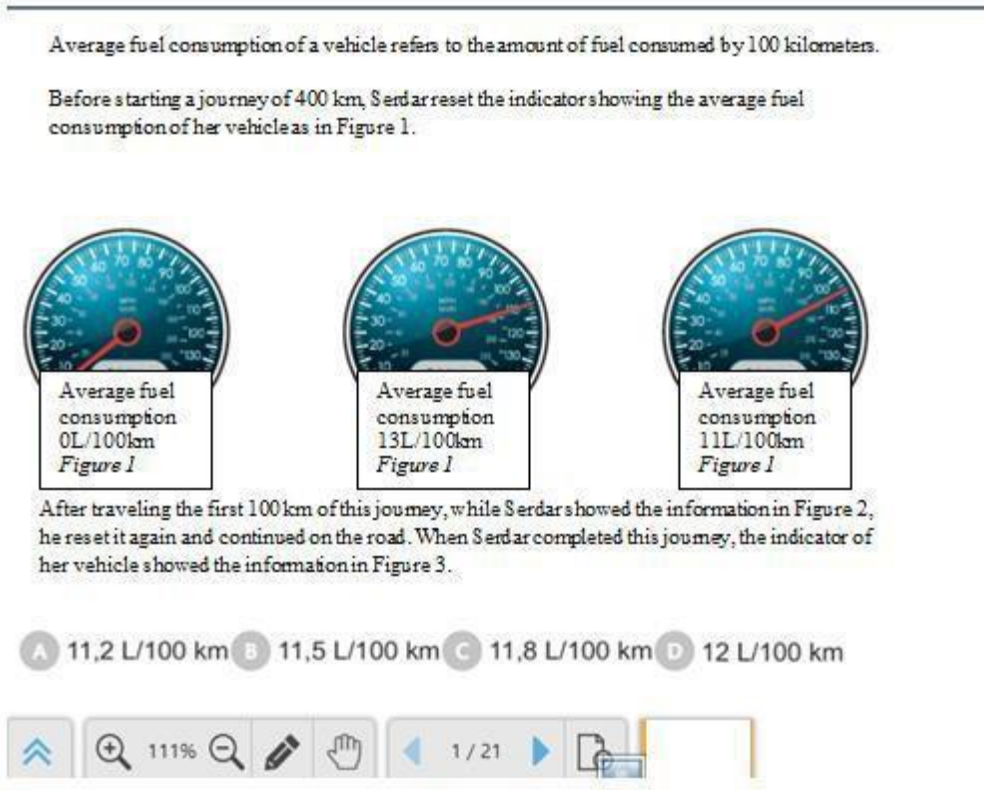

Figure 4. Sample question that exists in skill based tests

As shown in Figure 4, it is possible to reinforce the things learned and also reflect on the expressions and concepts when there are questions that are aimed at achieving the results by providing connection with real life. It is also possible to say that the use of EBA learning contents by means of interactive whiteboard is efficient in enabling the students to focus on the questions. As a result, the subtopics of "Data Collection and Evaluation" and "Data Analysis" existing in EBA learning content is appropriate to the standard of sufficiency.

Depth

Positive answers should be provided to the questions below for an expression to be appropriate to the standard of depth:

- Is there an in-depth look under the surface based on the reasoning used?
- Are other related perspectives taken into account?

It can be concluded that the examples, which have been made while EBA lesson contents have been prepared, are considered sufficient. Owing to the nature of math lesson, the results of four operations are true or false. Nonetheless, they are performed in different paths. When considered from this perspective, it was shown that the results of numerical operations in the examples that existed in EBA learning contents were correct. More so, the data used in the examples were built on solid bases. For instance, the example that exists in the chapter of "*Let's learn together*" on page 149 of digital course book analyses the distribution of age groups according to gender in Turkey in 2016. The data used in this example was acquired from the records of Turkish Statistical Institute (TUIK). In the example, which was extracted from the video lecture on the subject related to data organisation, the same data was shown in the form of vertical and horizontal column charts and the charts were formed by means of two different perspectives.

According to Figure 5, the presentation of the data by means of both horizontal and vertical column charts was made in order to enable the learners to look at the subject from different perspectives. The horizontal or vertical form of the column chart does not influence the result in any way.

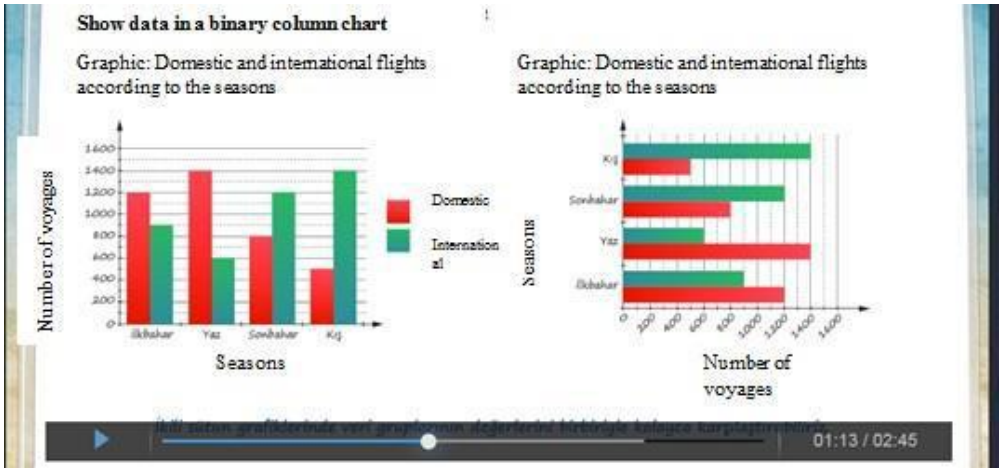

Figure 5. Forming column charts with different perspectives

According to these analysis, the subtopics of "Data Collection and Evaluation" and "Data Analysis" existing in EBA learning content is appropriate to the standard of depth.

Precision

Positive answers should be provided to the questions below for an expression to be appropriate to the standard of precision:

- Is the reasoning used precise enough?
- Is the precision provided with a degree that the target group needs?

It was shown that they were appropriate to the standard in terms of the precision of results. Thus, the results of the examples and questions that exist in EBA learning contents can be obtained.

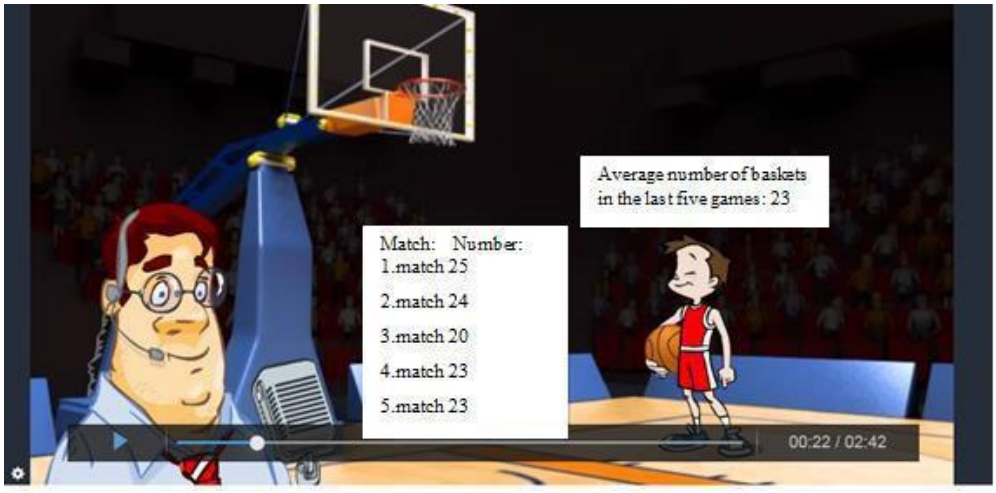

Figure 6. An example of a video lecture that is appropriate to the target group for using reasoning In the video lecture, as shown in Figure 6, the concepts of arithmetic mean and range were

focused on. Through this video, which is appropriately prepared for the age and level of 6th grade students, who are target groups, it is possible to enable students to use reasoning related to the

subject. In addition, more detailed explanations and examples related to the use of arithmetic mean or range for comparing data sets and describing the situation can be provided. While two sets of data are compared in terms of success, it is more useful to determine arithmetic means first. If the arithmetic means of two groups are equal, it is important to look at the range in order to determine the more successful group. Consequently, the information of the range is efficient in determining the order of data, which is supported by examples. This contributes to making the subject information more detailed. Accordingly, it can be stated that the expressions has precision as much as 6^{th} grade students, who are the target group. Also, real life needs, different disciplines, and the detailed information with the support of examples contributes to its appropriateness based on the standard of precision.

Conclusion

The COVID-19 pandemic has resulted in a socio-economic influence in many fields including the education sector. UNESCO predicts that approximately 900 million students were influenced by this after face-to-face education in schools ended in more than 100 countries because of the pandemic (Nicola et al., 2020). The children miss the opportunity to have academic and socio-emotional learning, formative relationships with peers and adults, playing games with schoolmates, and satisfying their other needs while they are at home (Levinson, Çevik & Lipsitch, 2020). In the study done by Livari, Sharma, and Olkkonen (2020), the digital transformation of daily life during the pandemic period was researched and it was observed that all children were not equal in terms of their participation in digital education. This created problems related to the abilities and skills needed to use digital media for teaching-learning activities. However, according to Code, Ralph, and Forde (2020), the pandemic created important opportunities for education and caused the blended learning activities to result in transformation. As a result, blended learning activities started including more personal and individualized education. Distance education involves the process whereby the learners are distant from each other, and the learning sources and the interaction is carried out by means of telecommunication systems (Simoson, 2006). The activities of distance education are carried out in Turkey and all over the world due to the COVID-19 pandemic (Kaynar et al., 2020). The Ministry of National Education has created a distance educational environment which support the students academically and socially (Özer, 2020). The students can also continue their learning activities without the limitation of time and place by means of EBA. Turkey has been able to effectively do this within the distance education period (Özbey & Koparan, 2020). When EBA learning contents, which belonged to “Data Collection and Evaluation” and “Data Analysis” subtopics of elementary school 6^{th} grade math lesson, were evaluated in terms of the standards of critical thinking, it was observed that they were appropriate to clearness, accuracy, importance, sufficiency, depth, and precision standards of critical thinking. In the study done by Erümit (2020), it was concluded that EBA TV supported the students in learning and provided them with psychological support. Furthermore, the concepts explained were visualized sufficiently and counterexamples were not sufficiently used in terms of the standard of clearness. Errors were not determined in the examples including four operations in the analysis conducted in terms of the standard of accuracy. In addition, the subjects in the course contents are presented in the context of real life situations, and this feature of subjects presented in connection with real life situation is efficient in ensuring the accuracy of the information. It is also possible to say that the applications that exist in EBA system increase student-teacher interaction by creating learning situations which are quite similar to real environment. Özer and Suna (2020) stated that the applications of live lesson existing in EBA enabled the teachers to have live interaction with

their students. Within this context, it is expected that the applications of live lessons support students in acquiring the target skills by creating learning environments which are similar to real classroom environment.

Thus, the chapters of "Data Collection and Evaluation" and "Data Analysis" were appropriate to the standard of importance. The examples that exist in the unit are related to real life, and it emphasizes the importance of the subject in a way that is appropriate to the level of 6^{th} grade. Also, the chapters analysed were generally appropriate to the standard of sufficiency. The examples and exercises in the chapters are sufficient, but the use of performance homework will be efficient in reinforcing the things that are learned. Using different perspectives related to the subject in the learning contents during the process of providing information is efficient in providing the standard of depth. The chapters of "Data Collection and Evaluation" and "Data Analysis" are also appropriate to the standard of precision. Hence, they are appropriate to Nosich's (2012) standards of critical thinking. In the literature review to analyse the printed course books at different grade level, which had been used for years in Turkey, it was observed that there were also studies in which the criteria used in their analysis overlapped the standards of critical thinking (Ünsal & Güneş, 2002; Ünsal & Güneş 2004; Atıcı et al., 2007; Demirbaş, 2008; Gülersoy, 2013). Ünsal and Güneş (2004) analysed the course book with a critical perspective in terms of scientific content, educational design, book layout, lack of information, language, and expression and concluded that the course book was generally appropriate to the criteria determined. Atıcı et al. (2007) conducted a critical analysis of biology subjects of middle school course books and used teachers' points of view as data. It was concluded that the books were appropriate to the students' level in terms of orienting the students towards research, enabling them to participate in the lesson, and using comprehensible language and sentence structure. Therefore, it can be stated that the similar findings of the researches, which were done previously, support the findings of this research.

Thus, when the literature was analysed, it was shown that the analysis of the course books used in different years and in different grade levels in Turkey were performed with a critical point of view. In this study, EBA, i.e., digital education platform, which was used for distance learning activities in Turkey and due to the COVID-19 pandemic was analysed within the frame of critical thinking standards. According to the findings, it was concluded that EBA lesson contents in which course books also existed were at the level of contributing to the development of the students' critical thinking skills. Therefore, in accordance with these findings, it is suggested that:

- In the case where COVID-19 pandemic continues and during the process of distance learning, the studies in relation to the development of students' higher level thinking skills can be made within the context of different disciplines.
- The training and seminars for students and parents can be provided to enable them to benefit from thinking skills when they have psycho-social troubles during the pandemic period.

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The Selfitis Behavior Scale: An Adaptation Study

Ersun Ciplak, (PhD)
Ministry of National Education, Turkey
Meral Atici, (PhD)
Cukurova University, Turkey

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Abstract

This study aimed to adapt the Selfitis Behavior Scale (SBS) to measure university students' selfitis behavior in Turkey. Within the scope of the study, the SBS was translated from English to Turkish. Data were collected in the validity and reliability studies from four study groups, including 343 university students. According to the confirmatory factor analysis findings, the SBS had good fit indices. As is expected, the criterion-related validity study found moderate- and high-level positive correlations between the SBS subscales and total scores and the Selfie Attitude Scale (SAS) subscales and total scores. The other criterion-related validity study demonstrated that individuals taking a higher number of selfies than the sum of the scale and subscales scored significantly higher than individuals taking a lower number of selfies. The internal consistency coefficient was calculated to be .92 for the SBS total score, .78 for the Environmental Enhancement Subscale (SBS-EE), .68 for the Social Competition Subscale (SBS-SC), .72 for the Attention-Seeking Subscale (SBS-AS), .84 for the Mood Modification Subscale (SBS-MM), .82 for the Self-Confidence Subscale (SBS-S), and .70 for the Subjective Conformity Subscale (SBS-SCon). The test-retest correlation values found by applying the measurement tool once in four weeks were .77 (SBS), .70 (SBS-EE), .60 (SBS-SC), .82 (SBS-AS), .80 (SBS-MM), .61 (SBS-S), and .61 (SBS-SCon), respectively. The mentioned findings demonstrated that the SBS was a valid and reliable measurement tool capable of measuring the selfitis behavior of university students in Turkey.

Key Words: Confirmatory Factor Analysis, Reliability, Selfie, Selfitis Behavior Scale, Validity

Introduction

Technological products considerably influence human life in the digital age, especially those that have become a part of everyday life. Nowadays, people communicate with smartphones, which are the most important among these technological products, and access and share information. Currently, it is very easy to communicate and access information since such a habit

has been added to the repertoire of human behavior. Therefore, it is not surprising to see people taking selfies almost everywhere. Taking selfies has become a part of everyday life, especially for young people (Senft and Baym, 2015).

In the related literature, taking a selfie is defined as taking a person's self-image (Alblooshi, 2015). Since smartphones both have a camera and easy access to photo editing programs, young people can take selfies, edit selfies, and share them on social media networks with no time and space limits. Recently, scientists have been trying to answer the following question: What makes selfies so attractive to young people? An answer may be that young people take selfies to socialize and become popular (Alfailakawi, 2018; Amurao and Castronuevo, 2016). While this answer is rational, it cannot be sufficiently descriptive on an important issue because that answer does not help experts understand that people are putting themselves in danger when taking selfies. In recent days, news about people injuring themselves while taking selfies has been frequently featured in the media (Dokur, Petekkaya, and Karadag, 2018; Nearly 260 People, 2018). That is why researchers are making intensive efforts to uncover the variables associated with selfie behavior.

Some time ago, there was a fake news story on social media. According to this news, 'selfitis' (selfie addiction) was identified as a psychiatric disorder in the *DSM*. However, the American Psychological Association (APA) soon denied the claim in the news (APA, n.d.; APA: Taking selfies, 2014; Zhang, 2017). This fake news stated that selfitis was a distinct mental disorder associated with narcissism and obsessive-compulsive disorder (APA, 2018). Although this fake news has been rejected, a number of researchers have indicated that excessive selfie-taking may be a psychopathology (Vats, 2015). Safna (2017) reported that selfie addiction might lead to several problems for young people, including accidents, suicide, plastic surgery, skin damage, and loss of self-confidence.

When the relevant literature is reviewed, it is observed that researchers have studied selfie-taking behavior using a very broad range of research methods, including qualitative and quantitative ones. In qualitative studies, variables associated with selfie-taking behavior were identified, while quantitative studies investigated the relationships among these variables (Al-Menayes, 2015; Balakrishnan and Griffiths, 2017; Boursier, Gioia and Griffiths, 2020a, 2020b; Cedillo and Ocampo, 2016; Charoensukmongkol, 2016; Edwards, 2017; Hingerton, 2016; Marcial, 2015; Mullai, Macaj and Kotherja, 2017; Nagalingam and Arumugam, 2015; Nagalingam, Arumugam, and Thenniz Preethy, 2019; Tiggemann, Anderberg and Brown, 2020). For example, in these studies, the relationships between selfie-taking and the variables of self-esteem, narcissism, attention-seeking, loneliness, egocentrism, interpersonal approval, and problematic internet usage were investigated. There are also studies on selfie-taking behavior that focus on establishing models and scale development (Balakrishnan and Griffiths, 2017; Charoensukmongkol, 2016; Solanki, 2017). The first one of these studies was conducted by Charoensukmongkol (2016). In this model, the researcher examined the relationships between selfie-taking behavior and the variables of attention-seeking, egocentrism, loneliness, and narcissism. As a result of the study, Charoensukmongkol found that these variables were associated with selfies. On the other hand, Solanki (2017) developed a scale including 47 questions. In addition to narcissistic personality disorder, Solanki's scale helps researchers determine the association of selfie behavior with various mental health disorders, such as low self- esteem and body perception disorder. Another scale development study was carried out by Balakrishnan and Griffiths (2017). On this scale, self-taking behavior is considered in association with six latent variables, namely environmental enhancement, social competition, attention-seeking, mood modification, self-confidence, and subjective conformity.

To date, researchers in Turkey have shown less interest in studying selfie-taking behavior. Therefore, there are few quantitative and qualitative studies on selfie addiction in Turkey. However, a scale development study aims to assess high school students' selfie attitude, as the literature shows (Ciplak and Cam, 2019). Since the Selfie Attitude Scale (SAS) is not such a measurement tool to identify selfie addiction and is also intended only for high school students, it has limitations in terms of the population that can be used and identifying addiction. Therefore, an absence of such a scale may hinder/make it impossible to study selfie-taking behavior for researchers in Turkey.

From this point of view, it is thought that the adaptation of the Selfitis Behavior Scale introduced by Balakrishnan and Griffiths (2017) to Turkish will meet a significant need. Depending on its significance and logical background, this study aimed to adapt the Selfitis Behavior Scale (SBS) to Turkish. To this end, the SBS was first translated into Turkish, and then the psychometric properties of the scale were examined and determined.

Method

Participants

The research included four study groups, comprising 343 students attending universities in different parts of Turkey during the 2020-2021 academic year. The first study group consisted of 37 university students (27 females: 73.0%, 10 males: 27.0%) and produced data for testing the language reliability of the scale. The confirmatory factor analysis study was carried out using the data obtained from another study group consisting of 246 university students (195 females: 79.3%, 51 males: 20.7%). In the criterion-related validity (similar scale validity) study, the third study group consisted of thirty (25 females: 83.3%, 5 males: 16.7%) university students. The fourth study group, in which the test-retest study was performed, included 30 university students (23 females: 76.7%; 7 males: 23.3%). Table 1 contains the detailed descriptive characteristics of the university students in the study groups.

Table 1: Descriptive characteristics of the participants

	Gender			Grade level		
		f	%		f	%
Sample 1	Female	27	73.0	First	-	-
N: 37	Male	10	27.0	Second	-	-
				Third	-	-
				Fourth	37	100.0
Sample 2	Female	195	79.3	First	75	30.5
N: 246	Male	51	20.7	Second	41	16.7
				Third	55	22.4
				Fourth	75	30.5
Sample 3	Female	25	83.3	First	5	16.7
N: 30	Male	5	16.7	Second	21	70.0
				Third	4	13.3
				Fourth	-	-
Sample 4	Female	23	76.7	First	6	20.0

N: 30	Male	7	23.3	Second	10	33.3
				Third	7	23.3
				Fourth	7	23.3

Data Collection Tools

Selfitis Behavior Scale (SBS): The aim of the SBS, established by Balakrishnan and Griffiths (2017), is to identify selfitis behavior in university students. The scale was developed with 400 university students. The scale comprises 20 items having five-point Likert-type response options. The SBS (α: .88) consists of six factors including Environmental Enhancement (SBS-EE, α: .84), Social Competition (SBS-SC, α: .83), Attention-Seeking (SBS-AS, α: .81), Mood Modification (SBS-MM, α: .82), Self-confidence (SBS-S, α: .79), and Subjective Conformity (SBS-SCon, α: .75). The factor loads of the scale items, in which 70.69% of the total variance is explained by six factors, change in the range of .71 - .86. The SBS has the following fit indices: X^2/df: 1.38; RMSEA: .031; GFI: .95; AGFI: .93; NFI: .94; CFI: .98. During the process of adapting the SBS to Turkish, Janarthanan Balakrishnan and Mark D. Griffiths were first contacted through e-mail, and the permission required to adapt the scale was acquired. After consent was obtained, three lecturers, proficient in English, translated the scale independently from the source language into the target language, i.e. from English into Turkish. As a result of the comparison of the translations, the Turkish statements representing every item in the best way were revealed. Afterward, the back-translation method was implemented with the aim of testing the Turkish version's equivalence with the original scale. To this end, three faculty members, proficient in Turkish and English, translated the Turkish version to English in an independent way, and therefore, the scale's back translation was acquired. Following the determination of linguistic equivalence, the scale's Turkish version was acquired. The correlation between the scale's Turkish version and the back translation of the scale was computed. The findings obtained through the SBS's linguistic equivalence research demonstrated that the correlation between the Turkish version and the original form was .98 for the overall scale.

Selfie Attitude Scale (SAS): The SAS, developed by Ciplak and Cam (2019), aims to determine selfie attitude in high school students. The scale was developed with 697 high school students. The scale comprises 28 items having five-point Likert-type response options. The SAS (α: .94) consists of two factors, including Positive Experiences to Selfie (SAS-PES, α: .91) and Negative Experiences on Prevention (SAS-NEP, α: .93). The factor loads of the scale items, in which 46.09% of the total variance is explained by two factors, change in the range of .44 - .78. The SAS has the following fit indices: X^2/df: 1.46; p: .00; RMSEA: .065; SRMR: .080; NFI: .92; NNFI: .97; CFI: .98. As part of this study, the following values were obtained as a result of the CFA conducted to test the validity of the SAS structure on university students: X^2/df: 2.99; p: .00; RMSEA: .090; RMR: .078; NFI: .90; NNFI: .93, and CFI: .93. The factor loads of the scale items varied between .38 and .82. The Cronbach's alpha values of the SAS are .91 (SAS-PES: .90 and SAS-NEP: .81).

Data Collection

Data were collected between September 2020 and December 2020. The data were collected using Google Forms under the COVID-19 pandemic conditions. The SBS and SAS were

transferred to the internet environment, and announcements were made to volunteer participants. Data collection, lasting for about 20 minutes, was performed on a voluntary basis.

Data Analysis

Within the scope of the current research, the data acquired from the measurement tools were primarily reviewed, the scales responded incorrectly were identified, and SPSS 22.0 and LISREL 8.70 statistical package programs were utilized for the analysis of the data transferred to the digital environment. In the data analysis, the independent samples t-test, confirmatory factor analysis (CFA), and Pearson's correlation coefficient were employed. While interpreting the findings, the level of .05 was considered significant.

Ethics

The university research ethics committee of the second author approved the research. Informed consent on participation in the research was acquired from all participants.

Results

Confirmatory Factor Analysis (CFA)

According to the CFA performed with the data obtained from 246 university students, the factor loads of 20 items of the SBS ranged from .60 to .88, and the error variances ranged from .23 to .66. Upon reviewing the fit indices, the values of X^2/df: 2.16, p: .00, RMSEA: .069, SRMR: .059, NFI: .96, NNFI: .97, CFI: .97, and GFI: .88 were found. The analysis demonstrated that the X^2/df, NFI, NNFI, and CFI values of the SBS exhibited excellent compatibility, whereas its RMSEA and SRMR values exhibited good compatibility. The t-values acquired as a result of the CFA for the items in the SBS ranged from 9.38 to 16.97 ($p < .05$). However, since the GFI value was not found within acceptable limits, the modification suggestions were reviewed, and a decision on combining the error variances of item 13 and item 19 of the same factor (the first factor) was taken.

The findings acquired following the modification showed that the scale's factor loads ranged from .46 to .88, and the error variances ranged from .23 to .79. Upon examining the fit indices, the values of X^2/df: 1.62, p: .00, RMSEA: .050, SRMR: .049, NFI: .97, NNFI: .98, CFI: .99, and GFI: .91 were acquired. The t-values obtained as a result of the CFA for the SBS items ranged from 6.93 to 16.99 ($p < .05$). The analysis demonstrated that the X^2/df, RMSEA, SRMR, NFI, NNFI, and CFI values of the SBS exhibited excellent compatibility, whereas its GFI value showed good compatibility. Therefore, when the analysis of all the values is conducted together, it is possible to say that the six-factor structure of the SBS showed compatibility (See Figure 1).

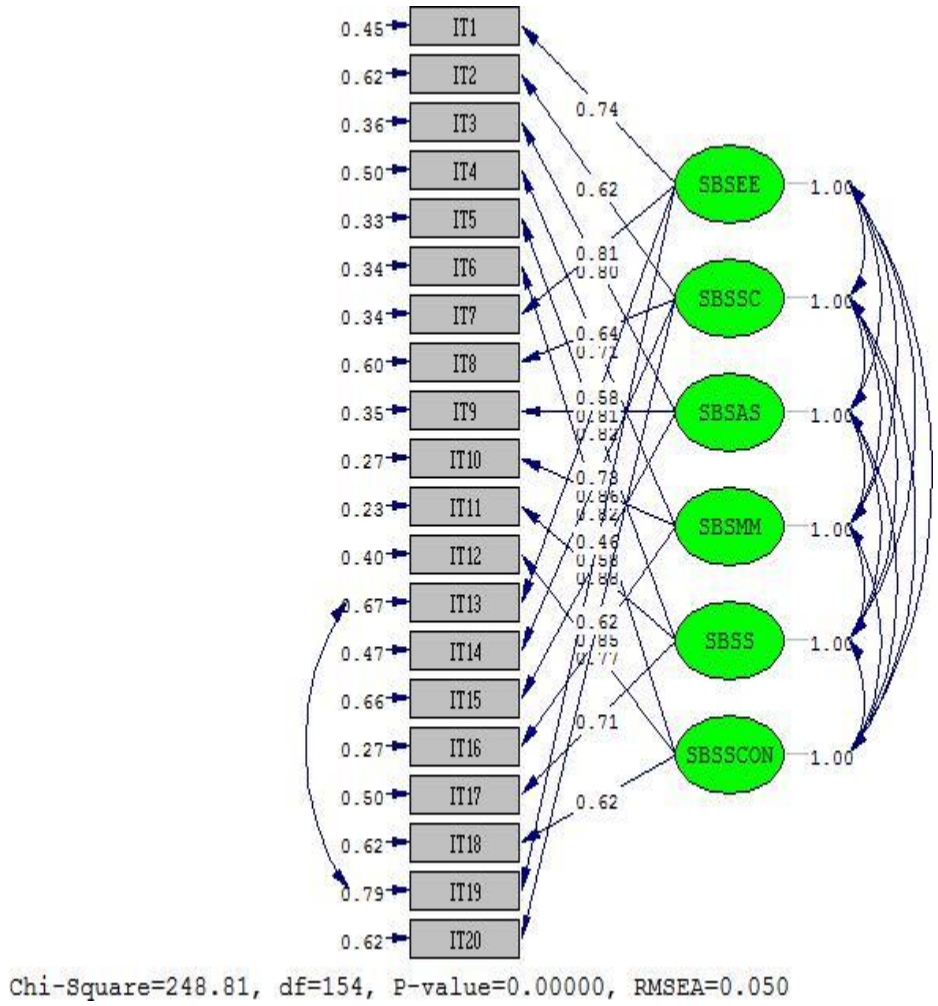

Figure 1: The SBS' path diagram

Second-Order Confirmatory Factor Analysis

The second-order CFA was also performed to determine whether the six-factor structure of the SBS predicted a single variable. As a result, the factor loads of 20 items of the SBS were observed to range from .60 to .86, and the error variances ranged from .27 to .65. Upon reviewing the fit indices, X^2/df: 3.03, p: .00, RMSEA: .091, SRMR: .069, NFI: .94, NNFI: .95, CFI: .96, and GFI: .83 values were obtained. As a result of the CFI analysis, the CFI and NNFI values of the SBS values exhibited excellent compatibility, whereas its X^2/df, SRMR, and NFI values exhibited good compatibility. The RMSEA and GFI values of the SBS were not at a good level. The t-values found as a result of the CFA for the items in the SBS ranged from 7.84 to 15.20 ($p < .05$). However, since the RMSEA and GFI values were not found within acceptable limits, the modification suggestions were reviewed, and a decision on combining the error variances of item 13 and item 19 of the same factor (the first factor) was made.

The findings acquired following the modification showed that the scale's factor loads ranged from .46 to .86, and the error variances ranged from .27 to .79. The standardized values between the SBS subscales scores and the SBS total score ranged from .76 to .94. When the fit indices were investigated, the values of X^2/df: 2.49, p: .00, RMSEA: .078, SRMR: .060, NFI: .95,

NNFI: .97, CFI: .97, and GFI: .86 were found. The t-values computed by the CFA for the SBS items ranged from 6.54 to 15.16 ($p < .05$). The analysis showed that the X^2/df, NFI, NNFI, and CFI values of the SBS exhibited excellent compatibility, whereas its RMSEA and SRMR values exhibited good compatibility. Despite an increase in the GFI value following the modification, it was not at a good level. Nevertheless, when the analysis of all the values is performed together, it is possible to say that the six-factor structure of the SBS showed compatibility (See Figure 2).

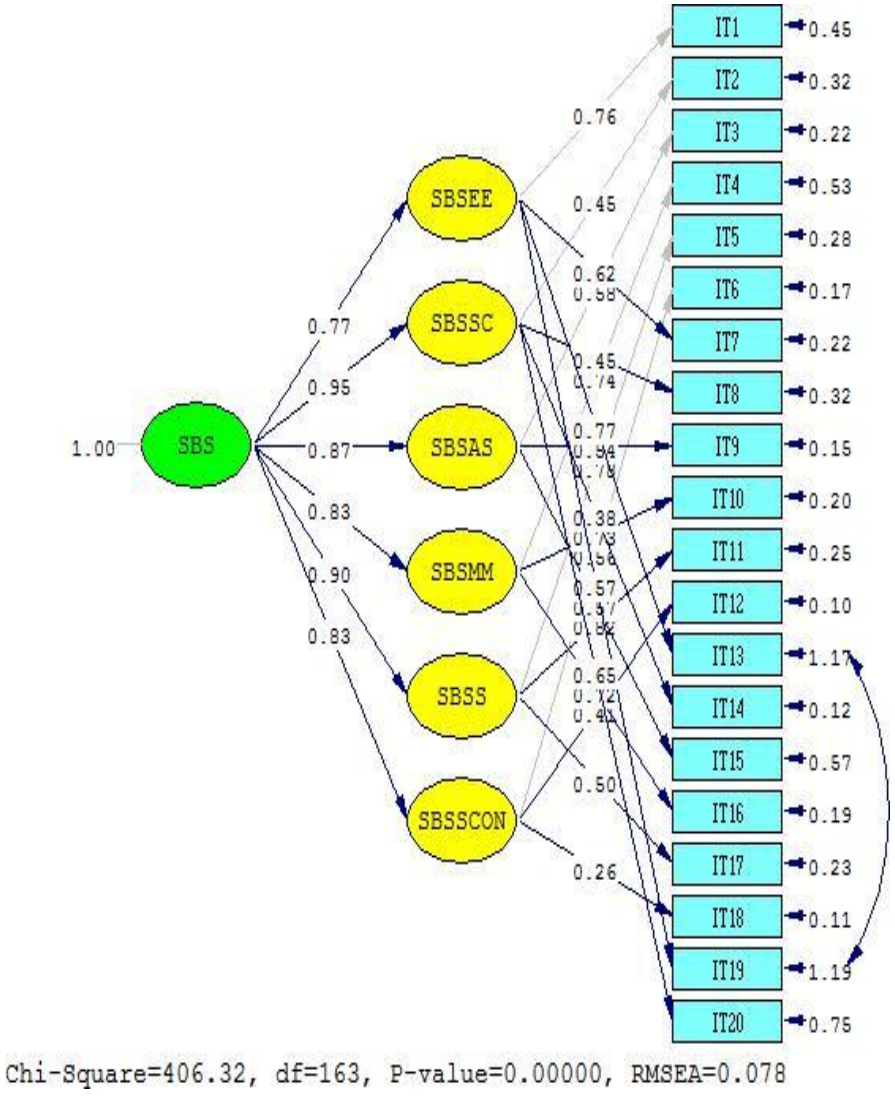

Figure 2: The SBS' second order path diagram

Criterion-Related Validity

The scale's first criterion-related validity study was carried out by investigating the correlations between the data obtained from a sample of 30 university students and the SBS and SAS scores (See Table 2). Positive significant correlation values were between 0.77 and 0.87 with the SBS total scores and the SAS total and subscale scores ($p<.05$). The correlation values were computed to be between 0.73 and 0.80 in the positive direction between the SBS-EE and the SAS total and subscale scores ($p< .05$). The correlation values of the SBS-SC, SBS-AS, SBS-MM, SBS-

S, and SBS-SCon subscale scores with the SAS total and other subscale scores were similar between 0.59 and 0.79 in the positive direction (p<.05).

Table 2: Correlation values of the SBS and SAS.

Variables	SBS-EE	SBS-SC	SBS-AS	SBS-MM	SBS-S	SBS-SCON	SBS
SAS-PES	.73**	.73**	.78**	.77**	.71**	.59**	.83**
SAS-NEP	.74**	.61**	.64**	.60**	.76**	.69**	.77**
SAS	.80**	.74**	.79**	.76**	.79**	.69**	.87**

*p< .05, **p< .01

SBS: Selfitis Behavior Scale, SBS-EE: Environmental Enhancement, SBS-SC: Social Competition, SBS-AS: Attention Seeking, SBS-MM: Mood Modification, SBS-S: Self-Confidence, SBS-SCON: Subjective Conformity, SAS: Selfie Attitude Scale, SAS-PES: Positive Experiences to Selfie, SAS-NEP: Negative Experiences on Prevention.

The other criterion-related validity research of the SBS was conducted with the sample in which the CFA was carried out. In the mentioned research, the selfie-taking frequency of university students was selected as a criterion. The comparison of these participants' arithmetic means of the scores was made by naming individuals who took selfies once a day at most "those taking fewer selfies" and individuals who took selfies twice a day and more "those taking more selfies" (See Table 3). Accordingly, a statistically significant difference was revealed between the SBS total and subscale scores' arithmetic means of university students taking more selfies and taking fewer selfies in favor of university students taking more selfies (p < .05).

Table 3: The findings of the t-test of groups who took more selfies and who took fewer selfies

	Groups		$\bar{x}$	Sd	t
SBS-EE	Fewer	51	4.73	1.50	-4.10*
	More	20	6.75	1.20	
SBS-SC	Fewer	51	4.78	1.35	-4.56*
	More	20	6.85	1.84	
SBS-AS	Fewer	51	4.67	1.86	-5.47*
	More	20	7.30	1.72	
SBS-MM	Fewer	51	5.16	1.71	-6.36*
	More	20	8.25	2.15	
SBS-S	Fewer	51	3.75	1.53	-2.15*
	More	20	4.60	1.43	
SBS-SCON	Fewer	51	3.61	1.52	-4.02*
	More	20	5.20	1.44	
SBS	Fewer	51	26.69	8.11	-5.63*
	More	20	38.95	8.63	

*p< .05

SBS: Selfitis Behavior Scale, SBS-EE: Environmental Enhancement, SBS-SC: Social Competition, SBS-AS: Attention Seeking, SBS-MM: Mood Modification, SBS-S: Self-Confidence, SBS-SCON: Subjective Conformity

Reliability Analysis

The internal consistency coefficient (α) of the total score computed for the 20 items of the scale was .92 (N=246). This value was calculated to be .78 for the SBS-EE, .68 for the SBS-SC, .72 for the SBS-AS, .84 for the SBS-MM, .82 for the SBS-S, and .70 for the SBS-SCon ($p < .05$). To determine the SBS test-retest reliability, the correlation value between the total scores of the scale implemented on 30 university students two times at intervals of four weeks was .77. ($p < .05$). The SBS-SC correlation coefficients were found to be .70 for the SBS-EE, .60 for the SBS-SC, .82 for the SBS-AS, .80 for the SBS-MM, .61 for the SBS-S, and .61 for the SBS-SCon ($p < .05$).

Item Analysis Results

In the item analysis, the item-total score correlation was investigated, and the end groups were compared (N=246). The correlation values between the university students' scores acquired from every item of the scale and the subscale corrected total scores were computed, and the values changed in the range of .55 - .70 for the SBS-EE, in the range of .44 - .57 for the SBS-SC, in the range of .48 - .60 for the SBS-AS, in the range of .68 - .74 for the SBS-MM, in the range of .60 - .76 for the SBS-S, and in the range of .47 - .62 for the SCS-SCon ($p < .05$). While comparing the end groups, the scores of university students acquired from the scale were listed from large to small, and the upper and lower 27% groups (N=134) were taken, and the comparison of the arithmetic means of the scores acquired from every scale item by the mentioned groups was made. The analysis demonstrated that the t-values computed for all scale items varied between 4.69 and 16.25 ($p < .05$). It was determined that the participants who scored higher from the total of the scale had higher mean scores in all items compared to the participants who scored lower.

Discussion

In this study, which aimed to adapt the scale to measure the selfitis behavior of university students in Turkey, the validity and reliability measures of the SBS were performed. When carrying out the study, the Selfitis Behavior Scale was translated to Turkish, and the langue validity was ensured. Afterward, CFA was conducted to test the six-factor structure of the Selfitis Behavior Scale, and accordingly, the scale's fit indices were revealed to be at the good and excellent levels. The second-order CFA results showed that the scores of the SBS subscales predicted the SBS total score. However, the AGFI value was below the acceptable limits. There is an explanation for this result in the literature that the sample size influences the AGFI values (Cokluk, Sekercioglu, and Buyukozturk, 2016; Karagoz, 2016; Meydan and Sesen, 2015; Secer, 2015). Although the critical N is 131.96 in this study, the small sample size (N: 246) may be responsible for this result. Thus, in the assessment of the results, particularly in a case of a small sample, it is beneficial to assess all the fit indices together by considering the CFI, NFI, and NNFI values working very well (Celik and Yilmaz, 2013; Cokluk, Sekercioglu, and Buyukozturk, 2016; Karagoz, 2016; Meydan and Sesen, 2015; Secer, 2015). Based on this information in the literature, the study's findings may be regarded as evidence of the scale's construct validity. Consequently, this result shows us that the SBS consists of a simple and stable structure with six factors.

Moreover, criterion-related validity studies examined the SBS correlations and subscale scores to the SAS total and subscale scores. High scores from the SAS and its subscales indicate that the selfie attitude of college students is strong. Likewise, the increase in the SBS scores and its subscales showed that university students' selfitis behavior was strong. Therefore, a moderate and

high positive correlation was expected between the scores from both scales. It is not surprising that a significant positive correlation was found between the SBS subscales and the SAS subscales. This result can be explained by the fact that environmental enhancement, social competition, attention-seeking, mood modification, self-confidence, and subjective conformity are closely related to both positive and negative experiences on prevention. Similar results of several studies in the literature show that people take and share selfies to make friends, develop self-confidence, and communicate (Cedillo and Ocampo, 2016; Charoensukmongkol, 2016; Edwards, 2017; Mullai, Macaj, and Kotherja, 2017; Nagalingam and Arumugam, 2015). Furthermore, a statistically significant difference between the mean scores of individuals who take "fewer" selfies and individuals who take "more" selfies shows that the SBS has a distinctive quality in terms of identifying university students' selfitis behavior. In other words, the Turkish version of the SBS can distinguish university students' selfitis behavior at the expected level and in the expected direction, which constitutes evidence for the validity of the SBS.

The internal consistency of the scale scores was computed, and discriminant reliability was evaluated. The fact that all the coefficients found for the total score and subscale scores concerning reliability were about .70 and higher than .70 demonstrates that the scale was highly consistent and time-sensitive with regard to measurement (Buyukozturk, 2011). There are three items in the SBS-SC subscale. Because the internal consistency coefficient is related to the number of items included in the scale, it is thought that calculating the Cronbach's alpha value as 0.68 does not lead to a reliability problem. The item analysis findings were in line with the validity and reliability results of the measurement tool and supported the tool's psychometric properties.

Recommendations

When assessing the results acquired in the scale's construct validity research together, it is regarded that the tool has suitable construct validity. Nevertheless, since the GFI and AGFI values are below the expected level, particularly as a result of CFA, it is suggested to re-confirm the structure in question with similar samples. Moreover, because data collection was difficult due to the COVID-19 pandemic, the scale's reliability studies can be repeated on a larger sample in the future. In this study, the SBS was adapted to measure the selfitis behavior of university students. Other research can investigate the validity and reliability of the SBS in younger and older age groups.

Conclusion:

As a result of this study, it can be said that the SBS is a valid and reliable measurement tool capable of measuring the selfitis behavior of university students in Turkey by considering its limitations.

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Compliance with Ethical Standards

Conflict of Interest

No conflict of interest is declared by the authors.

Ethical Approval

All procedures carried out in the present research, which included human participants, were

in line with the ethical standards of the research ethics board of the university and with the 1975 Declaration of Helsinki.

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A Qualitative Study on the Perception of Fatherhood

***Tanju Gurkan**, PhD*
Ankara University, Retired faculty member, Turkey
***Azize Ummanel**, EdD*
European University of Lefke, North Cyprus
***Nihan Koran**, PhD*
Eastern Mediterranean University, North Cyprus

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Abstract:

The changing structure of the society and the increase in the number of working women has been influential on the relationship between the child and the parent. Today, the woman, who is responsible for the nutrition and care of the child according to the traditional point of view, can perform these duties not on her own but with her husband and the basic needs of the child can be provided by the parents together. Therefore, the role of fatherhood has changed and fathers have become more involved in meeting the basic needs of the child. This study aims to explore how men perceive fatherhood and how mothers perceive their husband's fatherhood. 15 fathers and 15 mothers were included in the study. Mothers and fathers were interviewed to collect the data and the data were examined under the main categories of "Fatherhood self-assessment" and "Fatherhood role perception." The results provide insight into how fathers parenting children between the ages of 3 and 6, how they perceive their fatherhood and how mothers perceive their husband's fatherhood. Furthermore, results were obtained about how parents define fatherhood and which roles they associate fatherhood with. In conclusion it was found that fathers have a traditional perception on fatherhood, and the results were discussed in this context. As it is one of the first studies on fatherhood conducted in the TRNC, this study has importance and similar studies are suggested to carried out.

Key Words: Fatherhood, fatherhood role perception, TRNC.

Introduction

Starting from a young age, we demonstrate roles in our games that we may encounter in the later years of our lives; however, this time, we experience them as a fact of life, not as a game. One of these roles is undoubtedly parenting. While several studies related to motherhood and fatherhood prevail in the literature, studies related to fatherhood, in particular, have increased only in recent years.

Fatherhood, just like motherhood, emerges as an element of the social structure created under the institution of marriage; this structure is greatly influenced by the traditional way of life, thus forming different roles. From the traditional viewpoints of the Western and Eastern societies, a father works outside of the house and carries the responsibility of economically supporting the

family and a mother takes care of the house and children (Atmaca Kocak, 2004; McKeown, 2001; Pontes, Osorio & Alexandrino, 2009). Parenting is not biological; it comprises various roles wherein a man who fathers a child can be called "a father," even if he does not share a biological connection with the child (Richardson, 1995).

Within the family dynamics, mothers and fathers are responsible for the nutrition, protection, and the physical and emotional needs of a child; they play an active role in developing a child's personality and transferring social values to the child (Gungorduz, 2010). This unwritten agreement for the division of work among family members is influenced by cultural values; however, it can alter in accordance with economic ties (Coltrane, 1995; Dick, 2001). Further, a rise in the paternal involvement in childcare and a change in the traditional roles have been observed, as women are actively participating in maintaining a work–life balance (Bayer, 2020; Gursimsek, Kefi & Girgin, 2007; Raven & Sevim, 2004; Stubley, Rojas & McCroy, 2015). While the roles of a father who inculcates discipline, plans the future, interacts with the world outside of the family (Respect, 2008, p. 131) are changing, many fathers have begun experiencing the stress of managing economic support and facilitating paternal involvement (McKeown, 2001). Moreover, with the child's responsibilities being attributed to the mother and men leaving the traditional status of fatherhood wherein their roles are limited, a father's dilemma associated with the loss of masculinity is an evident phenomenon (Beyazit & Famagden, 2015).

Undoubtedly, changes in men's paternal roles in today's family life entail a closer father–child relationship. However, fathers worldwide spend much less time on childcare than mothers (Engle, 1997). Thus, investigating the ways in which men perceive fatherhood is vital. According to the traditional understanding, men perceive fatherhood as being the breadwinner of the house, the head of the family, a link between the family and the world outside, playing with the child, being responsible for the education and discipline of the child, and being a parent who protects their child (Summers et al., 1999). While fathers in Japan associate fatherhood with the concepts of discipline and authority (Kutz, 1994), fathers in Zimbabwe cannot hide their astonishment as they are informed about the importance of playing with the child from an early age (Engle, 1997). Although American fathers do not give their children more time for activities such as reading books, storytelling, and singing, they demonstrate behaviors such as changing diapers, preparing food, and feeding their children (Bronte-Tinkew, Carrano & Guzman, 2006). In Turkey, the perception of fatherhood is shaped around aspects such as ensuring the livelihood of the household, undertaking new responsibilities, and being in an authoritative position and providing protection. Among these points, the most crucial one is to ensure the livelihood of the household. While this aspect is becoming more prominent, new responsibilities such as caring for, showing love to, supporting, and being friends with the children are not very robust (Tol & Taskan, 2018). Studies conducted in Turkey indicate that the perception about fatherhood varies according to the father's age, level of education, and the age at which they first became a father, i.e. (Aksoy & Tatlı, 2019; Guzel & Tufekci, 2021; Telli & Özkan, 2016), as the age and experience of being a father increase, one's perceptions about fatherhood shifts from the traditional structure, and with an increase in the educational level, fathers become more sensitive to their child's needs and participate more in advancing child care (Gultekin Akduman & Turkoglu, 2013). In addition, researchers hold similar viewpoints regarding fathers with increased educational levels taking more responsibility as parents, as they become more democratic, have more flexible gender roles, and consider themselves more adequate in rendering child development (Coltrane, 1995; Model, 1981; Russell, 1982).

As the perception of fatherhood changes, paternal roles also change. Although variables such as education, income level (Bronte-Tinkew, Carrano & Guzman, 2006), age, experience (Gultekin Akduman & Turkoglu, 2013), and participation in infant care courses (Lewis & Warren, 2001, as cited in McKeown, 2001, p. 6) affect the perception of fatherhood, the notion of a mother also influences this aspect (Parquet, 2002; Parquet, 2004; Rohner & Veneziano, 2001). Fathers' primary source of learning about childcare is their spouses (Scarzello, Arace & Prino, 2016). However, if a father's weekly working time is less than that of the mother, fathers can be more involved in childcare (NICHD Early Childcare Research Network, 2000). Although fathers perceive themselves as a breadwinner and the mother as a person who is responsible for rendering physical care to children (Evans, 1997; Advice, 1998), the participation levels of the middle and upper class fathers in child care increases when the mother begins to work outside of the house (Yilmazcetin, 2003).

Although fathers have concerns about their masculinity, they spend more time with their families and participate more in childcare than in the previous century (Mercan & Sahin, 2017). This aspect gives fatherhood a more contemporary status and makes fathers happier, more expressive, emotional, and companionable individuals (Cullen & Grossman, 2007). Colombian fathers state that instead of being the family's breadwinner and an authoritative figure, they want to be more involved with the family and in the lives of their children; they want to show more love and devotion (Carrillo et al., 2016). In Finland, especially in the past 30 years, paternal involvement has increased. With the shift in the cultural expectation of fathers and the perception of men as parents, they have begun to be more caring toward their children. A study stated that Finnish fathers believe that participating in childcare in the early years is an indicator of responsible fatherhood; Finnish fathers have shifted from being the breadwinner to being the ones who share parenting roles and show more emotional support (Eerola, 2015). American fathers (Bronte-Tinkew, Carrano & Guzman, 2006) who already collaborated on matters regarding caretaking, such as changing diapers, food preparation, and feeding, also became more involved in their children's health problems in recent years (US Census Bureau, 2013; Yogman et al., 2016). Qatari men emphasize that fathers have a significant role in child development, but they regard themselves as non-egalitarian parents. While young fathers, in particular, noted that showing love to the child is an important paternal role, others argued that the matter of childcare should be handled equally. These fathers categorized errands such as playing games with the child, answering the child's questions, feeding, and dressing them up among the least important ones. This factor suggests that Qatari fathers are changing their mindsets but have not yet overcome the traditional viewpoint (Shafaie et al., 2014). In Turkey, the main determinant of paternal roles is the mother's working status; if the mother does not work, then the father displays a traditional attitude toward childcare and education, and if the mother works, the spouse shares such responsibilities (Tutkun & Tezel Sahin, 2016). According to Tol and Taskan (2018), fathers in Turkey are participating more in household chores, childcare, and their upbringing than in the past. Hence, the gap in father–child relationship is decreasing, girls are being valued, and behaviors such as caring and listening are becoming widespread.

Previous studies show striking results on the perception of fatherhood and the changes in paternal roles. A study revealed that some fathers want to be more involved in the care and upbringing of their children, while several fathers want to have closer emotional relationships with their children (Dick, 2011). Another similar study highlighted that fathers are aware that they have a significant place in their children's life and want to play an active role in it (Garfield & Chung, 2006).

This study learns about the perceptions of fatherhood of married couples living in Northern Cyprus; therefore, how men perceive fatherhood and how mothers perceive their husband's fatherhood are the topics of research. This study was inspired by the research conducted on fatherhood, as a phenomenon, in Turkey with the support of Mother Child Education Foundation (ACEV). Tol and Taskan (2018) categorized fatherhood as traditional, new traditional, diligent, keen, and exceptional fatherhood. Traditional fathers represent fathers that refuse to change, are authoritarian in nature, and who establish distant relationships with their children; characteristics such as being the rock of the family, the oak tree, the pillar of the house, the head of the family, strong, self-sacrificing, heroic, and protective are attributed to them. New traditional fathers refer to fathers who, while adopting the values of traditional fatherhood, have managed to overcome distance, particularly in the relationship with their daughters. Diligent fathers act contrarily to traditional gender roles as a responsibility. Keen fathers continue to hold the traditional perception of fatherhood but exhibit diligent paternal behaviors with their own decisions and opinions; such fathers undergo transformation with respect to father involvement. Finally, exceptional fathers are egalitarian in nature and have eliminated distances in the relationship with their children. According to Tol and Taskan (2018), more than a third of fathers in Turkey demonstrate traditional fatherhood characteristics. Traditional fathers are followed by new traditional fathers and keen or diligent fathers. Coming across exceptional fathers is hardly possible.

While no studies about fatherhood are found in Northern Cyprus, the legal description handles fatherhood biologically; fatherhood is confined on the basis of gender, not the roles. Therefore, the social perspective is also considered to be traditional. On the contrary, although the Turkish Cypriots have similar Turkish cultural and social traits, they have different family dynamics, i.e., egalitarian Turkish families based on equal control due to modern education and culture are found in Northern Cyprus (Alicik, 1997); both contemporary and traditional features are protected within the family structure in Turkey (Bayer, 2013; Ekici, 2014; Ulus, 2015). Therefore, the fatherhood phenomenon of Turkish Cypriots was worthy to be examined under a separate study.

Method

This section contains information about the research design, study group, data collection tool, data collection process, and data analysis.

Research Design

This study is a qualitative study structured according to the phenomenological pattern. Studies conducted with phenomenological pattern determine the participants' experiences and interpretations related to a given phenomenon. The important aspect of such studies is to reveal the viewpoints and perspectives people involved in the study on a given phenomenon. Phenomenological studies often use the interview method to obtain in-depth information from participants. In phenomenological studies, the researcher makes interpretations regarding the participants' experiences and elucidates the phenomenon (Creswell, 2013; Neuman, 2008).

Study Group

The study group was determined through convenience and purposive sampling; in all, there were 30 participants, including 15 fathers and 15 mothers. All participants were born in Cyprus and have children between the ages of 3 and 6. The average age of the fathers and mothers participating in the study was 39 and 36 years, respectively. Further, nine families had one child,

and six families had two children; these participants did not have more than two children; among the participating fathers, two completed middle school, three completed high school, four graduated from university, two possessed master's degrees, and four were doctoral graduates, and among the participating mothers, one completed primary school, one completed high school, six graduated from university, one possessed a master's degree, and six were doctoral graduates (see Table1). Further, the researchers informed the participants about the research and obtained their verbal consent.

Table 1. Demographic characteristics of the participants

	Gender	*Average Age*	*Educational Status*
Women	15	36	Primary School = 1
			Middle School = 0
			High School = 1
			University = 6
			Master's = 1
			Doctorate = 6
Men	15	39	Primary School = 0
			Middle School = 2
			High School = 3
			University = 4
			Master's = 2
			Doctorate = 4
Total	30	37.5	30

Data Collection

The study employed the interview method from the qualitative data collection methods as a data collection tool. Semi-structured questions were determined by the researchers for the interviews; these questions were sent to three experts, whose research area is qualitative studies and social sciences, and were rearranged following their recommendations. In addition to demographic information, the participants were asked five questions. A modified version of the questionnaire that was formulated for the fathers was also administered to the mothers. For example, questions such as "How do you spend time with your child?" and "Which one of your mentions do you do the most?" that were directed to the fathers were rephrased and directed to the mothers in the following manner: "How does your partner spend time with your child?" and "Which one of your mentions does your husband do the most?" This study conducted face-to-face or telephone interviews based on the participants' preferences. The interviews were scheduled in accordance with the participants availability and lasted for an average of 22 min. The interviews were recorded with the permission of the participants and the voice records of interviews were transformed in to written format.

Data Analysis

The collected data were analyzed through the content analysis method and examined under categories created through themes. In the content analysis method, the obtained data were first encoded and then divided into themes. While encoding, data containing the same themes were grouped and defined. Thus, the information obtained from the data was more meaningful (Yıldırım & Şimşek, 2016). In the first stage of data analysis, interview records were examined, codes and categories were defined. The data obtained from interviews were examined under the categories

of “fatherhood self-assessment” and “perception of fatherhood”. After the codes and categories were defined, the interview records were examined again and the data were analyzed according to the codes extracted from the data. Thus, a systematic structure has been created in which the data can be arranged in a systematic way (Maxwell, 2008; Merriam & Greiner, 2019). In all, two researchers performed the analysis of the data, and Miles and Huberman’s (1994) reliability formula was applied during the analysis process. The formula result was 52 / (52 + 5) × 100 = 91.2%. As the result was more than 70%, it indicated that the study is reliable (Miles & Huberman, 1994). The data obtained from interviews were examined under “fatherhood self-assessment” and “perception of fatherhood” categories.

Findings

This study reviewed the data obtained from the participants under two main categories, namely, “fatherhood self-assessment” and “perception of fatherhood.”

Fatherhood Self-assessment

Under this category, topics such as the definition of fatherhood according to the fathers, the type of father they are in their opinion, the type of father their husbands are according to the opinions of the mothers, how they spend time with their children as per their opinion, and how fathers spend time with their children according to the opinions of the mothers were analyzed.

T able 2. Definition of fatherhood according to the participating fathers

	f
Happiness	9
Responsibility	7
Life source	4
Total	20

On analyzing the responses of the participating fathers, the study revealed that nine fathers described fatherhood as happiness, eight fathers as responsibility, and four fathers as life source (see Table2). Fathers who described fatherhood as happiness quoted the following statements: “He/she (the child) is a source of happiness, I couldn’t understand (life) before him/her, I can’t imagine a life without him/her.” (F11) and “Having children means happiness. One feels very happy.” (F12). Fathers who defined fatherhood as responsibility quoted the following statements: “Being a father means responsibility, first of all. There are responsibilities related to school and health. I have responsibilities such as the child seeing me before he/she goes to sleep.” (F8) and “(Fatherhood) refers to responsibility like the responsibility of finance and health. It is important to financially meet all the needs.” (F14). Fathers who defined fatherhood as a life source quoted the following statements: “The beginning of my life, my life source.” (F6) and “He/she is like life. My life starts with him/her. I don’t know how it would go on without him/her.” (F7).

Table 3. Type of father they are according to the participating fathers’ viewpoints

	F
Self-sacrificing	6
Plays games	5
Spends quality time	3
Affectionate	2
Total	15

When the responses given by the 15 fathers were analyzed, six fathers defined themselves as self-sacrificing, five fathers as the type who play games with their children, three fathers as the type who spend quality time with their children, and two as the affectionate type (see Table3). Fathers who described themselves as self-sacrificing quoted the following: "Self-sacrificing. Every step I take, I think of my family, I think of my children's future." (F4) and "I'll do my best for them. I think of them more than I think about myself. I spare no sacrifices." (F14). The statements of those who defined themselves as fathers who play games with their children include the following: "I usually play with him/her when I spend time with him/her. I'm his/her playmate." (F13) and "We play as many games as we can. We're like kids." (F2). Statements of those who defined themselves as fathers who spend quality time with their children are "We do experiments and build trains to spend quality time together. Although, I spend little time with him/her, I try to offer him/her some valuable things during this time. Not only games, but I also share some vital information with him/her; for example, how trains work." (F13) and "I try to spend quality time; like instead of buying toys, we make them. I'll try to use our dexterity. Quality time is important." (F5). Further, fathers who described themselves as affectionate stated, "I am a father who gives happiness and loves their children. It is very important for me that they know and feel this love." (F7) and "I am a person who gives love. (My) Children should know and understand that I love them just like their mother does." (F15).

T able 4. Type of father their husbands are according the viewpoints of the participating mothers

	f
Involved	4
Plays games	4
Responsible	4
Angry	3
Total	15

When the responses given by the 15 participating mothers were analyzed, four mothers stated that their husbands were involved fathers, four described their husbands as the type of fathers that play games, four said that their husbands were responsible fathers, and three claimed that their husbands were angry fathers (see Table4). The statements of mothers who identified their spouses as an involved father included "He takes care of the children's every need. He knows what they like and their rhythm. If you ask me if I prefer a babysitter or their dad, I'll say dad because he is very involved." (M3) and "He is very involved in the house and with children. He pays attention to their activities. He runs errands. He deals with their lessons. Sometimes, he works a lot, but he makes sure that he is involved." (M15). The mothers who defined their husbands as fathers that play games stated, "He is a playmate even more than me. He loves this role and enjoys playing games." (M1) and "He actually has many traits, but he plays games the most, so he is the playmate." (M7). The following are the statements of mothers who described their spouses as responsible fathers: "He knows his responsibilities. He does not neglect his son and does not avoid responsibility" (M2) and "He got better with time. When our child was a baby, he would avoid taking responsibility, and as the child grew, he started taking more responsibility like taking them to school, activities, and shopping." (M13). Some expressions of mothers who identified their spouses as angry fathers included "He is angry. He's gets frustrated because he's impatient. He gets angry at children" (M7) and "He gets angry very quickly, and when he gets angry, he leaves everything. Actually, the kids do not do anything serious, they just act like children." (M8).

Table 5. How they spend time with their children according to the participating fathers' viewpoints

	f		*f*
Playing games	20	Going to the cinemas	1
Going on trips	4	Doing homework	1
Chatting	4	Drawing	1
Gardening	3	Going to an activity	1
Watching TV	1		
		Total	36

The answers to the question of how the 15 fathers spend time with their children and what they do the most with the children were analyzed. In all, 20 answers included playing games, four included going on trips, four included chatting, three included gardening, one included watching TV, one included going to the cinemas, one included doing homework, one included drawing, and one included going to an activity (see Table5). Fathers' responses included "We usually play games. We'll do something in the garden. Sometimes, we draw; sometimes, we play with plasticine (play dough)" (F3) and "We play games, chat, travel. We play games like friends." (F7).

Table 6. How fathers spend time with their children according to the participating mothers' viewpoints

	f		*f*
Playing games	17	Going to the cinemas	2
Watching TV	5	Putting the child to sleep	2
Washing	4	Chatting	1
Going to an activity	4	Petting the animals	1
Going for a walk	4	Reading books	1
Gardening	3	Getting ready for school	1
Cycling	2	Drawing a picture	1
Studying	2		
		Total	50

The 15 mothers responded to the question regarding how their husbands spend time with their children and what they do the most with the children. In all, 17 answers included playing games, five included watching television, four included washing, four included going to an activity, four included going for a walk, three included gardening, two included cycling, two included studying, two included going to the cinemas, two included putting the child to sleep, one included chatting, one included petting the animals, one included reading books, one included getting ready for school, and one included drawing a picture (see Table6). Some examples of the mothers' responses comprised "They always play games. Much more than I do" (M3) and "They play games the most. They play a lot of games at home and outside. They have a good time. They play more games than I do." (M7).

Perception of Fatherhood

Under this category, the present study analyzed the best and the hardest parts of fatherhood according to fathers and the best and the hardest parts of their husbands being fathers according to mothers.

T able 7. Best part of fatherhood according to the participating fathers

	f
Raising a child	7
Feeling the love of a child	4
Becoming a role model	3
Becoming a family	2
Total	15

To the question "What is the best part of being a father in your opinion," seven fathers responded raising a child, four responded feeling the love of a child, three responded becoming a role model, and two responded becoming a family (see Table7). Responses such as "You're raising an individual like growing a tree. He/she is slowly growing up, and you are doing something good" (F1) and "It makes me very happy to see him/her grow up and develop. His/her development reminds me that I'm alive." (F14) are examples to the category of raising a child. Responses such as "The child hugs and kisses you and shows you love by calling you 'Father.'" (F6) and "The best part is your child's loving gaze, and the way they show you love." (F15) are examples of the category of feeling the love of a child. Responses such as "My eldest son's sees me as a hero. I feel proud when he pretends to be me and impersonates me. For example, I ask my wife, 'What's that outfit?,' and he asks his mother, 'What is that outfit?'" (F8) and "He tries to look like me. He tries to shave and walk like me. That is the best part of this." (F11) are examples of the category of becoming a role model. Statements such as "With him, we became a family. We were missing a piece when we did not have a child. Now, if he's not in the house, we'll get into a flap. With him/her, the missing piece of our puzzle is complete." (F2) are examples of the category of being a family.

Table 8. The hardest part of fatherhood according to the participating fathers

	F
Adapting to fatherhood	9
Not having enough time for the child	4
Worrying about the child's future	4
Total	17

According to the responses of the participating fathers, the hardest part of fatherhood is adapting to fatherhood, not having enough time for the child, and worrying about the child's future (see Table8). In all, nine fathers responded adapting to fatherhood. Examples for this aspect consisted of the following: "For instance, it's hard to adapt to a life with children and not being able to do what you want whenever you want it. It's hard to adapt to a new life." (F9) and "For example, when he/she was sick for the first time, I didn't know what to do. It was so hard. I wanted to run away, but his father was no other than me. Getting used to being a father was really hard for me." (F12). Responses such as "I have two jobs. One shift ends, the other begins. I can only spend time with him/her on weekends. That is the hardest part for me, but everything is for him/her in the end" (F4) and "Not being able to spend time playing with him/her due to my busy and exhausting schedule is my biggest regret. I wish I could stay home longer." (F6) are examples of the category of not having enough time for the child. Answers such as "The hardest part is the concern. What happens when he/she grows up? Oh, do not let anything happen to him/her. I want him/her to be a good person. I am a little neurotic." (F13) and "Which profession will he/she

choose? Will he/she be loved? What kind of future awaits this child? I think the hardest part is thinking about these questions. The rest is easy. The important thing is to think about his/her future." (F15) are examples of the category of worrying about the child's future.

T able 9. The best part of their husbands being a father according to the participating mothers

	f
Becoming a role model	7
Feeling the love of a child	3
Becoming a family	3
Raising a child	2
Total	15

According to the participating mothers, the best part of their husbands being a father is being a role model, feeling the love of a child, becoming a family, and raising a child (see Table9). "He sees himself in our child. He gets very happy if his son also likes what he likes. He enjoys it when his acts like him." (M11) and "I think that the children are like him. We have two sons. He says, 'I hope they look like me and act like me.'" (M14) are responses to the category of being a role model. "He loves the intensity of the emotion. He likes their hugs, kisses, and them waiting for him to come home." (M3) and "He enjoys it when he/she hugs him and says I love you, being called Dad, and receiving hugs and kisses for no reason." (M7) are responses to the category of feeling the love of a child love. "I think he thinks we are a family with him/her. When we had a child, he felt he was in a family. He began staying more at home." (M2) and "The concept of family. The kid, him, and me. The presence of the children makes him happy. It was like he was the only one when the kids did not exist. When he became a father, we became a family." (M12) are responses to the category of being a family. Finally, the response "The power to guide an individual makes him happy. Teaching something new, raising him/her makes him very happy." (M1) is an example to the category of raising a child.

T able 10. The hardest part of their husbands being a father according to the participating mothers

	f
Taking responsibility	6
Not having enough time for the child	4
Communicating with the child	3
Do not experience difficulties	2
Total	15

According to the participating mothers, the hardest part of their husbands being a father can be listed as taking responsibility, not having enough time for the child, and communicating with the child. According to two participating mothers, their husbands did not experience any difficulties as a father (see Table10). "In a stressful period, meeting the needs of the child puts pressure on him; the child's desires exhaust him." (M1) and "He is fond of his own comfort. Sometimes, he complains that he couldn't rest or couldn't watch a movie; he argues that he always takes care of himself. I think the responsibility of being a father is hard on him." (M8) were statements for the category of taking responsibility. "His working hours are too long. He can't spend as much time with the child as he wants to. He sees the child for half an hour on weekdays after work or doesn't see him/her at all." (M3) and "When he leaves from work, it is the child's bedtime. Sometimes, they don't see each other at all. Sometimes I keep the kid from going to sleep,

but then, by that time, the child gets grumpy. I mean, I think not being able to see the kid is the hardest part." (M11) were responses to the category of not having enough time for the child. Finally, "Sometimes, they get stubborn. I don't understand which one is the adult and which the child. He threatens the child by saying if you don't do that I'll do this." (M7) and "When the child is being naughty and crying, he gets angry and shouts. If he changes that side of him and talks to him instead, he will be a better father." (M12) are responses that illustrated the category of communicating with the child.

Conclusion

Being a father is a situation that develops in a different way than being a mother, and it is not as tangible of a phenomenon as the maternal relationship of "giving birth and becoming a mother." Being a father, as well as its legal and cultural aspects, is often closely related to ensuring the livelihood of the child and the mother and is perhaps the most difficult part to understand of being a man (Zeybekoglu, 2013). The fathers who participated in the study considered fatherhood as a situation that gives them happiness and responsibility and commented on the financial dimension of this obligation. Engle (1997) stated that the presence of men in the family plays a vital role in the well-being of the children and women. This support manifests itself especially in economic terms, and the lack of such support negatively affects children and women. Along with being responsible, the fathers described themselves as self-sacrificing; this perception of self-sacrifice arises with the sense of responsibility when starting a family. In addition, the fathers stated that they consider their families before themselves when making any decisions or taking steps.

The mothers who participated in the study described their spouses as involved and responsible. Fathers, who show interest toward their children, noted that within this involvement, they provided for the children's needs and took them to various activities. This involved attitude reflects the responsibilities of the fathers. According to the United Nations Convention on the Rights of the Child (2020), parents together take responsibility for the upbringing and development of the child. While this responsibility entails the high benefit of the child, it should also attribute equal roles to parents in all areas. On the contrary, the shared responsibility of the children within the family may vary depending on the mother's working situation. If the mother does not work, the responsibility for caring and education is assigned to her; if the mother is working, this responsibility is shared between the spouses (Tutkun & Tezel Sahin, 2016). In this study, fathers consider themselves as self-sacrificing and responsible; however, the study observed that this responsibility is not reflected much in the housework. Both fathers and mothers expressed that fathers mostly play games with their children; they stated that the vast majority of the time that fathers spend with their children is for play. In addition, some fathers stated that they want to spend their game time as quality time, and in this sense, they choose to combine knowledge and skills within the game. Other studies also claim that fathers' choosing to play games as a quality time activity affects the social and emotional development of their children. However, factors such as workload and physical and mental fatigue can create obstacles while wanting to spend quality time (Turkoglu, Celikoz & Uslu, 2013).

Another point of attention among the findings is that regarding the time fathers spent with their children, there was no mention of acts devoted to self-care of their children. Yet some mothers noted that their spouses wash and put their children to sleep. Interpretations to this aspect may be that fathers do not consider self-maintenance activities as spending quality time or that they hesitate to specify these activities. In both cases, it can be said that the participation of fathers in

activities related to children's self-care is not very high. Previous studies focusing on the benefits of paternal involvement argued that fathers should get rid of a number of their concerns and share responsibility with the mother in the care of the child; creating common interests and strengthening communication with the child significantly affect the future years and psychosocial development of the child (Flouri, Midouhas & Narayanan, 2016; Lamb & Lewis, 2004; Opondo, Redshaw & Quigley, 2017; Yavuzer, 2010). Lewis and Warren (as cited in McKeown, 2001, p. 6) stated that fathers are sensitive and responsible toward their children just like mothers, suggesting that fathers are the ones to respond to their children's basic care needs while mothers work. However, if the mother does not work, then she is the one to often shoulder this responsibility.

One of the reasons why fathers have little or no participation in meeting their children's self-care needs may be related to the extent of paternity leave. Under maternity leave, in many countries, the period of leave granted to working mothers can be sufficient for them to recover themselves physically, spiritually, emotionally, and hormonally. The mother takes care of the baby during this time and also begins to meet the baby's basic needs. The period of legal leave granted to fathers after birth in the Turkish Republic of Northern Cyprus (TRNC) is three days (Public Officials Act, 1982). This leave grant limits the time that fathers can spend with their newborns. Although there are results that suggest longer periods of leave are associated with more frequent engagement in developmental tasks and caretaking when children are infants as well as during the first years of children's lives (Petts & Knoester, 2018), the father, who returns to work shortly after the birth of the child, may grow distant from the aspects of care and basic needs of the child.

The study findings also allow us to assess issues related to the perception of fatherhood. The perception of fatherhood is considered an integral part of individuals' decision-making processes and the behaviors they exhibit about fatherhood. Parke (2000) underlined that the perception of fatherhood is quite effective on the behaviors of fathers. For example, if a father has a perception that feeding the child is the work of the mother, he does not exhibit any behavior to satisfy the child's need for nutrition in the process; however, he takes responsibility in this process if he has a perception that he is also responsible for the child's nutrition. When the responses of fathers who participated in the study were evaluated for the perception of fatherhood for the question "What is the best part of fatherhood?" seven fathers answered raising a child, four answered feeling the love of children, three fathers answered becoming role models, and two fathers answered becoming a family. When evaluating the responses of mothers, it was determined that they ranked their husbands' best part of fatherhood in the form of becoming a role model, feeling the love of a child, becoming a family, and raising a child.

Given the responses of fathers, it is believed that fathers have a positive perception of taking care of and supporting the children, i.e., undertaking new responsibilities related to the child. This aspect suggests that fathers have a positive perception of the issues of meeting the needs of their children in the process of raising them and taking care of them. In addition to this, phrases such as being role models and being together are considered to be an indication that they have the sense of safeguarding their children (Tol & Taskan, 2018). These responses reveal that fathers are happy to actively participate in their children's lives and contribute to their upbringing. As a result of the research conducted by Gul (2019), fathers who participated in the study expressed that the positive facets of paternal roles were to fulfill their responsibilities related to their children and spend time with their children. When the responses of mothers were evaluated, they also gave similar responses to the fathers. In general, the responses of both parents concluded that fathers are pleased to be role models for their children and to have a family completed with the children. The presence of a father figure, eager to become a role model in the children's lives, positively

contributes to the development of the children. This factor suggests that fathers hold a vital role in the life of the child (Lewis & Lamb, 2003; Coral & Sahin, 2017; Honor, 2012).

Most of the fathers involved in the study expressed that the hardest part of fatherhood was adapting to fatherhood followed by not being able to spend time with the child and worrying about the child's future. Most of the mothers stated that the hardest part for their spouses was to take responsibility for their children. This response was followed by not being able to spend time with the child and the inability to communicate with them. According to the responses of the mothers, only two fathers did not experience any difficulties with fatherhood. When the responses of fathers and mothers were evaluated, it is believed that fathers have a traditional perception of fatherhood, both according to their own responses and the responses of their wives. The traditional father is usually portrayed as a person who does not take responsibility for the self-care of the child, who economically provides for the livelihood of the house, and is perceived as a source of authority in the family. These fathers are usually individuals who do not take part in matters related to childcare and have a bias against gender roles. In addition, traditional fathers perceive themselves as the breadwinner of the family and consider that they fulfill their responsibilities through economic contribution. The "Masculinity and Fatherhood" report published by ACEV (Tol & Taskan 2018) found that more than a third of the fathers involved in the study exhibited "traditional father" characteristics. Dagseven (2020) found a similar finding to this research in the results of a maternity report in Cyprus. Most of the mothers who participated in the study stated that they turned to their own families for support and responsibility in childcare and that their husbands did not share the parental role with them equally. Contrary to the belief, motherhood and fatherhood are not inherent characteristics of individuals. Motherhood and fatherhood are defined as attitudes and behaviors that are learned, exhibited, and evaluated (Baydar, Akcınar & Imer, 2012; Zeybekoglu, 2013). The concept of fatherhood is used to describe more behavioral aspect such as dealing with the care and needs of the child and taking responsibility. The fact that in general the mother is perceived as the primary caretaker in the society and that this role is attached to the mother as a gender role causes an obstacle in the process of fathers' perception of their responsibilities. The roles that society imposes on fatherhood not only affect how fathers perceive fatherhood but also have a complicating or facilitating effect on this development. A traditional viewpoint toward fatherhood depicts the father as the head of the house, the provider, and an authoritative person and restricts the father's participation in taking responsibility in childcare (Eggebeen & Knoester, 2001; Lewis & Lamb, 2003; Coral & Hawk, 2017). The research report "Fatherhood among Parenting, Masculinity, and Work–Life in Turkey" (Bozok, 2018) claimed that most of the fathers involved in the research show a sexist attitude toward domestic roles and noted that opposed to the idea of both themselves and their children taking responsibility for household chores. Along with the society, mothers and fathers have been modernizing gender roles; fathers' perspective on the childcare responsibility is observed to be changing, and the participation of fathers in the process of taking accountability for the child is increasing (Cabrera et al., 2000; Williams, 2008). Although some research studies (Kagıtçıbaşı, 2014; Onur, 2012) revealed that today there is a transition from traditional to new fatherhood, this study found that fathers perception of fatherhood still reflects a more traditional perception.

Suggestions

Paternal involvement represents the moderate and close relationship established between the father and the child. Babies attach to their fathers at the end of the first year of their lives, even if their fathers spend very little time with them (Cox, Owen & Henderson, 1992). At this point, the

quality of the time spent between the father and the child gains importance. Studies conducted in America and Europe show that paternal involvement is a major contributor to children's intellectual, social, and emotional development. According to Cano, Perales & Baxter (2019), the quality of the relationship between the father and the child and the father's response to the child's needs are the determinants of the cognitive performance of the child. Positive paternal involvement beneficially affects the social, behavioral, cognitive, and psychological development of the child (Aydogmus, 2018; Sarkadi et al., 2007) and contributes to the development of the child's language (Cabrera, Shann & Tamis Le Monda, 2007). In the light of this information, generating awareness in the society about the importance of paternal involvement and the effect of fathers spending quality time with their children is vital; thus, formulating and implementing father support programs is advised.

Paternal involvement can be effective in forming gender roles and stereotypes, especially in preschool children. Dick (2011) stated that fatherhood is also largely influenced by the man's relationship with his own father. The quality of this relationship, the emotional support of the father, and his being there also affected the child. Therefore, for future fathers to interact more with their own children, today's fathers must become more participatory. Therefore, activities related to parenthood can be included in higher education programs and public education studies. Short-term training can be organized wherein pregnant women and their spouses in particular are given the knowledge and skills in preparing to become parents. At this point, a review of programs, textbooks, and activities at various school levels starting from the preschool period to break down the stereotypes related to paternal roles is recommended.

A better understanding of the roles and participation of fathers in the family will also contribute to the future development of the country's programs and policies for family members and family relationships (Carrillo et al., 2016). In this context, considering the study findings, reviewing the length of paternity leave in the TRNC, updating the curriculum at schools with this aim, training the teachers who are going to be teaching this curriculum, weighing more toward mother and father trainings in adult education, and developing many such programs and policies in various areas, thereby remedying the deficiency in the country, are advised. Moreover, other research on fatherhood should be conducted because the findings of new research studies will enrich this study's results, thereby increasing the contribution to literature.

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Effects of Plyometric Trainings on Upper Extremity Anaerobic Power and Shotspeed in Male Handball Players

Mahmut Alp (Associate Professor)
Suleyman Demirel University, Turkey
Mahmut Ozdinc (Research Assistant)
Suleyman Demirel University, Turkey

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Abstract

This paper focuses on the effects of plyometric trainings on upper extremity anaerobic power and shotspeed in 20 volunteer male handball players, who are in the men's handball team at Süleyman Demirel University. Players were randomly divided into two groups as handball training group (HTG) and plyometric training group (PTG). While HTG continued routine handball training, plyometric trainings were applied to PTG additionally for 8 weeks, 3 days a week, at least 30 minutes a day. The upper extremity anaerobic power and shotspeed tests were applied to the groups in 1st and 8th weeks of the period (Inbar et al., 1996). Data analysis was made by using comparison tests. The study reveals that plyometric trainings have positive effects on shotspeed in handball. Considering that plyometric training provides maximum contraction in the shortest time possible, it can be said that applying plyometric training in pre-season and in-season training programming may be more effective.

Keywords: Plyometric, anaerobic power, shotspeed, handball

Introduction

The developments in sport and the increasing performance of athletes has brought about competition. In this developing competitive environment, success is ensured, maintained, and kept at a high level through scientific studies (Başlamışlı & İri, 2004; Alp et al., 2015; Işıldak, 2020).

Handball is a sport branch that uses anaerobic and aerobic energy systems together, depending on the duration of the fight. It must be sufficiently developed in basic motor characteristics such as strength, velocity, endurance, flexibility, and coordination (Eler & Bereket, 2001). Through scientific studies, appropriate training methods are planned and applied to develop the basic motoric characteristics required by many sports branches (Ürer, 2014). In addition, anaerobic capacity is one of the main factors which determines the criteria for performance in handball (Suna et al., 2016).

With the developing and changing rules, superior performance expectations from the players has made the game of handball an even faster game. This situation required them to adopt the desired tactics in a shorter period than the time required for jumping, running, changing

direction, passing, goalshooting, and technical movements in the game (Cardinale, 2001). However, as in every sport, strength is significantly important since the main goal in handball is to gain more goals than the opponent (Gençoğlu, 2008).

To win the game in handball, players' jumping, diving, blocking, passing, ball control, and agility are at the highest level. However, the shooting ability changes the result of the game. The speed of the shot is one of the most important factor for scoring (Van Muijen et al., 1991). In handball, the basic techniques of blocking these shots is to prevent the jumpshot and goal made by the players, and winning the game requires a large amount of jumping strength. The shooting techniques used in handball are largely dependent on the strength of the fingers, wrists, and especially the arm. The most important condition required for the fulfillment of technical and tactical skills in the game is sufficient strength. The rate of shooting in handball varies depending on the ability to generate strength (Komi, 2005).

Plyometric exercise is an effective training when the aim is to improve muscle strength. It is also an important method to increase explosive power to higher levels (James, 1999). Although it is used extensively for the lower extremity, various exercises can also be applied to the upper extremity. In the game of handball, players use both the upper and lower extremities. This include cross runs, jumping, and deception movements with the opponent using the ball or empty runs without the ball for the lower extremities. On the other hand, movements such as block making, various goal throws, 7-meter shooting, holding and pushing the opponent for defense are mostly related to the upper extremity and require strength. Therefore, besides the studies performed to increase the general strength development of the players, the plyometric exercises designed to build upper extremities will have positive effects on both strength development and shooting speed performance (Gençoğlu, 2008; Koçyiğit et al., 2018).

According to the literature on plyometric trainings, Hammami et al. (2019) stated that plyometric training programs allow handball players to improve important components of their physical performance. In addition, Mazurek et al. (2018) emphasized that the plyometric training program of routine handball training improved aerobic capacity and anaerobic fatigue indexes. Also, Chelly et al. (2014) revealed that plyometric training in addition to the standard trainings evolved the features which are important for top performance in handball, particularly examples of explosive strength such as sprints, jumps, and shotspeed. Hermassi et al. (2014) also advised that trainers and conditioners should allocate additional time for plyometric training throughout the season to improve performance in handball players.

Thus, this study focuses on examining the effects of plyometric training on upper extremity anaerobic power and shotspeed in male handball players.

Method

Participants

20 handball players competing in the interuniversity 1st league category participated in the study voluntarily. Players were randomly divided into handball training group (HTG) (n = 10) and plyometric training group (PTG) (n = 10). The mean age of the handball players for HTG was 20.60 ± 1.35, while PTG was 22.10 ± 2.13 years; mean height for HTG was179 ± 3.94, while PTG was 179.50 ± 3.83 cm; and the mean weight for HTG was 76.10 ± 8.64, while PTG was 78.40 ± 5.94 kg.

Measures and Tests

Measurement of Height

The height was measured using a measuring tape with an accuracy of 1 mm. The players stood in a flat body position on bare feet during the measurement. Values were recorded in cm (Alp & Suna, 2020).

Measurement of Weight

The weight was measured using a digital scale with a sensitivity of 0.001 kg. The players also dressed lightly during the measurement in order to get accurate data. Values were recorded in kg (Alp & Suna, 2020).

Wingate Upper Extremity Anaerobic Strength Test

Monark 891 E model ergonometer developed for upper extremity anaerobic power measurement was used under standard laboratory conditions. Tests were done at least for two hours after the last meal. Participants were asked not to engage in strenuous physical activities during the rest period and before the tests. However, the tests were explained to each participant before they began each test and the participants had to get acquinted with the test tools. The settings of the ergobike were also made individually for each participant in a way that the athletes were comfortable with their height and the same settings were used in all tests.

A warm-up protocol was applied for 4-5 minutes with two short loads (20-30 W) of 2-3 seconds inbetween, and a warm-up pedal speed of 15-20 rpm without applying any resistance. After the warm up, the athletes rested passively for about 2-3 minutes. Test load was determined as 35 g per kilogram of body weight for upper extremity in tests performed with ergobyl. The test started after the weight was determined as resistance.Thereafter, the test was placed on the pan of the ergomonark, and the maximum voluntary rotation possible for 30 seconds with loads was requested. Each athlete was verbally encouraged during the test. The pedal speed was also recorded automatically with the help of a photocell connected to the computer (Inbaret al., 1996).

Shotspeed Test

Ball Coach Pocket Radar was used for the shotspeed test. The shotspeed test was performed in the standard handball court and indoor sports hall. Before the test, each athlete was given 5 minutes to warm up with the ball. While warming up with the ball, the athletes also warmed up with goal throw and passes. After the warm-up, each athlete was asked to shoot as fast as they could to throw the handball into the goal with their own shooting technique. During the shot, one foot of the athlete must touch the ground. They were asked to shoot as fast as they could to the goal, over the seven-meterline. During the shot, the radar was placed 1 m behind the shooter's shot arm so as not to affect the athlete's shot. It was left blank so that there would be no objects between the radar and the shot arm during the shot. Two shots were given to the athletes and the highest value was recorded as km/h. At least 15 seconds of rest was given between shots (Zapardiel Cortés et al., 2017).

Procedure

While the HTG continued with their routine handball training, strength training for the upper extremity was applied to the PTG for 8 weeks, 3 days a week, at least 30 minutes a day in addition to handball training.

Content of Handball Training

90 minutes unit trainings were given to the players. The initial stages of the training sessions consist of 20 minutes. This phase consists of the starting run, the handball half-court, general and special warm-up, and opening and stretching. The main phase of the training takes 50-60 minutes. This phase includes mutual and group passing exercises, offensive-defense and fast attack organizations, pivot, playmaker shooting exercises, goalkeeper training, and technique-tactics. The finishing phase of the training takes 10-20 minutes. In this phase, the regional shots, 7-meter shots, and cool-down were terminated.

Content of Plyometric Training

Bench, 3kg medicine balls, and 500g health balls were used in the plyometric training. The movements consisted of 2 sets of 15 repetitions in the first 3 weeks, 3 sets of 10 repetitions during the next 5 weeks.

Throwing medicine balls while lying down: Athletes lie on the bench on their back with their arms stretched upwards, the assistant at the head of the table stands with a 3 kg medicine ball in his hand and drops the ball down. The athlete catches the ball and throws it up again.

Medicine ball sit-up: Athletes lie on the floor in the supine sit-up position. A medicine ball is held on the head and the assistant stands in front of the athelete's auxiliary feet. While the athlete is doing sit-ups, he throws the medicine ball towards the assistant, and while he lies back, the assistant throws the ball back to the athlete.

Throwing medicine ball: The athlete throws a 500g medicine ball to the other assistant in the basic shooting position (Ateş & Ateşoğlu, 2007).

Statistical Analysis

Statistical Package Program was used to analyze the data. As a result of the "Shapiro-Wilk" Normality Test, the data showed a normal distribution. "Descriptive Statistics" and "Paired t-Test" were used to compare the data. Significance level was accepted as "p <.05".

Results

Table 1. Upper Extremity Results of Groups

Group (Watt)	Test Sequence	Mean±SD	t	p
HTG	Pretest	528.50 ± 35.99	-9.75	.000*
	Posttest	536.30 ± 36.31		
PTG	Pretest	531.50 ± 27.49	-18.39	.000*
	Posttest	544.30 ± 29.13		

Table 1 shows Paired t-Test's results of Upper Extremity. According to Table 1, statistically significant differences were found in both HTG and PTG's upper extremity results ($p < .05$).

Table 2. Shot Test Results of Groups

Group(km/h)	Test Sequence	Mean±SD	t	p
HTG	Pretest	75.20 ± 3.88	-7.66	.097
	Posttest	75.50 ± 3.40		
PTG	Pretest	73.90 ± 3.98	-16.21	.000*
	Posttest	79.00 ± 3.36		

Table 2 shows Paired t-Test's results of Shot Test. According to Table 2, significant difference was found in PTG ($p < .05$). However, there was no difference in HTG values ($p > .05$). Table 3. Comparison of Groups' Results

Test (Watt)	Group	Mean±SD	t	p
Pretest	HTG	528.50 ± 35.99	-.209	.836
	PTG	531.50 ± 27.49		
Posttest	HTG	536.30 ± 36.31	-.543	.594
	PTG	544.30 ± 29.13		

Table 3 shows the comparison of the results between the groups. According to Table 3, there were no differences in both pre and posttest values of the groups ($p > .05$).

Table 4. Comparison of Groups' Shot Test Results

Test (km/h)	Group	Mean±SD	t	P
Pretest	HTG	75.20 ± 3.88	.739	.469
	PTG	73.90 ± 3.98		
Posttest	HTG	77.50 ± 3.40	-.990	.335
	PTG	79.00 ± 3.36		

Table 4 shows the comparison of shot test results between groups. Acccording to Table 4, there were no differences in both pre and posttest values of groups ($p > .05$).

Discussion

The effects of plyometric trainings on upper extremity anaerobic power and shot speed in male handball players were investigated in this study.

Based on the comparison of the upper extremity pre and posttest values of the groups, the difference was statistically significant in both groups ($p <.05$). However, no difference was found as a result of the comparison of the pre and posttest values of the groups with each other ($p>.05$). In a similar study conducted on handball players, it was found that 6 weeks plyometric exercises applied to the players' upper extremities did not have positive effects on players' upper extremity muscle strength. It was emphasized that the good training history of the athletes was the reason for the emergence of this result, and it was stated that plyometric training should be applied for a long time in order to improve the upper extremity strength level of handball players (Gençoğlu, 2008). In another study conducted on handball players, strength and resistance training was applied to the players for 8 weeks, and the handball players in the control group continued their current training programs during the same period. Results of the study revealed that when compared with the handball players in the control group, a statistically significant improvement occurred in the upper and lower extremity muscle strength levels of handball players who applied strength and resistance training (Hermassi, 2011).

Furthermore, while comparing the pre and posttest values of the shotspeed of the groups, there was no difference in HTG values ($p> .05$) and the difference in PTG values was found significant ($p <.05$). No difference was found as a result of the comparison of the pre and post shotspeed test values of the groups with each other ($p> .05$).

Earlier on, it was stated that the shot velocity has an important place in the sports branches such as handball where the shooting motion is applied. It is known that especially for the shoulder, internal and external rotator muscles are important determinants on the speed of shooting in

handball (Marques, 2011). In the study conducted by Pontaga (2014), it was found that the shotspeed of elite handball players was closely related to the strength levels of the athletes. In another study conducted by Marques (2007), it was concluded that maximal dynamic force significantly affects the rate of shot in elite handball players. Hence, it was determined that there was no significant relationship between the shot velocities and the shot hit rates of the handball players participating in the study and in the experimental group after flexi-bar training. On the other hand, in the pre-test parameters of the experimental group, it was determined that the hit rate of the shot had a negative effect on the hit rate of shots fired at some corners of the goal. In the pre-test measurements of control group, no significant relationship was found between the shotspeeds and the shot hit rates. However, in the posttest measurements, it was found that there was a significant relationship between the shot velocities and the shot accuracy rates in general. Therefore, the reason the shot velocity did not affect the shot accuracy positively was the fact that handball players wanted to hit the target in addition to the speed when shooting.

Conclusion

In conclusion, this study shows that plyometric training positively affects upper extremity anaerobic power and shooting speed in handball players. Considering that plyometric training provides maximum contraction in the shortest time possible, it can be said that applying plyometric training in pre-season and in-season training programming may be more effective. This is because these plyometric training protocols will contribute to future training plans for trainers and athletes in the handball branch.

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The Evaluation of the Social Studies Curriculum in Turkey: The Guiding Principle of Balance

Gurbuz Ocak, *Prof.Dr.*
Afyon Kocatepe University, Turkey
Akin Karakuyu, *Lecturer*
Hatay Mustafa Kemal University, Turkey

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Abstract:

This study investigates the social studies curriculum applied in 4th 5th 6th and 7th grades in Turkeyaccording to the principle of balance, which is one of the guiding principles of curriculum development. The research is conducted with a case study of qualitative research methods. The research is designed with a holistic case study design. Research data were collected by the methods of the interview with social studies teachers, observation in 4th 5th 6th and 7th grades and document review of the course objectives in the social studies curriculum and analyzed by content analysis technique. The reliability of the data was calculated with the multi-degree Kappa coefficient based on the agreement between the observers and the opinion agreement for the opinions. According to the results of the study, it was found out the principle of balance was generally neglected, and there is balance with regards to the past and present, different cultures and local culture, close and distant environment, classroom and out-of-class learning while there is no balance in terms of using only written, verbal and visual materials and the other principles. The research consequently suggested recommendations to curriculum development experts and teachers to ensure the principle of balance.

Key Words: Principle of Balance, Curriculum Evaluation, Social Studies Curriculum

Introduction:

The main purpose of the curriculum is to design the course levels according to the school levels and reveal the potential of individuals in all areas in a balanced way and enable them to acquire new skills.

A curriculum is a series of learning products that enable decision-making in both teaching and evaluation, or the planning or design of the entire content to be taught with the goals and evaluation dimensions of a field (Posner, 1995, p.5). The instructional program, on the other hand, is a program that consists of certain knowledge categories and aims at teaching knowledge and skills in a planned manner in line with the objectives set in the curriculum by focusing on skills and practice in some schools (Küçükahmet, 2009, p.9).

Today, developments in knowledge, science, and technology affect the education system, making it necessary to rearrange curriculum from time to time and adapt them according to the conditions

of the day. The curriculum development process is a multidimensional and continuous process consisting of planning, design, pre-application, and evaluation stages (Khan & Law, 2015, p.67). The first step of this process is to design the curriculum. According to Adıgüzel (2017), the purpose, content, educational attainments, and assessment dimensions to be included in the curriculum at the draft stage are arranged logically and systematically.

There are some principles in the curriculum design process. According to Yücel et al. (2017, p.707), these principles are scope, progressiveness, continuity, cohesion, balance, usability, and flexibility. Besides, Hewitt (2006) listed curriculum design principles as scope, progressivity, continuity, and balance. According to Ornstein and Hunkins (2016), curriculum design principles are scope, sequence, continuity, integration, harmony, and balance.

According to the principle of balance, students should be allowed to use and internalize what they have learned, taking into account their mental, personal, and social development (Doğanay, 2008, p.23). Balance means ensuring the adaptation of the sometimes complex curriculum with the students' developmental levels (Hewitt, 2006). When designing a curriculum, educators attempt to give equal weight to each feature of the design as required by the principle of balance. In a balanced curriculum, students gain the opportunity to acquire and use knowledge in personal, social, and intellectual ways (Ornstein & Hunkins, 2016, p.256).

The aim of designing a balanced curriculum in schools is to firstly develop students' artistic aspects such as social, sports, and music and discover their skills and secondly, to improve their academic performance, and thirdly, to balance their learning outside the school (Kibet, 2016). A balanced curriculum also had positive results on student achievement (Squires, 2013). Galton (2000, p.16) stated that one of the four questions to be asked for the success of the curriculum implemented at the national level is how broad and balanced curriculum can be ensured. Porter (1989) stated in his study titled "An unbalanced curriculum: example of primary school mathematics" that teachers could not know what they taught in an unbalanced curriculum and that success was left up to chance.

A balanced curriculum is important for the multifaceted development of students. It offered three alternatives to create a balance in a better program. The first is that the learning objectives are aimed at basic concepts and skills, the second is to ensure a balance in in-school and out-of-school interaction and the third is to balance between subject-centered traditional education and meaningful, autonomous and activity-based education (Akker, 201, p.42).

In the studies on design principles in the literature, the information and technologies curriculum (Geçitli and Bümen, 2020), the foreign language-weighted 5th grade English curriculum (Canlıer & Bümen, 2018) and Primary and Secondary English curricula (Yücel, Dimici, Yıldız and Bümen, 2017) were previously investigated. When the studies on the social studies curriculum are examined, there are primarily studies focusing on the opinions about the curriculum and the comparisons of previous social studies curricula with the current one (Çakmak, Kaçar and Arıkan, 2017; Gürel, 2017; Taş and Kıroğlu, 2018; Sözen and Ada, 2018; Yıldız and Kılıç, 2018). There is no study examining the social studies curriculum in terms of design principles. In this study, the principle of balance, one of the principles of social studies curriculum design, was thoroughly examined to fill this gap in the literature.

The research was conducted based on 17 principles suggested by Oliva and Gordon II (2018, p.468-470) to achieve balance in the curriculum. These principles are as follows:

1- Student-centered and subject-centered curriculum,
2- The balance between the students' and society's needs
3- General and customized education balance,
4- Balance between width and depth in content,
5- Establishing a balance between cognitive, affective, and psychomotor development areas,

6- Establishing a balance between individualized education and general education,
7- Ensuring a balance between innovation and tradition,
8- Balance between the logic of the subject and the student's learning psychology,
9- Balance between the needs of extraordinary and non-extraordinary students,
10- Balance in terms of the needs of different students in terms of intelligence,
11- Balance between written, verbal, and visual techniques and materials,
12- Balance between near and far in terms of time and environment,
13- Balance between academic aspects, entertainment, and physical activities,
14- Balance between in-school and out-of-school learning,
15- Balance between disciplines,
16- Balance between curriculum,
17- Balance within the disciplines.

Developing a balanced curriculum is extremely important, as balancing the curricula enables students to develop in many aspects. For this reason, this study evaluates the social studies curriculum based on the principle of balance and seeks answers to the following questions:

Problem Statement:

How is the principle of "balance" as one of the principles of curriculum design reflected in the social studies curriculum?

Sub-Problems:

How is the principle of balance reflected in the social studies curriculum from the following aspects?

1- Being student-centered or subject-centered,
2- Meeting the needs of students and society,
3- Among the sub-branches of the course (history, geography, citizenship),
4- Distribution of goals to cognitive, affective, and psychomotor domains,
5- Suitability for group learning and individualized learning,
6- Compliance of the content with the logic of the subjects and students,
7- The suitability to the students' intelligence level (high, average, etc.),
8- Use of written, verbal, and visual techniques,
9- Including academic aspects, sports, entertainment, and physical activities,
10- Providing opportunities for in-class and out-of-class learning,
11- Compliance with different disciplines,
12- Allowing different learning approaches,
13- Appropriateness to students' development level
14- Being open to innovations and being tradition-bound,
15- Compliance with the near and far and past and current developments

METHOD

Research Model:

This study, which examined in depth the suitability of the social studies curriculum to the principle of balance, which is one of the principles of curriculum development, was conducted as a case study from qualitative research methods. Case studies are a qualitative approach concerning real life in which the researcher deals with a situation and collects detailed and in-depth data on

this case (Creswell, 2007, p.97). The qualitative research model used to find answers to scientific questions and seen as a distinctive approach is called a case study (Büyüköztürk et al., 2011, p.273). If a single unit of analysis is used in case studies and its specific situations are studied, a holistic case study design is used (Yin, 2014). In this study, since the social studies curriculum is considered as a curriculum and a single case is analyzed, the holistic case study design is used.

The case study design in the study includes the following stages, respectively:

1- Examination of the course objectives in the Social Studies curriculum
2- Conducting semi-structured interviews with social studies teachers according to the balance principles determined by Olivia and Gordon II (2018)
3- Observation by using co-observes,
4- Analysis of data obtained from three data collection tools,
5- Interpretation of the obtained findings.

Data Collection Tools:

The research data were collected by using data triangulation with observation, interview, and document review techniques.

Semi-Structured Interview Form: The interview form consists of 15 open-ended questions prepared for primary school teachers teaching 4th grades and social studies teachers. The researchers prepared the questions within the framework of the principles determined to ensure the balance in the curriculum by Olivia and Gordon II (2018). The questions were revised by submitting them to three experts in the field of education curriculum and teaching. The interviews were conducted with 8 teachers.

Observation Checklist: The checklist was created by the researchers, considering the balance principles suggested by Olivia and Gordon II (2018), and was finalized by submitting to the opinion of three experts in the education curriculum and education field. The observation form consists of 18 items. The items were graded from 1 to 3 from insufficient to sufficient. The observations lasted for 4 weeks, in the form of 2 lesson hours for the 4th grades and 3 lesson hours for the 5th, 6th, and 7th grades.

Document: In the study, 131 objectives included in the social studies curriculum updated in 2018 by the Ministry of National Education were examined as documents to determine to what extent the principles of balance are reflected in the social studies course curriculum. Data Analysis:

Content analysis was used to analyze the opinions collected from the teachers in the analysis of the data. In the content analysis, opinion agreement among researchers was determined using Miles and Huberman's (1994) opinion agreement formula. In the analysis of the data obtained through observation, the observation forms created as a result of the observation made with the co-observer were analyzed using the multi-degree Kappa coefficient formula, and the document analysis was analyzed with the content analysis technique. The Kappa test is a statistical method that measures the reliability of the agreement between two or more observers regarding the phenomenon they observe. The Kappa coefficient formula is Pr(a) - Pr(e) / 1-Pr(e). Here, Pr(a) refers to the observed agreement, and Pr(e) to the probability of random agreement (Cohen, 1960 as cited in Kılıç, 2015, p.142). In the observation form used in the study, the scoring was 3-graded in the form of 1-2-3, and the multi-degree Kappa coefficient was used instead of the two-degree Kappa coefficient. The Kappa formula applied in this method is the same as the Kappa formulas applied in the two-degree method. However, the data matrix is not in the form of 2x2, and the number of matrices is determined by the number of degrees in the form of 3x3 or 4x4 (Şencan,

2005, p.488).

The interpretation of the Kappa coefficient according to the result is as follows (Şencan, 2005, p. 485)

1- Slight agreement = <0.20
2- Fair agreement = 0.20 - 0.40
3- Moderate agreement = 0.40 - 0.60
4- Substantial agreement = 0.60 - 0.80
6- Almost perfect agreement = 0.80 - 1.00

Validity - Reliability:

Since the validity and reliability of the case studies are the subjects of criticism, and they are regarded as one of their weaknesses, data diversification was used to increase the validity of the study. In this context, the data were collected by examining the lesson observations with the co-observer, face-to-face interviews with the teachers, and the examination of the curriculum objectives using the document technique. The teacher interview form and observation form prepared by the researchers were presented to the opinions of three experts from the curriculum and education field and revised the consequent form to increase the reliability of the study. Besides, while observing in the learning-teaching process, observations were made with a co-observer who received doctorate education in curriculum and teaching.

For the reliability of the data obtained from the teachers using the semi-structured interview technique, the opinion agreement formula of Miles and Huberman (1994) was used. This agreement is formulated as "Opinion agreement = (Consensus / Disagreement + Consensus) * 100." The opinion agreement on teachers' opinions in the study was calculated as 83.33%. According to Miles and Huberman (1994) and Patton (2002), the consensus between coders is expected to be at least 80%.

According to the Kappa Test, the rate of agreement of the opinions expressed by the observers in the observation form for the observation results is as follows:

The observed agreement rate for 4th Grade is Pr(a)=14/18= .77
The observed agreement rate for 5th Grade is Pr(a)=15/18= .83
The observed agreement rate for 6th Grade is Pr(a)=15/18= .83
The observed agreement rate for 7th Grade is Pr(a)=14/18= .77

FINDINGS

Table 1: Opinions about the Focus of the Curriculum

Theme	Category	Frequency
The Focus of the Curriculum	Student-Centered	1
	Subject-Centered	7

In the interviews with the teachers, there are opinions that the curriculum is subject-centered (f=7). Some of the teachers' opinions are as follows:

"Although it seems to be student-centered, when we have a general perspective, it is subject-centered, especially in a history course, which is a sub-branch of social studies." (T2)

"The curriculum was tried to be designed as student-centered, but the sequence and level of the content cannot catch the students' interest." (T5)

"I think it is subject-centered. There is a lot of lecture and content. The number of activities is very low."

(T8)

"Curriculum and activities are generally student-centered, but the teacher must have certain competencies to be able to do these activities." (T6)

When the curriculum objectives are examined, findings that confirm these opinions were accessed. In the observation made with the co-observer, the observers marked an inadequate option in the checklist. In this sense, it is seen that the curriculum is more subject-centered regarding its focus and is not in a balance in terms of being student and subject-centered.

Table 2: Opinions Regarding the Curriculum's Meeting the Needs

Theme	Category	Frequency
Curriculum's Meeting the Needs	For Student Needs	2
	For Social Needs	6

In the interviews with the teachers, it is predominant that the curriculum is more oriented towards the needs of the society in terms of the needs of the students and the society (f=6). Some of the opinions of teachers are as follows:

"The needs of the society were met in matters such as homeland, nation, and homeland love, but it is not enough for the respect, responsibility, and values that individuals need." (T1)

"In the curriculum, issues related to adaptation to society are taught by introducing our culture to students, while the needs of the society are met, the needs of individuals are neglected." (T6)

"There are deficiencies in meeting the needs of the students. We cannot take teaching out of the classroom. This is at the discretion of the teacher. Social needs, on the other hand, were met to a great extent." (T8)

When the social studies course objectives were examined, only one objective, which is the balance between subject and society needs, was determined. As the social studies course is perceived as preparing students for society, it can be suggested that the needs of the society are important, and there is no balance in terms of student and society needs in this sense.

Table 3: Opinions Regarding Balance Among Sub-Branches of the Course

Theme	Category	Frequency
Balance Among Sub-Branches of the Course	Balanced in Sub-Branches of the Course	3
	Not Balanced in Sub-Branches of the Course	5

In the interviews with the teachers, the opinions that the curriculum does not have a balance between the sub-branches of the social studies course, such as history, geography, and citizenship, are more prevalent (f=5). The following are some of the opinions of teachers:

"There is absolutely no balanced distribution. Citizenship and democracy have little weight in general. History is more weighted than the others. The teaching of geography subjects is insufficient." (T5)

"There is the main focus on citizenship. In particular, the field of geography is included in only one theme. I do not think it is balanced." (T6)

"The content is not evenly distributed with its sub-branches. Citizenship subjects were mentioned in a limited way. There are unnecessary details for the field of geography that will not be useful for 4th-grade students." (T7)

"The distribution seems sufficient in terms of the sub-branches of the course, although some courses seem to come to the fore when we look at the whole, we can say that there is balance. (T4)

When the objectives in the social studies curriculum are examined, it is seen that there are mostly objectives in the field of history and very limited objectives in the field of geography.

Table 4: Opinions on the Distribution of Goals to Cognitive, Affective, and Psychomotor Areas

Theme	Category	Frequency
Balance Regarding Distribution of Goals	Balanced	1
	Not Balanced	7

The psychomotor area is almost non-existent. In this sense, according to the teachers' opinions in the curriculum, the principle of balance in objectives was violated (f=7). Some of the opinions of the teachers are as follows:

"In general, very little space was given to the psychomotor area at the cognitive and affective level." (T2)

"More emphasis was placed on the cognitive area, and not much was on the affective and psychomotor areas." (T6)

"The distribution of the curriculum to the cognitive and affective domains is generally good. However, it is missing in the psychomotor area. In order to develop it, studies on individual motor skills should be included." (T7)

"The cognitive field is more dominant, but this is only at the level of knowledge. There is almost no place given to psychomotor learning more than the affective field psychomotor field." (T8)

Considering the curriculum's objectives, it was determined that the educational situations were more oriented to conveying information during the lesson observations, in which cognitive objectives were predominantly included due to the characteristics of the field of social studies.

Table 5: Opinions on the Suitability for Group Learning and Individualized Learning

Theme	Category	Frequency
Suitability for Group Learning and Individualized Learning	Suitable for Individual Learning	1
	Suitable for Group Learning	7

According to teacher's opinions, it can be said that the social studies curriculum is suitable for group learning rather than individualized learning (f=6). Some of the opinions of the teachers are as follows:

"Some objectives were attempted to be given through the student examples. Although this situation seems appropriate for individualized teaching, it can make it difficult to learn the subject in general terms." (T3)

"I do not think that it is not very suitable for students who need individualized teaching because their interests, abilities, and needs differ." (T4)

"There are some objectives and activities for individualized teaching, but they can be increased a little more." (T6)

"I do not think it is very suitable for individualized learning, although it seems appropriate when we look at the curriculum, the situation is different in practice." (T5)

When the objectives in the curriculum are examined, the objectives that include individualized education are limited. During the observations, co-observers determined that the teachers could not include individualized education to teach the objectives in the determined period. In this sense, it can be said that the principle of balance was violated.

Table 6: Opinions on the Compliance of the Content with the Logic of the Subjects and Students

Theme	Category	Frequency
Compliance of the Content	Student's Logic	2

with the Logic of the Subjects and Students	Subject's Logic	6

Based on the opinions received from the teachers, it can be said that the content, which is one of the basic elements of the social studies curriculum, is prepared mainly by considering the features of the subject (f=6). In the observations, it was determined that the teachers tried to adapt the abstract points to student logic by supporting them with materials and examples. Some of the opinions of the teachers are as follows:

"Even if there is no problem in the compliance of the subjects with the logic, the students can be prone to logic by increasing the examples according to the economic, social, and cultural environment of each student." (T1)

"The content is given a lot of unnecessarily extended details. Instead, it can be adapted to the logic of the student with a simpler and concrete content." (T3)

"The content items in the curriculum are in line with the logic of the subjects but do not appeal to the logic of the student. Due to the nature of the course, there are many different sub-branches, so content can appear like many stacking." (T4)

"The content design is absolutely negative. There is no continuity between subjects. There is a sequence that skips from branch to branch. The student has a hard time connecting. Course hours should be increased, and the subjects of History, Geography, and Citizenship should be given systematically and chronologically." (T5)

"I do not think there is any problem in terms of compliance with the logic of the students in general. Some of the concepts can remain abstract, and they can be arranged by making arrangements about them." (T7)

Table 7: Opinions on the Suitability to the Students' Intelligence Level (high, average, etc.)

Theme	**Category**	**Frequency**
Suitability to the Students' Intelligence Level	Suitable for Different Types of Intelligence	2
	Not Suitable for Different Types of Intelligence	6

According to the opinions of teachers' it can be suggested that although the social studies curriculum is sufficient to meet the needs of average and upper-level students, it is not sufficient for the needs of lower-level students (f=6).

"We can say that the student level in the social studies course is generally the closest to the homogeneous. There is not much problem in meeting student needs." (T1)

"There are appropriate objectives to meet the needs of both average and high-level students. (T6)

"It meets the needs of normal students sufficiently. But I think it is a bit lacking for high-level students." (T7)

"Normal and high-level students understand basic level concepts that they will need in daily life, but lower-level students have difficulties." (T8)

When the objectives in the curriculum are examined, it can be indicated that different individual characteristics of individuals with different intelligence types are considered in the curriculum, but in the observations conducted in this study, teachers adopt a standard approach more than students with average intelligence levels.

Table 8: Opinions on the Use of Written, Verbal, and Visual Techniques

Theme	**Category**	**Frequency**
The Use of Written,	Suitable for Different Types of	8

Verbal, and Visual Techniques	Techniques	
	Not Suitable for Different Kinds of Techniques	0

According to the teachers' opinions, the social studies curriculum is a field where these techniques can be used together in the written, verbal, and visual sense, and a balance was achieved in this regard (f=8). Some of the teachers' opinions on this issue are as follows:

"Cognitive level objectives also necessarily need written and visual support in affective level gains. It is positive that the textbook pictures are real pictures to make them concrete. Its use depends mostly on the research ability of the teacher." (T3)

"It is appropriate in terms of written, verbal and visual, but needs to be further enriched in terms of visual techniques. Visual elements are more suitable for children at this age, especially for their level." (T4) "It is naturally not appropriate to use these techniques in every theme. However, if we consider the curriculum in general, it is balanced in terms of the use of each of these techniques in terms of achieving the objectives." (T6)

When the objectives in the social studies curriculum are examined and in the observations made, it can be said that different written, verbal, and visual techniques are used by teachers, and the principle of balance is included in the curriculum.

Table 9: Opinions on the Balance between Academic Aspects, Entertainment, and Physical Activities

Theme	**Category**	**Frequency**
Balanced between Academic Aspects, Entertainment, and Physical Activities	Balanced between Academic Aspects, Entertainment, and Physical Activities	1
	Not Balanced between Academic Aspects, Entertainment, and Physical Activities	7

According to the teachers' views, there is no balance between the social studies curriculum in terms of academic aspects, sports, entertainment, and physical activities (f=7). Some of the teachers' opinions on this sub-problem are as follows:

"The balance between the academic aspect and sports, entertainment and physical activities is insufficient. If more opportunities are offered to schools, more active learning could occur." (T4)

"Not only in terms of social studies, but all other curricula are lacking in this regard, there is an artificial understanding of art and limited sports activities." (T5)

"Activities such as trips, observations, and research within the scope of the curriculum ensure the harmony between these activities." (T6)

"There is content that supports these activities. However, in general, this fit can be further increased. In order for learning to be more permanent, physical activity adaptation should be given more place." (T7)

When the objectives in the curriculum were examined, there was no one that included academic aspects, sports, entertainment, and physical activities. Besides, during the observations, it was observed that teachers did not give much place to these activities. In this context, the curriculum is not suitable for the principle of balance in terms of academic aspects, sports, entertainment, and physical activity.

Table 10: Opinions on the Balance of the Curriculum in Providing Opportunity for In-Class and Out-Class Learning

Theme	**Category**	**Frequency**

Providing Opportunity for In-Class and Out-Class Learning	Balanced in Providing Opportunity for In-Class and Out-of-Class Learning	6
	Not Balanced in Providing Opportunity for In-Class and Out-of-Class Learning	2

According to teachers' opinions, although there is a balance in the social studies curriculum in terms of providing in-class and out-of-class learning, it is dependent on some external factors rather than the curriculum in out-of-class learning (f=6). In the observations, it was found out that teachers teach out-of-class mostly through homework. Some of the teachers' opinions on this sub-problem are as follows:

"The content of the subjects as well as in the classroom can give allow them to learn outside the classroom. In fact, unlike many lessons, the content of the lesson is in the way of making use of events outside the classroom visually." (T1)

"There are usually in-class activities. This situation depends on the socio-economic status of the school and the teacher's devotion rather than the curriculum." (T2)

"Actually, there is a curriculum that provides many opportunities, but external factors such as space, economy, and socio-cultural structure are more effective." (T5)

"There are more in-class activities in the curriculum; if the teacher gives individual out-of-class activities that support the in-class learning of the students, the learning is carried out of the classroom." (T6) "The information in the content supports the research direction of the students. Especially it provides an opportunity for learning outside the classroom." (T7)

Table 11: Opinions on the Balance of the Curriculum in Terms of Compliance with Different Disciplines

Theme	**Category**	**Frequency**
Compliance with Different Disciplines	Balanced with Other Disciplines	8
	Not Balanced with Other Disciplines	0

According to the opinions obtained from the teachers, the social studies course is related to other disciplines as it is a core field, and a balance was established between them (f=8). Some of the teachers' opinions on this sub-problem are as follows:

"Social studies course is a flexible course, and by using this flexibility in the curriculum, this balance was achieved with other courses and discipline areas." (T5)

"We can say that the objectives of the primary school 4th-grade social studies curriculum are compatible with mathematics, science, and Turkish courses." (T6)

"The social studies lesson curriculum is associated with Turkish, science, and mathematics courses. In this respect, there is a balance between them, but sometimes they can be more abstract than other lessons." (T8)

When the course objectives are examined, it was ensured that many objectives from all grade levels are compatible with different disciplines. During the observations, it was indicated that in the educational situation of the teachers, the lesson provided harmony with various explanations and examples with both sub-branches and other disciplines, and in this respect, the principle of balance was achieved.

Table 12: Opinions on the Balance of the Curriculum in Terms of Allowing Different Learning Approaches

Theme	**Category**	**Frequency**

Allowing Different Learning Approaches	Allows Different Learning Approaches	8
	Not Allows Different Learning Approaches	0

According to the teachers' opinions, social studies lesson allows different learning approaches because it has different themes and different contents related to its sub-disciplines and many fields (f=8). Some of the teachers' opinions on this sub-problem are as follows:

"If we consider the social studies curriculum in our country with regards to citizenship transfer, social sciences and reflective thinking accordingly, it allows different learning approaches for structuring, prediction, and critical thinking dimensions." (T1)

"Social studies course is suitable for using different learning approaches as there are many learnings from life." (T4)

"The curriculum can help students gain different learning approaches in terms of the objectives and units within each theme." (T6)

In the curriculum, some objectives can be achieved by using different learning approaches, and in the observations made, it was found out that the principle of balance was achieved in terms of teachers trying to include different learning approaches in accordance with the course objectives and content.

Table 13: Opinions on the Balance of Curriculum Content in Terms of Appropriateness to Students' Development Level

Theme	**Category**	**Frequency**
TheAppropriateness of Curriculum Content to Students' Development Level	Suitable for Student Development	3
	Not Suitable for Student Development	5

According to the opinions of the teachers, the content of the social studies course is not suitable and balanced for the development level of the students because of the abstract subjects (f=5). During the observations, it was observed that some of the objectives in the curriculum remained abstract and used materials such as smartboards to concretize these objectives. Some of the teachers' opinions on this sub-problem are as follows:

"The contents are suitable for the development of the students. In some subjects, for example, to fully understand the subject of selection and election, the 4th graders need to be addressed in more detail in terms of adopting democracy education and understanding." (T1)

"I think some subjects remain abstract because they are not suitable for the development level of the students." (T4)

"Absolutely not suitable. It needs to be simplified and the content divided into relevant areas. The transition between subjects and an emphasis on logic should be provided. For example, it is not very logical to teach Seljuk history after forests." (T5)

"Generally, I find it appropriate. However, the fact that some subjects are full of abstract concepts in the 4th grade makes learning difficult." (T6)

"There is a straight narration; only the use of maps is included as material. The use of more materials and tools should be included. We try to concretize the subjects with animations on the smartboard." (T8)

Table 14: Opinions on the Balance of the Curriculum in Terms of Being Open to Innovations and Being Tradition-Bound

Theme	**Category**	**Frequency**

Being Open to Innovations and Being Tradition-Bound	Being Open to Innovations	3
	Being Tradition-Bound	5

According to the opinions collected from the teachers, the social studies curriculum is not balanced between innovation and tradition (f=5). The more traditional aspect of the curriculum prevails. Some of the teachers' opinions on this sub-problem are as follows:

"Our curriculum is not very open to innovations and put teachers into narrow forms. In this case, it brings along more traditionalism." (T1)

"I can say that there is a partial balance. The culture and heritage learning area is informative about traditions." (T3)

"I think it should be more open to innovations. It would be better if it covers the traditions of different cultures." (T4)

"It is more traditional as in all our curriculum." (T5)

"Although the curriculum is not completely dependent on innovation, adaptation studies to innovation do exist in recent years, although they are not very effective at this stage." (T6)

When the objectives in the social studies curriculum are examined, it can be said that a balance is tried to be ensured between innovation and traditionalism, but this situation cannot be achieved in the observations and teachers' opinions in practice, and in this sense, the principle of balance is violated.

Table 15: Opinions on the Balance of the Curriculum in Terms of Compliance with the Near and Far and Past and Current Developments

Theme	**Category**	**Frequency**
Compliance with the Near and Far and Past and Current Developments	Suitable for the Near and Far and Past and Current Developments	8
	Not Suitable for the Near and Far and Past and Current Developments	0

According to the opinions taken from teachers, the social studies curriculum established harmony and balance between the distant past and the current. Additionally, it was found that attention was paid to this principle in most of the acquired objectives (f=8). Some of the teachers' opinions on this sub-problem are as follows:

"Social studies are not a field that varies much except the field of history. Advances in the technological field have some impact on the content of the curriculum. There is a balance between the distant past and the present in terms of updating." (T1)

"Near, far, and current time is included, but the logic can be taught more properly. However, it can still be considered sufficient. It can even be mentioned that the balance situation is good, especially in some subjects." (T5)

"The curriculum is a little more limited with the distant past, but there are harmony and balance with current developments." (T7)

DISCUSSION, CONCLUSION AND SUGGESTIONS

In this study, the social studies curriculum was evaluated according to the principle of balance, which is one of the guiding principles of curriculum development. As one of the curriculum theories, reductive theory explains the balance under conditions such as the laboratory where everything is fixed. However, educational curricula have a complex theory (Morrison, 2010). There is no one right or one answer to a situation. For this reason, data was collected and analysed through observation, interview

and document analysis by making data triangulation in the study.

The social studies curriculum is more subject-centered than student-centered, especially due to the sequence and level of content, and the principle of balance could not be achieved in this sense. This may be due to the fact that the most crucial feature of the constructivist approach that it puts the student in the center is not fully reflected in the content. The teachers generally expressed that the content was too much on this subject and that the activities were less included. According to Demirtaş and Erdem (2015), one of the criticisms brought to the curriculum is that the content is too boring, and it supports this finding in this study. Another principle that the balance cannot be achieved in the curriculum is that the needs of the society in terms of the needs of students and society are prominent. Similarly, Yücel et al. (2017) found in their study that the balance principle was violated regarding students' interests and needs in the English language curriculum. Cuban (1992) stated that schools cannot find a solution to every problem of society and should not feel obliged to do so. The social studies course is a course that includes sub-disciplines such as history, geography, and citizenship. However, when the achievements are examined, it is stated that there is no balance in the field of history and that the field of history is more prominent based on the teachers' opinions, and the field of citizenship is given less space. This result is similar to Gürel's (2017) result that the discipline of history and geography comes to the fore in terms of sub-disciplines of the course in the social studies curriculum. All of the 131 objectives in the curriculum were examined, and it was determined that there was no balance in the distribution of the objectives in the cognitive, affective, and psychomotor areas, and during the observations, more cognitive goals were included. The teachers asserted that cognitive and affective goals were included in the curriculum, and psychomotor goals were almost non-existent. According to Ediger (2007) there should be a balance between knowledge, skills and attitudinal goals in terms of course objectives; otherwise, the student may have knowledge but cannot use it. Merter et al. (2012) stated that the 2011 secondary education English curriculum's targeted course hours were quite intensive, and the principle of balance was ignored. This finding may be closely related to the continuation of a success-oriented vision in education. It can be said that social studies lesson includes more group learning in terms of group and individualized learning. Teachers stated that the program is not suitable for individualized education because the students' interests, abilities, and needs are different in this sense. In the observations made, it was observed that the teachers, where the lessons were conducted mainly in groups, could not deal with students of different nationalities, especially because they did not know the language and did not have enough time and experience.

One of the basic elements of the curriculum is content. It must be balanced between the subjects and the logic of the students to provide the principle of balance in content. The principle of balance is to include a good variety of content to contribute to the development of the student (Tan, 2011). The teachers mentioned that the content remained too intensive and abstract due to the sub-disciplines of the course and that the balance could be achieved by reproducing the examples according to the students' economic, social and cultural environment. In this respect, it can be said that the content of the curriculum is determined by considering the logic of the subject. This finding coincides with the fact that the curriculum is subject-centered rather than student-centered in the first sub-problem for which an answer was found out. Taş and Kıroğlu (2018) asserted that the curriculum content is intense, which shows that the balance cannot be achieved in terms of content. In the study examining the balance between themes in the science curriculum in Lebanon, Boujaoude (2010) revealed that the curriculum violated the theme of "science as a way of knowing" and that there is no balance between themes. This finding is in the same directions as the result of the study. While preparing the curriculum, it is important to balance these differences by considering the characteristics of students with different intelligence types. When the curriculum objectives are examined, the characteristics of individuals with different intelligence types are considered, but in the observations made in practice, teachers adopt a standard approach more than students with average intelligence levels. In the interviews with the teachers, the

teachers underlined that the curriculum was mostly aimed at students with average and high intelligence. In this context, the principle of balance for different intelligence types was violated. This finding also points out that inclusive education practices cannot be fully reflected in the curriculum.

The use of written, verbal, and visual techniques in the curriculum is one of the principles of balance. According to Ornstein and Hunkins (2014), it is essential to give appropriate weight to each of the different techniques while designing the curriculum to bring learners to their goals. When the objectives were examined and the observations made, it was determined that different written, verbal, and visual techniques were used by teachers. The teachers expressed that the balance was achieved by suggesting that the lesson was the most appropriate lesson in terms of using different written, verbal, and visual techniques. Some objectives in the curriculum, such as academic direction, sports, entertainment, and physical activities, were available, but in the observations of this study, it was seen that the academic side of the curriculum was prioritized. This may be due to the insufficient course time and physical facilities of the schools. A sufficient number of objectives are included in the course to enable in-class and out-of-class learning. In the interviews with the teachers, they suggested that the curriculum is balanced in this regard. However, out-of-class learning is primarily dependent on external factors such as parents, economy, and socio-culture. The observations determined that teachers try to realize out-of-class teaching mostly through homework and activities. Besides, Jonyo and Jonyo (2019) emphasized the role of school principals to balance and supervise in-class and out-of-class learning.

The social studies course is closely related to many different disciplines in terms of its content, which has different sub-disciplines. When the objectives are examined, the balance of the course with different disciplines was achieved in many objectives at each grade level. The teachers stated that the course is especially compatible with Turkish and science disciplines. During the observations, it was determined that in the educational situation of the teachers, they established a relationship with both the sub-branches of the course and other disciplines by harmonizing them with various explanations and examples, and in this respect, the principle of balance was ensured. Bayır, Köse, and Balbağ (2016) stated in their study that benefiting from different disciplines in which teachers benefit from the intermediate disciplines of the lesson gives students various knowledge, skills, and values. Turan (2019) concluded that the social studies curriculum is associated with different disciplines at the level of learning areas. These results support the result of the study. Because of these features, it can be said that the course allows different learning approaches, and the principle of balance is implemented. In the curriculum, some objectives can be achieved by using different learning approaches, and in the observations made, it was observed that teachers included different learning approaches in accordance with the outcome and content, although not very diverse. The teachers stated that the lesson allows for different learning approaches because it has different themes and different contents related to their sub-disciplines and many fields. A balance could not be achieved in terms of the compatibility of the content of the social studies course with the students' development levels. Hewitt (2006) also added that the balance between the developmental stages of learners and the complexity of the curriculum is important. It was determined that some of the objectives in the curriculum remained abstract, and the teachers mostly used smartboards to concretize them. On the contrary to this result, Geçitli and Bümen (2020) found out that the information technologies curriculum was trying to achieve the principle of balance by considering the students' age and development levels. The balance between being open to innovations and commitment to tradition could not be achieved in the curriculum. When the course outcomes are examined, it can be expressed that there is a balance between innovation and tradition only in the field of culture and heritage learning. Teachers stated that adaptation studies were carried out in the last curriculum and that they were insufficient at the moment and that the curriculum came to the fore with its traditionality. In the social studies curriculum, the balance was included in many objectives in terms of adaptation to the near and far past and current developments. Teachers indicated that both the past and current developments are included in the course content in the curriculum.

Consequently, the principle of balance, which is one of the main principles of curriculum design, is provided in terms of the use of written, verbal, and visual techniques of the social studies curriculum, providing opportunities for in-class and out-of-class learning, the course being compatible with different disciplines, allowing different learning approaches, and adaptation to near and far past and current developments. Nevertheless, the balance is ignored for other principles.

Suggestions:

In light of the results obtained in the research, the following suggestions are made to ensure the principle of balance in the social studies curriculum:

Suggestions for Curriculum Developers:

1-The social studies curriculum is more subject-centered and was designed to appeal to the needs of society and the logic of the subject. Based on this background, it can be suggested that the student is more prominent and prepared in accordance with the logic of the student rather than the logic of the subject, by balancing their interests and needs with the needs of the society.

2-History, which is one of the sub-branches of social studies, is given more space in the content. It may be suggested to increase the content related to Geography and Citizenship and to establish a balance of content within the sub-branches.

3-Cognitive learning is prominent in terms of learning skills. Increasing the number of affective and psychomotor learning skills can be suggested to achieve a balance between these learning skills.

4-The curriculum was prepared to appeal to average and high-level students. Considering the lower level and other different students, it can be suggested to create a balance between different groups and make them suitable for individualized education.

5-It may be suggested to establish a balance between academic direction, sports, entertainment, and physical activities in the curriculum considering schools' facilities.

Suggestions for Teachers:

In light of the observations and findings made, the following suggestions can be made for teachers who are the implementers of the curriculum:

1-A balance between student- and teacher-centered education in lessons should be established.

2-A balance by including not only cognitive learning skills of students but also affective and psychomotor learning should be provided.

3-A balance should be ensured between students with different levels, cultures, and socio-economic characteristics in the courses, considering the inclusive education,

4-Based on the possibilities of the classroom, school, and environment, a balance should be implemented by appealing to many sensory organs of students such as academic aspects, sports, entertainment, and physical activity,

5-By using more than one learning method and technique in the lessons, suggestions can be made to establish a balance between the didactic and questioning learning of the students.

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Attributes of 3D Computer Models for Learning the Structure of Atom by Undergraduate Science Teacher's Students

Dr. Mustafa Akıllı
Bursa Uludag University, Faculty of Education, Turkey

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Abstract

This paper focuses on examining the effectiveness of three-dimensional (3D) computer models on student teachers' academic achievement, mental model construction, and spatial ability used in learning the "atomic models" topic in this study. The students were randomly assigned into two groups: the treatment group (TG) where 3D computer models were used and the control group (CG) where models were not used for teaching. The treatment group was instructed using 3D computer models, while the traditional learning process was adopted in the control group. With the help of SPSS software, the independent-groups t-test and one way MANOVA were performed between the control and treatment groups. Cohen's d and eta-squared values were calculated for the effects of the computer models. Through this study, it was seen that the instruction using 3D computer models contributed to students' achievement, mental model construction, and spatial ability more than the traditional instructional process.

Keywords: 3D computer models, atomic models, modelling, spatial ability, mental models

Introduction

A model is a representation of an object, a process or a system which is commonly used in science (Gilbert & Boulter, 1998). Models are constructed when an object or a phenomenon is too small, too large, too complex, too distant or inaccessible (Valanides & Angeli, 2008). Models and modelling are important in science because they play an important role in technology and the nature of science (Bekiroglu Ogan, 2006). Based on the different researches cited from Krell, Upmeier zu Belzen, and Krüger (2014), their importance in scientific communication and reasoning is well known.

Models can be classified into two types which are mental (internal) and expressed (external) models (Gobert & Buckley, 2000). Mental or internal models refer to individuals' representation of their explanatory mechanisms, while expressed or external models are the external representations of internal models. Expressed models can be diagrammatic, physical or computational models (Kim & Lee, 2013) such as 3D computer models, simulations or animations. Learning environments with computer models in science education started years ago while using some computer software, which was studied in several researches (Chen, Hsiao, & She, 2015). Computer modeling has been stated as a useful instructional tool which can be used to encourage students in the design of scientific models for describing, explaining, and predicting scientific

phenomena (Jara, Esquembre, Christian, Candelas, Torres, & Dormido, 2012). They are also seen as a key process for teaching and learning science (Acher, Arca, & Sanmarti, 2007), effective pedagogical tools for teaching (Halloun, 2007), and playing a central role in the justification and formation of knowledge in science education (Koponen, 2007). There are also other studies that recognize the importance of models in science education (e.g., Gilbert & Boulter, 1998; Gobert & Buckley, 2000; Justi & Gilbert, 2000).

Students have significant difficulties when learning science (Rutten, van Joolingen, & van der Veen, 2012) because many science concepts are invisible and abstract for students. As a result, students often create numerous alternative or inappropriate conceptions and models in their minds (Chen et al., 2015). Some studies have suggested several possible solutions to overcome these hard situations such as integrating some visualization tools (Barak & Hussein-Farraj, 2013) which are important for better understanding (Habraken, 1996) and communication (Ametller & Pinto, 2002) among students about science concepts. This helps them get the knowledge that they may not obtain from verbal explanations alone (Patrick, Carter, & Wiebe, 2005). 3D computer models enhance visual explanations of scientific phenomena that are not directly observable (Gobert, 2000) and provide a meaningful learning experience to make connections between observable phenomena and targeted concepts (Kim & Lee, 2013). For science, integrating computer models in instructional contexts may provide new or different opportunities to students to improve their understanding of unobservable phenomena (Barak, Ashkar, & Dori, 2011; Gilbert 2005; Zhang, Liu, & Krajcik, 2006), and to make abstract concepts visible (Barak & Hussein-Farraj, 2013).

Learning and 3D Computer Models

Why is learning with 3D computer models effective? Reasons for better learning with 3D models can be explained by Mayer's cognitive theory of multimedia learning. According to Mayer (2003), multimedia learning recognizes when students construct mental representations from words and pictures presented to them, and they can learn more from multimedia messages than from more traditional modes of presentation involving words only. This theory is based on three presumptions: (i) the dual channel presumption, (ii) the limited capacity presumption, and (iii) the active processing presumption (Mayer & Moreno, 2002). The dual channel assumption of Mayer uses the dual coding theory of Paivio which suggests teaching students about a system using both verbal and nonverbal codes (Moreno & Valdez, 2005). Mayer's assumption states that the presentation and processing of information in humans is cognitively cared for by two independent sub-systems: one concerned with verbal, and the other concerned with non-verbal (visual) materials. Thus, this assumption supports a dual coding hypothesis. Also, the limited capacity assumption is compatible with Baddeley's working memory model and Sweller's cognitive load theory (Paas, Tuovinen, Tabbers, & Van Gerven, 2003). The limited capacity presumption states that each working memory channel can build only a limited amount of visual or verbal information at any time (Mayer & Moreno, 2003). More so, the active processing assumption of Mayer stated that students note the relevant information, organize them by selection and exchange selected information into coherent mental representations, and integrate these mental representations into prior knowledge (Urhahne, Nick, & Schanze, 2009). According to this presumption, meaningful learning involves significant conscious processing within the verbal and visual channels (Moreno & Valdez, 2005).

The "learning by modelling" role of models in science education is highlighted by Gobert, O'Dwyer, Horwitz, Buckley, Levy, and Wilensky (2011). Krell, Reinisch, and Kruger (2015) have also cited the increasing value of using models to learn scientific content knowledge. As a type of models, the use of 3D computer visualization models in the science classroom has big potential to produce higher learning outcomes in ways not previously possible (Akpan, 2001). In their article,

Rutten et al. (2012) reviewed the researches about the learning effects of computers in science education. They reported that computers had improved better understandings, more knowledge expansions, and higher learning outcomes. Similarly, Chen et al. (2015) cited that many studies have suggested that multimedia tools or software enable students to overcome the difficulty of learning successfully and thus help students to achieve better learning outcomes. This study intended to explore if students' achievement performance in the atomic models topic after learning with 3D computer models are different from students who learn in the traditional learning process where teachers use only static 2D pictures, figures, etc.

Mental Models and 3D Computer Models

One of the definitions of mental models was made by Johnson-Laird in 1983 that "*a mental model is a type of dynamic representation that people use to present the world in order to understand a body of knowledge, predict the development of the world, and generate follow up actions*". Norman in 1983 also stated that "*a mental model is an interactive product that people form as a result of the interactions between the environment, people, and the artifacts of technology*" (cited in Chen et al., 2015, p.171). In the years that followed, Franco and Colinvaux (2000) stated that mental models are people's internal representations of real situations in their minds which they use for understanding and perceiving what happens. It can therefore be said that mental models are a form of an individual's knowledge representations about their environment. Mental models are cognitive representations (Buckley & Boulter, 2000) that are personal and private (Gobert 2000), unscientific, incomplete and unstable (Greca & Moreira, 2000), and unique to the observer (Coll & Treagust, 2002). The main role of mental models is to allow their builder to explain and make predictions about the system represented by it (Greca & Moreira, 2000). They are constructed by learners and scientists to interpret their experiences and to make sense of the physical world (Coll & Treagust, 2002). They also interpret the result when people face specific situations in order to solve problems and create new concepts (Vasniadou & Brewer, 1992).

According to Greca and Moreira (2000), the idea behind computer models is that mental models can be considered as `mental simulation' of the real situation of the problem and as `feasible' causal models for the system or mechanism they represent. Therefore, this study aims to explore the effectiveness of 3D computer models with respect to students' mental model construction.

Spatial Ability and 3D Computer Models

Spatial ability is defined as the capacity to generate, retain, retrieve, and transform well-structured visual images (Lohman, 1993), and it involves representing, rotating, and inverting objects in three dimensions when they are presented in two dimensions (Barnea, 2000). Spatial ability is the capacity to imagine changes which have occurred after folding or rotating the two or three dimensional objects. It comes into prominence when rotating objects, visualizing images or arranging pieces of an entire system in a suitable way (ChanLin, 2000; Hartman, Connolly, Gilger, & Bertoline, 2006; Orde, 1997). According to Hartman et al. (2006), many tasks in our world require the ability to perform spatially. Without spatial ability, success within specific disciplines such as science, engineering, the arts, etc. can be limited. Similarly, Black (2005) stated that spatial ability is a cognitive factor that is linked to high performance in science. Since science is an abstract area, Orde (1997) stated that spatial skills have brain functions for the processing of information which enable the conversation of an abstract visualization to a concrete product. As mentioned above for science learning, it seems that 3D computer models are important constructs.

Hartman et al. (2006) also stated that in some situations, it may be possible to improve the spatial ability of students. This study thus aims to investigate if 3D computer models are able to impact students' spatial ability.

Purpose

The purpose of this study was to determine the effectiveness of 3D computer models, used in the atomic models topic in the Introduction to Modern Physics course, on first year science teacher candidates' achievement, mental models, and spatial ability before and after the teaching and learning process. The study aimed to answer the following research questions:

Research Question 1: Is there any significant difference in students' achievement between a learning environment supported by 3D computer models and a traditional learning environment in the topic of atomic models?

Research Question 2: Is there any significant difference in students' mental models between a learning environment supported by 3D computer models and a traditional learning environment in the topic of atomic models?

Research Question 3: Is there any significant difference in students' spatial ability between a learning environment supported by 3D computer models and a traditional learning environment in the topic of atomic models?

Methodology of Research

Participants and Procedure

Sixty-one second-year undergraduate (science teacher candidate) students from two classes of the "Introduction to Modern Physics" course, taught by the researcher, participated in this study. The students were randomly assigned into two groups: treatment group (TG) where 3D computer models were used and the control group (CG) where models were not used for teaching. The CG was taught the atomic models topic using 2D graphics, pictures, figures, etc. from textbooks in a teacher centered approach using talk-and-chalk type lessons, while the TG was taught using 3D computer models for two weeks. The pre-tests for achievement and spatial ability were given to students of both the control and treatment groups before they were taught the topic of atomic models. The post-tests for achievement, spatial ability, and mental models were given immediately to both control group and treatment group students after they finished two weeks of learning. The framework of the teaching and learning process involved in this study is summarized in Figure 1.

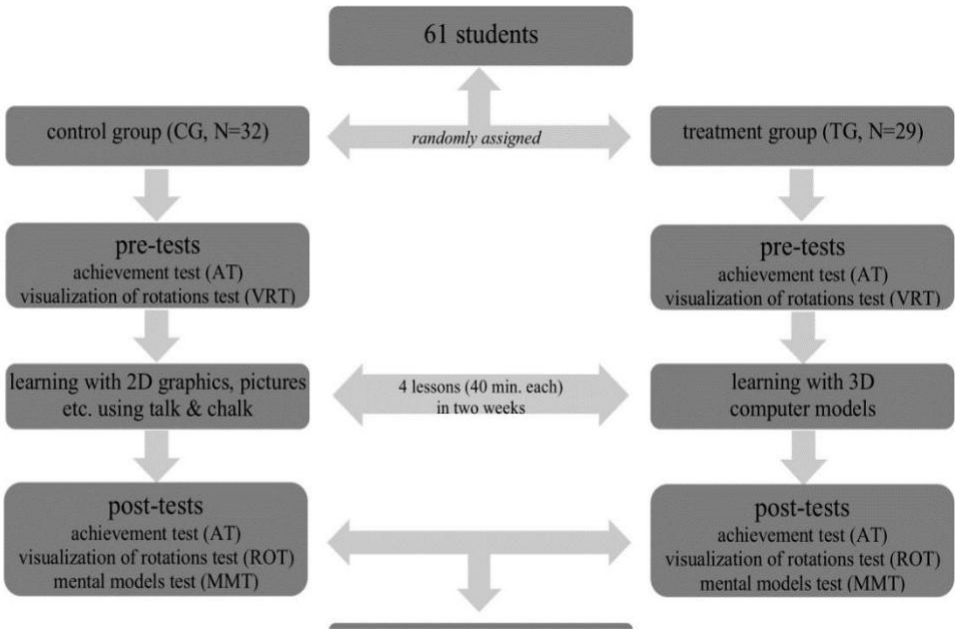

Figure 1. The framework of the study

Design of 3D Computer Models

The 3D computer models used in the treatment group for teaching were prepared using the 3D Studio Max 9 program in order to describe atomic models. This program is a professional 3D modeling, animation, and rendering software used mostly by design visualization specialists, game developers or visual effects artist. The models could also be thought of as a different type of animation films. Some properties of models used in instruction are given in Table 1.

Table 1. Properties of 3D computer models

Models	Subject	Purpose	time (s)
Model 1	Thomson's atomic model	To explain Thomson's atomic model and theory	91
		To explain Rutherford's experiment (materials, process and results)	
Model 2-3-4	Rutherford's atomic model	To explain Rutherford's atomic model and theory	178 76
		To explain Rutherford's atomic model drawbacks	91
Model 5-6	Bohr's atomic model	To explain 1st postulate of Bohr's atomic model	90
		To explain 2nd postulate of Bohr's atomic model	90
		To explain atomic excitation	
Model 7-8	Energy levels in atom	To explain relaxation back to the ground state of an atom	85 100

Some examples from the 3D computer models used for teaching in the treatment group are

given below (Figure 2).

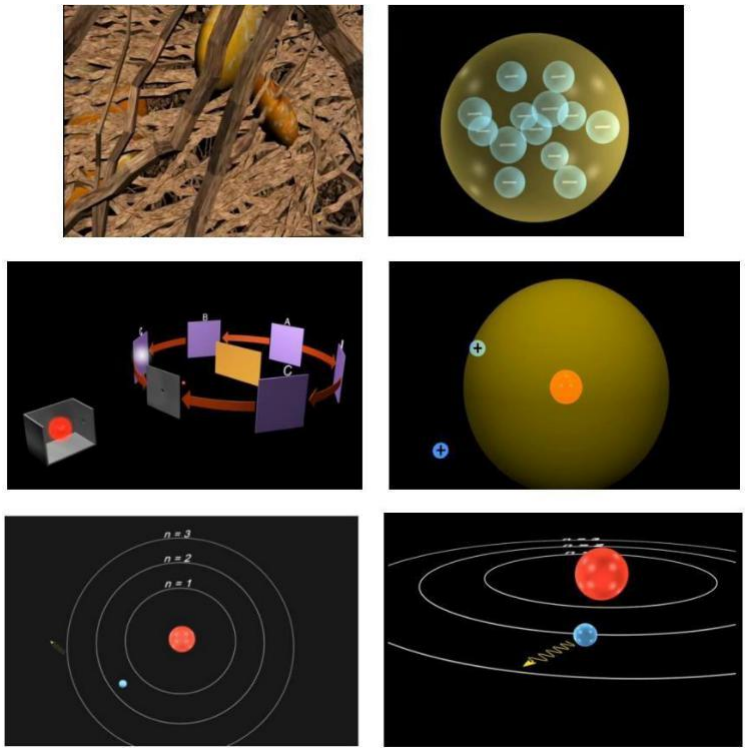

Figure 2. Screenshots from 3D computer models

Achievement Test

The achievement test (AT), developed by a panel of six experts (including the researcher, one science education researcher, three physics education researchers, and one chemistry education researcher), was used to determine students' achievement in the atomic models unit and to observe if there was a significant difference between the two groups. The AT is a multiple-choice test which consisted of 20 questions. Every question had five responses and a value for one point was awarded for a correct answer. Therefore, the test gives continuous scale scores ranging from 0 to 20. The Cronbach's α value was 0.72, thus the achievement test had satisfactory statistical reliability.

Mental Model Test

The mental model test (MMT) was developed to examine the accuracy of students' mental models and their construction of atomic models after instruction with 3D computer models. The same panel was involved in the process of designing the test. Five open-ended mental model construction questions related to Thomson's atomic model, Rutherford's experiment and its results, and Bohr's atomic model and his postulates were developed which required students to draw their mental models and provide explanations. For the MMT, the students' drawings and explanations in each item were analyzed. Scores from 0 to 2.0 was awarded for their wrong drawings and/or wrong explanations, 1 point was given for partial drawings and/or partial explanations, and 2 points was awarded for correct drawings and/or explanations. Thus, there was a total of 20 points for the MMT with a maximum possible score of 10 points for drawings and 10 points for explanations.

Purdue Visualization of Rotations Test

The Purdue visualization of rotations (ROT) test, one element of the Purdue Spatial Visualization Test Battery, was developed to measure students' spatial ability in terms of rotating 3D objects. ROT, which consisted of 20 items, was developed by Bodner and Guay (1997). The Kuder-Richardson (KR-20) reliability of the ROT test was found to be 0.80. This data suggested that the ROT test was internally consistent. An example of an item in the ROT test is given below (Bodner, 1976) in Figure 3:

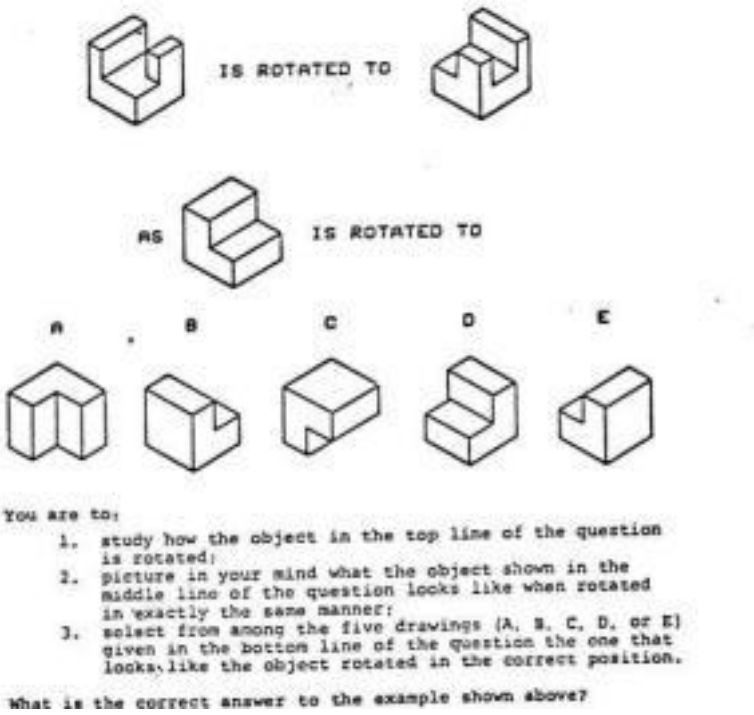

Figure 3. Directions and an example of ROT

Results of Research

Analysis of Achievement Test

Descriptive statistics and independent samples *T* test were employed to investigate if treatment group students made progress on their atomic models topic before and after learning. This was supported by 3D computer models in comparison with the control group. Analysis showed that there was no statistically significant difference between the groups in the pre-test ($T_{(59)} = 0.52$, $p > .05$). However, the TG students who learned the atomic models topic with 3D computer models made statistically significant differences in the post-test ($T_{(59)} = 5.95$, $p < .05$)

Table 2. The results of the achievement test

	Pre-test				Post-test			
	N	Mean	SD	t-value	*N*	Mean	SD	t-value
CG	32	6.47	2.34	0.52	32	12.88	2.15	5.95*
TG	29	6.14	2.61		29	15.66	1.37	

*p < .05

Cohen's *d* was also calculated for the effect size of 3D computer models in this process. The

Cohen's *d* of the TG students in the achievement test in comparison to the CG students was found to be 1.54.

Analysis of Mental Models Test

After two weeks of the learning and teaching process, the MMT was administered to both students in the TG and the CG. As shown in Table 3, students in the TG had better scores than the students in the CG.

Table 3. The results of mental models test

		MMT-drawing		MMT-explanation		MMT-total	
	N	Mean	SD	Mean	SD	Mean	SD
CG	32	3.19	1.89	6.84	1.19	10.03	2.34
TG	29	7.76	1.38	7.21	1.74	14.97	2.57

One way MANOVA was conducted to explore whether students' scores in the TG and the CG were statistically significant or not. It was found that Wilks' Lambda significance value was .000 ($F_{2,58}$ = 57.083, p < .05). Thus, there is a statistically significant difference between the CG and the TG for one or more dependent variable. As shown in Table 4, there was a statistically significant difference between the groups: MMT-drawing scores ($F_{1,59}$ = 114.230, p < .05) and MMT-total scores ($F_{1,59}$ = 61.397, p < .05). Also $\square^2$ values were found to be .659 for MMT-drawing scores and .510 for MMT-total scores. Considering the mean scores in Table 3, it is clear that these differences are in favor of the TG.

Table 4. One way MANOVA results of the mental model test

Dependent variable	Sum of squares	df	Mean square	*F*	*p*	$\square^2$
MMT-drawing	317.880	1	317.880	114.230	.000*	.659
MMT-explanation	2.006	1	2.006	.918	.342	.015
MMT-total	370.394	1	370.394	61.397	.000*	.510

*p < .05

Analysis of Purdue Visualization of Rotations Test

The descriptive statistics and independent samples *T* test was employed to determine whether the 3D computer models helped the TG students' spatial ability in comparison with the CG. Analysis showed that there was no statistically significant difference between the groups in the pre-test ($T_{(59)}$ = 0.176, p > .05). However, the TG students who were instructed in the atomic models topic with 3D computer models made statistically significant differences ($T_{(59)}$ = 4.50, p < .05) from the pre-test to the post-test compared to the students in the CG. As seen in Table 5, the ROT test scores of students in the TG increased approximately to 16.7%.

Cohen's *d* was computed to determine the effect size. For the spatial ability performance of the TG students in comparison with the CG students, the effect of 3D computer models was found to be 1.16 according to the Cohen's *d* test.

Discussion and Conclusion

This study examined if 3D computer models could help students develop their learning, mental model construction, and spatial ability in the atomic models topic. The study suggests a possible way to overcome difficulties about learning abstract topics in science specific to atomic models and opens a new avenue for students to construct true and complete mental models.

According to the analysis of independent samples *T* test, 3D computer models are effective for better learning of the atomic models topic (see Table 2) in comparison with the traditional learning process with 2D representations involving pictures, figures, etc. in textbooks. This result is supported by other researches that suggest that 3D computer models provide higher academic achievement and learning performance in comparison with traditional approaches such as textbooks or 2D visualizations (Barab, Hay, Barnett, & Keating, 2000; Daugherty, Li, & Biocca, 2008; Dickey, 2005; Frederiksen, White, & Gutwill, 1999; Gobert & Pallant, 2004; Kim, 2006; Küçüközer, Korkusuz, Küçüközer, & Yürütmezoğlu, 2009; Sanger & Badger, 2001; Taylor, Barker, & Jones, 2003; Young, 2004). With this result, it can be clearly stated that abstract issues such as science 3D computer models must be included in learning and teaching if possible. Also, the effect size (Cohen's *d*) when using 3D computer models was found to be 1.54. According to McMillan and Schumacher (2006), 3D models have large effects on learning about the atomic models topic (see in page 295 for evaluation criteria of Cohen's *d*).

Another result obtained from the study focused on students' mental model construction. According to one way MANOVA analysis, students in the TG had more correct and clear mental models in comparison with students in the CG. As seen in Table 3, their drawing scores and total scores are better than those of the students in the CG. This result is supported by some researchers (e.g., Barak & Hussein-Farraj, 2013; Dalgarno, Hedberg, & Harper, 2002; Gobert & Pallant, 2004; Meheut, 2004; Urhahne et al., 2009; Wu & Chiang, 2013; Wu & Shah, 2004; Wu, Krajcik, & Soloway, 2001) who have reported that 3D computer models and representations are better tools than 2D representations or physical materials. This is because they have the potential for building new, correct, and clear models or changing incomplete mental models in students' minds. Also, the eta-squared (^{2} = .659) value in Table 4 shows that 3D computer models have large effects on students mental models. For evaluation of eta-squared, Leech, Barrett, and Morgan (2005, p.133) pointed out that .31 and higher values are indicators of large effects.

Lastly, the results of the ROT demonstrated that 3D computer models are effective in facilitating students' spatial ability. As seen in Table 5, the students in the TG increased their ROT scores after instruction. This result shows parallelism with many other studies (Potter & Merwe, 2001; Alias, Black, & Gray, 2002; Kwon, 2003; Lajoie, 2003; Woolf, Romoser, Bergeron, & Fisher, 2003; Wu & Shah, 2004; Kim, Yoon, Whang, Tversky, & Morrison, 2007; Wang, Chang, & Li, 2007; Williamson & Jose, 2008) that report that 3D models and visualizations enhance students' spatial abilities. Also, Cohen's *d* was found to be 1.16, thus showing that 3D models have large effects on students' spatial ability. According to Hartman et al. (2006), it may be possible to improve the spatial ability of students.

In this study, the effects of 3D computer models for learning the atomic models topic were investigated. The results show that these models are very effective tools for better learning, better

mental model construction, and enhancing spatial ability. It can be clearly pointed out that for abstract concepts in science or in other disciplines, it is important to concretize them. Therefore, it is suggested that if the usage of these models is possible, they certainly must be included in the learning and teaching process.

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