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About the Journal

Journal of Educational Technology and Online Learning (JETOL) is an open-access double-blind peer reviewed academic educational technology and online learning journal. The Journal targets both researchers, practitioners and policy-makers of educational technology and online distance learning fields. JETOL is available free-of-charge to anyone with access to the Internet, and there are no article submission or access charges for publication, and it has been published triannual, in January, May, and September. JETOL is currently indexed by ERIC - Education Resources Information Center, ProQuest, Google Scholar, I2OR - Institute of Organized Research, J-Gate, ESJI - Eurasian Scientific Journal Index, BASE - Bielefeld Academic Search Engine, DRJI - Directory of Research Journal Indexing, ResearchBIB - Academic Resource Index, ROAD - Directory of open Access Scholarly Resources, Root Indexing - Journal Abstracting and Indexing Service, Index Copernicus, CiteFactor - Academic Scientific Journals, Cosmos, Asos Index,InfoBase Index.

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From the Editors

Dear JETOL readers,

We are proud to announce that JETOL is now indexed in Education Resources Information Center (ERIC). ERIC is an important database with international recognition, and it is an online library of education research and information, sponsored by the Institute of Education Sciences (IES) of the U.S. Department of Education.

The Covid-19 outbreak, which has been in our lives for more than 1 year, still continues its effect. Hence, most educational institutions continue their operations with distance education applications. It can be said that Covid-19 pandemic will gradually end with the spread of the vaccines. However, in this process, distance education has become a very important part of our lives. It can be said that even if the Covid-19 pandemic ends, distance education applications will continue intensively. Within this context, the interest of researchers in this field continues to increase.

In our fourth age, in other words, the fourth volume and the second issue, we introduce a wide array of articles. We would like to thank to all authors and reviewers who contributed to the advancement of scientific knowledge and to the field of educational technology and online learning.

In our fourth year, we worked hard and gained a great momentum and indexed in different databases: ERIC - Education Resources Information Center, ProQuest, Google Scholar, I2OR - Institute of Organized Research, J-Gate, ESJI - Eurasian Scientific Journal Index, BASE - Bielefeld Academic Search Engine, DRJI - Directory of Research Journal Indexing, ResearchBIB - Academic Resource Index, ROAD - Directory of open Access Scholarly Resources, Root Indexing - Journal Abstracting and Indexing Service, Index Copernicus, CiteFactor - Academic Scientific Journals, Cosmos, Asos Index,InfoBase Index. We hope that JETOL will continue to be a premier source for those who seek and pursuit knowledge.

In the second issue of 2021, we have 16 articles. The articles in this issue of the journal emphasize many of the important dimensions related to current issues in educational technology and online distance education. We are sure that the topics will gain our attention immediately.

We hope and believe that, as an open access journal, we will move forward and contribute the universal knowledge ecology. Enjoy!

Yours respectfully,

Editorial Team

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A thematic review of using digital teaching technologies in Turkish language teaching

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Abstract

When examining the current thematic analysis studies on digital teaching technologies in learning-teaching processes, three main limitations were encountered. The first of these limitations is that most of the thematic analysis studies dealt with all studies conducted in the literature, regardless of country. The second limitation of the studies conducted in the literature is that the existing thematic analysis are quite old. The last of the limitations is that the thematic analyzes of the studies on the use of digital teaching technologies in language education or teaching-based courses were mostly carried out in the field of foreign language teaching / second language teaching. This research aims to examine the literature on the use of digital teaching technologies in Turkish language teaching studies and to reveal a synthesis of this; get a general idea of the frequency of research in this field; to present the general framework of researches published in different regions, different journals and studied in different universities as thesis and to reveal how various variables (technology type, index of published journals, thesis type, etc.) affect the use of technology in Turkish language teaching studies. The research was designed in the thematic content analysis design, which is a type of content analysis. The general characteristics, reasons, aims, method information, results, and recommendations of the studies examined in this study were presented by analyzing them. The research results revealed that there is still a need for studies on using digital teaching technologies in Turkish language teaching studies. There are almost no studies, especially in some learning areas. Also, it has been concluded that digital teaching technologies are highly effective in learning areas of reading and writing. High socioeconomic levels and female students use technology better in the Turkish language course, and many positive and negative aspects of technology have been discovered for students.

1. Introduction

Our world has entered a new period of change with technological developments in the last century. To keep up with this change, people have had to improve some of their knowledge, set new goals, and develop new habits and be open to new learning (Erkman et al. 2019). Turkey announced in 2018 "Digital Turkey," the road map was a follower of this change; It has set its goal to transform in the industrial field with leading technologies such as artificial intelligence, autonomous robots, big data, and advanced analytics, cloud computing, augmented and virtual reality, internet of things, smart sensor technologies and cybersecurity (Republic of Turkey Ministry of Industry and Technology [MoIaT] 2018). However, the change mentioned

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above has impacted the industry and all areas related to human and social life, especially those that have significantly affected educational activities. Reports and documents published by various institutions also support this view. For example, the European Commission (2008) stated that digital technologies have the potential to improve and change necessary activities in educational environments, and OECD (2016) stated that information and communication technologies improve students' traditional learning experiences and these technologies will act as a catalyst if a similar change process occurs. The Ministry of National Education, on the other hand, set two main goals under the heading of 'digital content and skill-supported transformation in learning processes' in the 2023 Education Vision document (MoNE 2020), which was prepared to raise individuals equipped with the skills of the age and the future, and aimed to integrate learning-teaching processes into technological change with the actions to be taken (Ekoç 2020). Through these opinions, it can be said that in the future, learning-teaching activities will be mostly based on digital teaching technologies (Şen and Hava 2020), and these technologies will be used more frequently in mother tongue education and other fields (Birinci 2020). Because the studies conducted, have shown that digital teaching technologies can increase learners' learning performance/motivation and provide more effective learning (Shadiev and Huang 2020). For this reason, for possible practical tools that may arise, developments in digital teaching technology should be followed carefully, how these digital teaching technologies can be used for language education or teaching, and the functionality and up-to-dateness of the technologies used should be reviewed more frequently. Thus, by comparing the practices developed in the past, today, and in the future, it will be possible to benefit from the most effective and correct source in shaping the learning-teaching processes.

The potential impact of technological developments on learning-teaching processes has pioneered the development of various digital applications, tools, and activities that help students better understand concepts, phenomena, and theories (Chauhan 2017; Kan and Murat 2020; Koong and Wu 2011; Li and Lim 2008), an active learning environment was provided to the students with the development and use of innovative, interactive-based technological applications (de Koning-Veenstra et al. 2014). Besides, as a result of the widespread use of technological devices such as computers, tablets, and mobile devices, and they are reaching more people, the application demands increased, leading to an increase in the number of digital applications developed (Yılmaz and Batdı 2016). These developments in recent years have provided educators with the opportunity to use digital teaching technologies in their learning-teaching processes. This opportunity has been used in the field of language education as in every field. It is aimed to improve students' language skills by using different digital teaching technologies, primarily virtual and augmented reality applications, and the use of these technologies has become increasingly common (Shadiev et al. 2019). As a result of the conducted researches, it has been revealed that the use of digital teaching technologies in the learning and teaching process has a positive effect on student achievement at the primary, secondary, high school, and university levels (Bax 2011). The positive impact of digital teaching technologies on students' academic achievement is also supported by the research (Broekhuizen 2016) conducted within the scope of developing basic language skills within mother tongue education.

1.1. Justification of the Study

Digital transformation, which has an impact on educational activities and in all fields related to human and social life, has increased the number of in-class applications and scientific studies related to the use of technology in education. These studies in the field of educational sciences constitute an undiscovered large working group for thematic analysis studies. Thematic analysis studies examine the rationale, purpose, method, results of the studies conducted by following different research methods and the suggestions stated in these studies and provide important information based on a broad perspective to the readers; It is promoted by prominent journals in the field of social and behavioral sciences, as it focuses on the main parts of these studies by discussing a wide range of studies on the subject under investigation (Eden 2002; King and He 2006).

In order to provide a comprehensive overview of the researches on the use of digital teaching technologies in learning-teaching processes, thematic analysis studies have been previously conducted by various researchers. However, when examining the current thematic analysis studies on digital teaching technologies in learning-teaching processes, three main limitations were encountered. The first of these limitations is that most of the thematic analysis studies dealt with all studies conducted in the literature, regardless of country. This situation has caused thematic analysis studies, focusing on using digital teaching technologies in learning-teaching processes, on being incomplete in describing countries' current situation on this issue. However, many variables such as economic power, digital technology infrastructure, technology perception, teacher-student competencies, and family factors require countries to be considered separately to determine the use of digital technology in learning-teaching processes more clearly (Nettleton 1991). Therefore, this research has dealt with the Turkish language of learning and teaching that deals with digital technology in the process and the work carried out in Turkey; the researchers about the work carried out in this field in Turkey were intended to give a general idea. The second limitation of the studies conducted in the literature is that the existing thematic analysis (Göktaş et al. 2012; Kurtoğlu and Seferoğlu 2013; Şimşek et al. 2008; Tatar et al.2013) are quite old. In this respect, the studies mentioned above do not provide information on studies that have increased in recent years and focus on using different digital teaching technologies in Turkish education. The last of the limitations is that the thematic analyzes of the studies (Alyaz and Akyıldız 2018; Duman, Orhon and Gedik 2015; Merzifonuoğlu and Gonulal 2018, Baturay, Yıldırım and Daloğlu 2009; Saran, Seferoglu and Cagıltay 2009) on the use of digital teaching technologies in language education or teaching-based courses were mostly carried out in the field of foreign language teaching / second language teaching. In this context, Turkey's private digital teaching technologies Turkish language education to get a general idea about research dealing with space use, it was decided to undertake a thematic analysis of prospective studies to make more accurate forecasts and see the gap in the literature. With this research to be carried out, it is aimed to achieve the following goals;

• To examine, synthesize, and adequately integrate the literature created by research on the use of digital teaching technology in Turkish language education.

• To get a general idea of the frequency of research conducted in the literature in question, Turkey has carried out in different places, have been published in different journals, and completed as a thesis in different universities put forth the general framework of research.

• To determine the distribution of various variables (the type of digital teaching technology, index of published journals, thesis type) in studies on the use of digital teaching technology in Turkish language education.

2. Methodology

The research conducted is designed in a thematic content analysis pattern, a type of content analysis. Thematic content analysis studies are based on the principle of interpreting, evaluating, and synthesizing the main parts of the studies carried out in a particular field, such as general trends, results, and suggestions, with a critical point of view by creating specific themes and codes (Au 2007; Çalık and Sözbilir 2014; Çalık et al. 2008). Thus, it is ensured that all available resources on a particular subject are examined. In this respect, these studies are a rich resource for researchers, educational scientists, and teachers working in the relevant field and having difficulty in accessing all resources (Çalık et al. 2005; Çalık et al. 2015). The study method in question also constitutes a rich reference resource for educational researchers, teachers who implement educational processes, and education policymakers in terms of revealing the similar and diverging aspects of studies that deal with a specified subject from different dimensions (Çalık et al. 2005; Gül and Sözbilir 2015). This study aimed to examine the studies on the use of digital teaching technology

in Turkish language education and present the general trends, results, and suggestions of the studies under specific themes/codes; and in this direction, the thematic content analysis method was used.

2.1. Data Collection

Web of Science, ERIC, EBSCO, Google Academic, National Academic Network and Information Center [NANaIC] National Database, and Council of Higher Education Institution [CoHE] Thesis Center databases were scanned to reach the studies 2010-2019 on the use of digital teaching technology in the field of Turkish language education. The reason for the inclusion of the studies since 2010 in the thematic analysis in this study is that there are other review studies recently. However, we did not come across any review studies on this subject until 2019, when the research started. This process is a limitation of this research. While searching the databases to find relevant studies, "digital technology, digital teaching technology, Turkish lesson, reading, writing, listening, speaking, augmented reality, cartoon, electronic reading, electronic writing, screen reading, digital story, digital writing, internet, computer" words are preferred as keywords. Studies in the field of teaching Turkish as a mother tongue were taken into account in the study. Studies in teaching Turkish to foreigners and teaching secondary languages were not included in the study's scope. In this study, Turkey addressed peer-reviewed articles published in national and international journals, and the thesis registered in the CoHE central thesis has been included. However, the possibility of finding some studies that could not be reached is a limitation of the research. In line with the criteria and principles explained above, 75 studies, including 50 articles and 25 thesis studies, have been included in the research conducted. The list of these researches is shared in the appendix.

2.2. Data Analysis

The data analysis process started with transferring the studies included in the research to the Nvivo package program. After the relevant studies were transferred to the Nvivo package program, they were analyzed according to the program features' content analysis method (Bazeley and Jackson 2013). As a result of this examination, specific themes, codes, and sub-codes were determined. The themes determined are "the reasons for the studies, the purpose of the studies, the method information of the studies (design, sample size, and sample type), the results of the studies and the recommendations of the studies." Also, similar thematic analysis studies previously performed for the analysis phase (Ünal et al. 2006; Kurnaz and Çalık 2009; Bağ and Çalık 2017; Kozaklı Ülger et al. 2020) were also examined, and It has been determined that these studies focus on similar themes/categories. Besides, the general characteristics of the studied studies were also included in the analysis. Accordingly, the distribution of articles/theses by types, distribution of articles/theses by years, and distribution of the technology used in the studies according to the learning areas were also examined. An analysis example is presented below.

Table 1.

An Example of the Analysis of the Studies Included in the Study

Rationale	Purpose	Design	Sample size	Sample type	Conclusion	Suggestion
Lack of academic study	Determining the impact (success)	Quantitative research (quasi-experimental)	33	Middle school student	Positive effect	(1) Using technology with different techniques (effect)

All the studies discussed were analyzed in the example above, and the relevant themes and codes / sub-codes were determined. The presentation of the findings conducted by considering the relevant theme and code / sub-codes. Information on the data collection and analysis process of the research is shown in Table 2.

Table 2.

Data Collection and Analysis Process

Date	Action Taken
10.02.2020/05.03.2020	Scanning databases to reach relevant studies
07.03.2020	Processing the obtained resources into the Nvivo package program
08.03.2020/27.04.2020	Theme, code and subcode study
28.03.2020/15.04.2020	Submission of the created theme, code, and sub-codes to expert opinion
01.04.2020/10.04.2020	Examining the data analysis of different thematic analysis studies
16.04.2020/25.05.2020	Placing the contents in theme, code, and sub-codes according to the evaluations of expert opinions
04.05.2020/15.05.2020	Re-checking databases in order to avoid data loss
17.05.2020	Presenting the findings by processing all data into themes, codes, and sub-codes

2.3. Validity and Reliability of the Study

In the study, firstly, databases were examined meticulously by two researchers in order to prevent data loss, and screening studies were carried out. At the stage of determining the theme, code, and sub-code, analysis processes in other thematic analysis studies were examined, and Nvivo package program reviews were included in the process. Each study was handled one by one, and the other study was not started before one study was completed to avoid errors. After the theme, code, and sub-code determination processes were completed, a return was made, and the compatibility of the raw data with the theme, code, and sub-code was rechecked. The process was presented continuously to expert opinion, and expert opinions influenced the analysis's realization process. The researchers carried out the stages of determining the theme, code, and sub-code. The theme, code, and sub-codes of the three studies determined before the determination of the theme, code, and sub-codes of all studies were determined by both these researchers and two academic staff who are experts in qualitative research. Consequently, the agreement between coders was calculated according to the formula of Miles and Hubermann (1994) [Reliability = Agreement / (Agreement + Disagreement) x100], and the agreement rate was determined as 0.92. Based on this result, the researchers continued the process of determining the theme, code, and sub-codes of other studies. All themes, codes, and sub-codes determined at the end of this process were presented to the opinion of an academic specializing in content analysis. The process was explained in detail, and the validity and reliability control were ensured by revealing the procedures in detail.

3. Findings

3.1. Findings Regarding the General Features of the Studies (Journal and Thesis Types and the Years of Publication)

Table 3.

Distribution of Articles by Journal Types

Index	f	%
SSCI	4	8
ESCI	1	2
Education area index *	6	12
TR index [NANaIC]	27	54
Other index	12	24
Total	50	100

*Eric, ISI, Education Full Text, H.W. Wilson

When the studies on the use of digital education technologies in Turkish language education are examined, it was determined that a total of 50 studies were carried out in the relevant period. It was observed that four of the conducted studies were scanned in the SSCI index and one in the ESCI index. It has been determined

that the vast majority of the studies were published in journals scanned by the TR [NANaIC] index. It was determined that 24% of the related researches was published in journals scanned by other national and international indexes.

Table 4.

Distribution of Thesis

Thesis Type	f	%
Master Thesis	21	84
PhD thesis	4	16
Total	25	100

According to Table 4, it was seen that 21 of the thesis studies examined within the scope of this study were master's theses, and four were doctoral dissertations. Master theses represent 84% in the distribution.

Table 5.

Distribution of Studies by Years

Publication years of the studies	SSCI	ESCI	Education area index	TR index [NANaIC]	Other index	Master Thesis	PhD thesis	Total	Percentage
2019	---	---	2	5	---	10	1	18	24
2018	---	1	---	4	2	2	2	11	14.67
2017	---	---	2	5	4	---	---	11	14.67
2016	1	---	1	3	---	---	---	5	6.67
2015	1	---	1	5	---	1	1	9	12
2014	---	---	---	---	4	1	---	6	8
2013	---	---	---	3		4	---	7	9.33
2012	---	---	---	1	2	1	---	4	5.33
2011	---	---	---	---	---	1	---	1	1.33
2010	2	---	---	1	---	---	---	3	4
Total	4	1	6	27	12	21	4	75	100

According to Table 5, the number of studies has increased from the past to the present, and especially in 2019, a considerably higher number was reached. It turns out that more than half of the research has been carried out after 2017. It is observed that most of the thesis studies have been carried out in the last two years. In this context, the increasing number of studies in recent years reveals the necessity of this research.

3.2. Findings Regarding the Content Features of the Studies

Findings regarding the distribution of the type of digital teaching technology used in the studies according to learning areas

The studies included in the study's scope, which types of digital teaching techniques are used, and which learning areas the research focuses on were examined. Accordingly, when these studies' contents were examined, it was determined that the focus was on four essential learning areas (reading, writing, speaking, listening), Turkish course success, and first reading and writing teaching. The types of digital teaching technology used are divided into sixteen among themselves; however, since some studies do not specify which type of digital teaching technology is used, they are presented separately.

Table 6.

Distribution of the Type of Digital Instructional Technology Used in Studies According to Learning Areas*

	Reading	Writing	Speaking	Listening	Turkish course success	First reading and writing	Total	Percentage
Digital story	6	8	---	3	8	---	25	30.86
Computer/web-site	1	---	---	---	1	1	3	3.70
Animated cartoon	---	---	---		1	---	1	1.23
Multimedia	1	---	---	---	1	---	2	2.47
Digital children's book		---	---	---	1	---	1	1.23
Digital literacy	3	4	---	---	4	---	11	13.58
Digital game		1	---	---	3	---	4	4.94
Digital writing		2	---	---	---	---	2	2.47
Educational software			---	---	---	1	1	1.23
Screen reading	15	---	---	---	---	---	15	18.52
e-reading	1	---	---	---	---	---	1	1.23
Social media	1	1	---	---	---	---	2	2.47
Story bird	---	1	---	---	---	---	1	1.23
Wattpad	---	1	---	---	---	---	1	1.23
Web- based system	---	---	---	1	---	---	1	1.23
Webquest	---	---	---	---	1		1	1.23
Unspecified	1	3	---	---	4	1	9	11.11
Total	29	21	0	4	24	3	81	100
Percentage	35.80	25.93	0	4.94	29.63	3.70	100	---

* Some studies have been conducted with more than one learning area and type of digital teaching technology.

When the learning areas of the research are examined, it is seen that 35.80% of the mentioned studies are carried out in the field of reading learning. After the reading, the Turkish course success with 29.63% and the studies for writing with 25.93% draw attention. No research focusing on speaking has been found. When analyzed according to the type of digital teaching technology they use, it is seen that a significant proportion (30.86%) of the studies are conducted with the use of digital stories. After using digital stories, screen reading comes with 18.52% and digital literacy, with 13.58%. In 11.11% of the conducted studies, it was not specified which digital teaching technology was used.

Findings regarding the distribution of the type of digital teaching technology used in the studies according to learning areas

The reasons for researching the use of digital teaching technologies in Turkish language education are presented in Table 7.

Table 7.

Distribution of Studies by Reasons*

Theme	Code	f	%
Reason	Lack of work in the field	35	26.12
	Example of digital technology-education integration	28	20.90
	The widespread use of digital teaching technologies	25	18.66
	The importance of using digital teaching technology in Turkish education	10	7.46
	The need to reveal the positive/negative aspects of digital technology	6	4.48
	The role of teachers and prospective teachers in using digital teaching technology	5	3.73
	Not knowing how to use digital teaching technologies in Turkish education	5	3.73
	The necessity of diversifying activities in Turkish education	4	2.99

	The importance of the learning areas covered and their relationship with digital teaching technology	4	2.99
	The necessity of demonstrating the digital competence of teachers	3	2.24
	Misuse of digital teaching technologies	3	2.24
	Challenges related to the learning areas covered	2	1.49
	Shortcomings in the curriculum	1	0.75
	The need for a design to control digital platforms	1	0.75
	The necessity of demonstrating the digital competence of students	1	0.75
	Unspecified	1	0.75
Total		134	100

*Some studies have provided more than one reason.

By Table 7, the lack of academic study in the relevant field is the most expressed reason (26.12%) by the studies examined. Due to the lack of studies in the field, the lack of exemplary implementation for applying/integrating digital education technologies in Turkish education is also among the top reasons for realizing the studies. The widespread use of digital education technologies and the importance of adapting them to teaching processes is another justification. The importance of using digital teaching technologies in Turkish education and the necessity to reveal the positive/negative aspects of technology are the other reasons that come to the fore. In a study conducted, the justification was not clearly stated.

Findings regarding the purposes of the studies

One of the points addressed within the thematic analysis study's scope is the aims of the research. The purpose/objectives of the researches in the relevant field are presented below.

Table 8
Distribution of Studies by Purpose

Theme	Code	Subcode	f	%
Purpose	Status detection		27	36
	Determining the impact	Success	22	29.33
		Success + attitude	1	1.33
		Attitude	1	1.33
	Getting opinion		15	20
	Introducing the use of Digital Technologies in Turkish language education		5	6.67
	Measuring tool development		3	4
	Creating a skill description and proposing to the program		1	1.33
Total			75	100

*Some studies have provided more than one reason.

When the aims of the researches on the use of digital teaching technologies in Turkish language education are examined, it is seen that 36% of the related studies were carried out to determine the situation. The studies aimed at determining the situation focused on the prevalence of the use of digital teaching technologies, the positive/negative aspects of digital technologies, the digital teaching technology competencies of teachers, teacher candidates, and students, how digital teaching technologies are used in Turkish language education and the mistakes made in this process. Studies aiming to test the effect of digital teaching technologies on a dependent variable, success, and attitude variables were discussed. Studies aiming to test the effect of digital teaching technologies on a dependent variable constitute 32% of all studies. 20% of the research focused on teachers' and students' opinions about the using digital teaching technologies in Turkish lessons. Introducing digital education technologies in Turkish education, developing measurement tools, and making suggestions for the curriculum by creating a skill definition are the other codes.

Findings regarding the methods, sampling, and data collection tools of the studies

This section analyzes the method-design, sample size, and sample type in which the studies are carried out. While reporting the analyzes carried out under the method theme, the names of methods and design expressed in the studies were used as stated in the relevant publication. The method information of the research was presented as a code and the pattern information as a subcode. Under the theme of sample size, certain intervals were determined, and analyzes were made on how many people were conducted. Since some studies were compilation and document analysis, sample size were not included, and these studies were coded as out of scope. In the sampling type, information about who the participants of the studies are is meant. The method-design, sample size, and sample types preferred in the studies were analyzed separately, and the findings are presented below.

Table 9.

Distribution of Studies by Method

Theme	Code	Subcode	f	%
Method-Design	Quantitative	Semi-experimental with experimental and control groups	14	18.67
		Single group experimental	1	1.33
		Control group design with only post-test	1	1.33
	Qualitative	Case study	8	10.67
		Design not specified	6	8
		Phenomenology	4	5.33
		Case study	1	1.33
		Descriptive	1	1.33
	Mixed	Design not specified	3	4
		Simultaneous	2	2.67
		Embeded	2	2.67
		Sequential explanatory	1	1.33
		Explanatory	1	1.33
	Screening	Descriptive	14	18.67
		Relational	3	4
		Cross-sectional	1	1.33
	Compilation		6	8
	Scale-rubric development		3	4
	Document review		2	2.67
	Action research		1	1.33
Total			75	100

When Table 9 is examined, it is seen that 21.33% of the studies conducted are quantitative research, 26.67% qualitative research, 12% mixed research, and 24% screening research. The majority of quantitative studies are designed in a quasi-experimental design with experimental and control groups. While the case study is more preferred in qualitative studies, the number of studies (f = 6) without any design is relatively high. Also, in mixed-method studies, a significant ratio (4%) was not the preferred design, but instead, it was stated that the research was only a mixed method. It is seen that screening research focuses on descriptive researches. Apart from these methods, review studies have been preferred more, with 8% among all studies. Other themes are scale-rubric development, document analysis, and action research methods, which are other methods preferred in research.

Table 10.

Distribution of Studies by Sample Size

Theme	Code	f	%
Sample Size	Out of scope	10	13.33
	0–30	19	25.33
	31–100	32	42.67
	101–200	4	5.33
	201–300	3	4
	301–500	3	4
	500 and above	4	5.33
Total		75	100

According to Table 10, it was determined that 42.67% of the studies on the use of digital teaching technologies in Turkish language education were carried out with 31-100 participants. Afterward, the studies conducted with up to thirty participants are intense (25.33%). In 13.33% of the related studies, the sample size was not given due to the research approach. Finally, it was seen that there were four studies conducted with five hundred or more participants.

Table 11.

Distribution of Studies by Sample Type*

Theme	Code	Subcode	f	%
Sample Type	Student	Pre-school	1	1.32
		Primary school	22	28.95
		Middle School	18	23.68
	Teacher	Primary-school Teacher	8	10.53
		Turkish language teacher	3	3.95
	Prospective teacher		14	18.42
	Document		5	6.58
	Out of scope		6	7.89
Total			76	100

* Some studies have been conducted with more than one sample type.

When Table 11 is examined, it is seen that more than 50% of the studies were conducted with primary and secondary school students. It is noteworthy that both student and teacher samples are studied more intensively at the primary school level. Studies were conducted with 18.42% of pre-service teachers in the conducted research. Studies were carried out by examining the documents in five studies. Since six studies are a compilation, method information is not included. These studies have only sections that include an introduction and conclusion. Therefore, a sample type was not specified for these studies; it was named out of scope.

Findings regarding the results of the studies

In the study carried out, the research results were included in the analysis and examined under the themes of situation determination, intervention effectiveness, opinion, and measurement tool development. Seventeen codes were reached under these themes. The research results were presented according to the codes under the relevant themes, the frequency, and percentage of the codes.

Table 12.

Distribution of Studies by Results*

Theme	Code	f	%
Status detection	Examining the use of digital teaching technology in Turkish education according to various variables	10	8.20
	The necessity of using digital teaching technology in Turkish education	8	6.56
	Teacher competence	7	5.74
	Digital classic comparison	7	5.74
	School equipment	6	4.92
	Curriculum	5	4.10
	Digital education technology usage areas	5	4.10
	Student competence	3	2.46
	Level of benefiting from digital education technology	3	2.46
	The adequacy of technological tools	2	1.64
Intervention Effectiveness	There is a positive effect.	19	15.57
	No positive effect	5	4.10
Opinion	Positive aspects / points / benefits of digital teaching technology	24	19.67
	Negative aspects / points / benefits of digital teaching technology	9	7.38
	Use cases and forward thinking	6	4.92
Measuring tool development	A valid and reliable scale	1	0.82
	A valid and reliable rubric	2	1.64
Total		122	100

* Some studies have reached more than one result.

According to the results of the studies discussed within the study's scope, it was determined that more results were obtained regarding the analysis of the use of digital teaching technology according to various variables under the theme of situation determination. In these studies, especially in the analyzes made according to the gender variable, it was concluded that female students were more successful than boys. It has been revealed that students with high socioeconomic status use digital teaching technology in Turkish lessons more. The fact that the using digital teaching technology in Turkish education is necessary was emphasized in the conclusion part of eight studies. The conducted studies concluded that teachers generally lacked technical knowledge and could not ensure the efficient adaptation of instructional technologies to Turkish education processes. In the conclusion parts of the research, it has been determined that the comparisons of digital teaching technologies and classical methods are relatively high, and the positive/negative aspects of both are expressed. Under the theme of intervention effectiveness, it has been found that the vast majority of impact studies have reached a positive effect in favor of the use of digital teaching technology. In studies that did not detect a positive effect in favor of digital teaching technology, it was concluded that reading on the screen generally (f = 3) did not have any positive effect on reading comprehension. Apart from this, it has been observed that there is a significant difference in favor of the experimental group (15.57%) in studies aiming to determine the effects of other types of digital teaching technology on the relevant learning areas. Under the theme of opinion, the results obtained from the opinions of the teachers, teacher candidates, and students regarding the use of digital teaching technologies in Turkish education were evaluated. Under this theme, the positive/beneficial aspects of digital teaching technologies are generally emphasized. According to the research results, it is understood that there are more positive opinions about the use of digital teaching technologies in Turkish education. These opinions; It is stated that digital teaching technologies increase students 'interest in the course, help them gain reading habits, and support students' permanent learning when taught on digital teaching technologies. However, negative opinions were expressed in nine studies. These opinions are that classroom management is difficult when lessons are taught using digital teaching technologies. Technology harms students in terms of health,

and attention should be paid to harmful content in technological environments. Under the theme of developing measurement tools, it was concluded that valid and reliable measurement tools were added to the literature.

Findings regarding the recommendations of the studies

In the study, the examined studies' suggestions were also analyzed, and the themes for whom these suggestions were directed were specified. It has been observed that the suggestions expressed in the investigated studies are directed at the Ministry of National Education, teachers, and researchers.

Table 13.

Distribution of Studies by Suggestions *

Theme	Code	f	%
Ministry of National Education	Training teachers for the effective use of digital teaching technologies in Turkish lessons	36	16
	Training students for the effective use of digital teaching technologies in Turkish lessons	19	8.44
	Creating resources for the effective use of digital teaching technologies in Turkish lessons	18	8
	Updating the curriculum	4	1.78
	Adding technology and literacy courses to the curriculum	6	2.67
	Family Education	3	1.33
	Setting up a technologically robust internet infrastructure	2	0.89
Teacher	Use of digital teaching technologies in lessons should be ensured	35	15.56
	Individual effort (for practical use and prevention of digital divide)	3	1.33
Researcher	Conducting studies with larger samples	31	13.78
	Conducting studies on the effect of different technological tools/techniques/equipment	24	10.67
	Impact studies on different skills/learning areas	13	5.78
	Conducting studies with different research directions	11	4.89
	Conducting studies with different sample groups	6	2.67
	Conducting studies on the relationship with different variables	4	1.78
	Performing more level determination studies (teacher and student)	3	1.33
	Conducting studies on the effect of using digital education technologies together with different techniques/strategies	1	0.44
Unspecified	No recommendation expressed	6	2.67
Total		225	100

* In some studies, more than one recommendation has been presented.

When the Ministry of Education suggestions are examined, it is noteworthy that it is highly recommended to train teachers and students in the use of digital teaching technologies in Turkish lessons. Apart from this, technology-based digital resource development is also among the highly recommended codes. Suggestions offered to teachers are towards using digital teaching technologies in Turkish lessons in a practical way. Most studies emphasized that teachers should use digital teaching technologies in their lessons. When the suggestions presented to the researchers are examined, conducting studies with a larger sample ranks first with 13.78%. Apart from this, using different technological tools, focusing on different skills/learning areas, and choosing different research methods are among the suggestions identified under this theme and presented by many studies.

4. Conclusion and Discussion

When the research findings are examined, the research published in national and international journals is frequently scanned in the TR [NANaIC] index (Table 3). At the same time, thesis studies are mostly carried

out at the graduate level. It is thought that the publication of the articles included in the scope of the study in journals that are scanned by the TR [NANaIC] index is related to the associate professorship criteria of the Interuniversity Board of the Republic of Turkey (IBRoT). IBRoT (2020) announced it must publish at least three publications in journals indexed by TR [NANaIC] in March and previous application conditions. Apart from this, the low number of studies scanned by the Web of Science (WoS) indexes (Table 3) is seen as a negative situation. In this respect, it is thought that academicians working in the relevant field should be encouraged more. The academic promotion criteria should be reviewed in this context for the publication of WoS data-based studies. A small number of universities give the fact that the thesis studies favor the Ph.D. degree because the postgraduate education programs in the relevant field are generally limited to master's education.

When the studies are examined by years, it is seen that there has been a significant increase in the number of studies on the use of digital teaching technology in Turkish language education (Table 5). Bağ and Çalık (2017) stated that digital teaching technology studies are less studied due to the difficulty of implementation and should be carried out more frequently. Considering the number of studies in which digital teaching technology is used in Turkish language education, it can be thought that this need has been realized in Turkish language education. The increase in the popularity of digital teaching technology in recent years and the increased inclusion of these technologies in learning-teaching processes are seen as the reason for this increase (Lai and Bower 2019).

According to the findings obtained as a result of the study, it was seen that in the studies on the use of digital teaching technology in Turkish education, digital story creation, screen reading, and digital literacy digital teaching technologies were preferred as a type of technology (Table 6). It can be said that digital story creation studies are highly preferred because students do not usually enjoy writing activities more fun (Özerbaş and Öztürk 2017; Demirer and Baki 2018). Because it is seen as one of the necessary conditions to make students enjoy the process more in order to increase their writing success (Clark 1990). Today, screen literacy and digital literacy are thought to be preferred because they eliminate the need to carry books, are fast accessible, and are carried out everywhere via smartphones (Tavşanlı and Akaydın, 2017). It is also predicted that it may have been preferred in terms of not restricting teaching only to the classroom, thus expanding the learning paradigm (Su and Cheng 2013). It can be said that the increase in the frequency and duration of social media use ((Haşiloğlu et al. 2020; Perrin 2015; Yılmazsoy et al. 2020) is one of the reasons why this type of technology is preferred. However, it is known that social media platforms have different uses with new updates every day. For this reason, studies should be continued on how to repeat these studies periodically and how to integrate social media environments into education processes better (Lau 2017).

When the learning areas of the researches are examined, it is seen that reading skill is in the first place, and Turkish language course general success and writing skill follow reading skill. It is thought that these learning areas are preferred more because reading and writing skills have a significant effect on the general success of individuals in the Turkish language course and determine the limits of students' overall academic achievement (Aram 2005). In addition, the benefits of reflective writing and reading on the academic success of students, especially during the pandemic period, have been determined. Because reading and writing skills are the basis of learning (Salim et al. 2021). After learning how to read and write, the individual can improve himself in many aspects, primarily cognitive (van den Broek and Espin 2012). Because of these qualities, reading and writing skills are studied more frequently than listening and speaking skills. However, the lack of any studies on speaking skills is seen as a severe deficiency. To overcome this deficiency, the number of technological designs for mother-tongue teaching should be increased. As teachers use technologies for listening and speaking skills in their classrooms, students'

competence in these areas will increase. It is stated that technology should be present in all areas of mother-tongue teaching (Cardoso 2019).

In the investigated studies, the reasons for conducting the research were not clearly stated, and the reasons for the research were obtained through a detailed reading and analysis. In this regard, the most frequently expressed research justification was expressed as a deficiency in the field. When Table 5 is examined in the findings section, it is seen that this situation may be a deficiency until a specific period. However, the increase in studies on the digital teaching technology in Turkish education has helped eliminate this deficiency. It is a known fact that digital teaching technologies increase their popularity day by day in the field of language education (Bax 2011). In this context, the increase in the number of digital teaching technology-based studies conducted for Turkish lessons means that Turkish researchers continue their research by following the current international literature. When other reasons are examined, the reasons for setting an example for technology education integration and increasing the prevalence of technology come to the fore. After the digital teaching technology becomes widespread and effective in every field, how it can be adapted to learning-teaching processes and made efficiently is an important issue (Christensen 2002). The Ministry of Education launched the Fatih Project in Turkey and has carried out serious work across Turkey to support this process. However, it was stated by the researchers that some problems were encountered in this project (Ayvacı et al. 2014). In this direction, it is vital to prepare well for this process and identify applications that will increase productivity and create a model. It is understood that this deficiency is noticed in the reasons for the studies that deal with the use of digital education technologies in Turkish education. Another reason is the importance of using digital teaching technologies in Turkish lessons. The importance of this issue was emphasized insistently in the research examined. It was stated as a justification that the studies in this field should increase in line with the importance of digital teaching technologies (Bal and Uslu 2018; Özdemir 2017). However, teacher inadequacies, incorrect practices, and technical/infrastructural problems in the use of digital teaching technology are also the reasons for some studies (Büyükkarcı and Müldür 2017; Ertem 2016; Yılmaz 2019). The reasons mentioned above show that the work to be carried out in this field would maintain its importance.

The reasons mentioned above show that the work to be carried out in this field will maintain its importance. Within the study's scope, the research aims were also examined, and it was seen that the purposes of determining the situation were determined frequently. This situation is based on the assumption of lack of research, as is often stated in the research reasons. Because researchers want to reveal the current situation first. Apart from due diligence, it has been observed that researches generally aim to determine the effect of digital teaching technologies on achievement and attitude. It can be said that this is because success and attitude are the most studied variables in educational research (Çalık et al. 2015). The frequent use of attitude scales and achievement tests relaxes the researchers in the data collection process and allows collecting large numbers of data in a short time. In terms of these qualities, it is thought that success and attitude variables are frequently preferred. Revealing the views of teachers, students, and teacher candidates, who are the stakeholders of the process, on the use of digital teaching technology is also among the studies' aims. It can be said that these goals are generally preferred as they allow a more in-depth examination of the current situation, which is quantitatively put forth. In studies aiming to develop a measurement tool, it may be thought that the measurement tools to be developed will enrich the field and facilitate researchers with valid/reliable measurement tools.

Generally, qualitative research methods are preferred in the investigated studies (Table 9). The screening method's preference the most after qualitative research methods also shows that studies have yet to understand the process. Both qualitative research and screening studies aim to reveal, examine, and interpret the existing situations in depth. It is seen that quantitative and mixed research methods are also preferred in the studies discussed (Table 9). The fact that researchers researched different intervention programs

(different types of digital technology) increased the number of studies that preferred quantitative and mixed research methods. Compared to quantitative, qualitative, and screening studies, fewer mixed-method studies have been conducted. This situation is thought to be due to the high workload of mixed-method studies and the longer time to reach results / less recognition than other research methods (Yin 2006).

It is seen that most of the studies included in the scope of the research were carried out with a sample size of 31-100 people (Table 10). It is thought that the samples of the studies were determined in this way by the nature of the research methods. For example, most quantitative studies examined have an experimental and control group. The majority of such studies have been conducted with this number of samples. Again, reaching more participants may not be preferred, as it is both challenging and will increase the workload. It can be said that the high number of studies conducted with 30 or fewer participants is due to the nature of the qualitative research method. It is known that qualitative research is carried out with a small number of participants since the data collection, raw data processing, and data analysis process are complicated, and the study is based on an in-depth analysis (Eisner 2017). It is seen that the studies on the use of digital teaching technologies in Turkish lessons are mostly carried out with teachers and students who are the stakeholders of the process. It is thought that it is a deficiency that there is no study conducted with high school students. When the studies are examined based on branches, it is seen that the primary school level is preferred more, as they mostly work with primary school students and classroom teachers. It is thought that this is because primary school is a critical period for students' language development (Aram 2005).

When the studies' results were examined, it was seen that the positive aspects of digital teaching technologies were revealed more (Table 12). There are studies in which the negative aspects of using digital teaching technology are also determined. However, it was observed that the use of technology in teaching processes would be beneficial, and suggestions for the future were made in this direction (Bernacki et al. 2020; Raja and Nagasubramani 2018). In the studies conducted, it has been determined that the intervention results generally result in a positive effect. It can be said that presenting new methods other than traditional methods to students, using technology better by students, adapting to the process more efficiently, and using technology (Zabatiero et al. 2018) are the reasons for this positive effect. There are also studies in which interventions have no positive effect. In these studies, it was stated by the researchers that the digital teaching technologies were not used correctly, the processes were not operated correctly (for example, the technological competence of the practicing teacher is low).

It was observed that the use of digital teaching technology applications in Turkish language courses was also examined according to various variables. For example, it has been concluded that female students are better at technology literacy than male students. However, it has been stated that male students are more successful in digital games. This situation can be explained by the fact that female students are more eager to read and write (Abd Ghani et al. 2020), and male students are more willing to play games (Tavşanlı, 2018). This finding shows that the gender variable affects the use of digital teaching technology. In the studies conducted, it was concluded that besides the gender variable, socio-economic status also affects technology use. It is not surprising given that technology use is associated with economic efficiency (Rowe 2019). Again, in the studies conducted, it was concluded that teachers 'perceptions in terms of technological competence were low, students' perceptions were high, and this situation caused the digital divide. These results reveal the importance of teachers' technological competence. Because the inadequacy of the teachers, who are the implementers of the process, is one of the most fundamental factors that prevent the use of technology in educational processes (Joo et al. 2018).

5. Suggestions

In the conducted researches, suggestions for the Ministry of National Education, teachers, and researchers were presented. The recommendations submitted to the Ministry of National Education are gathered under the headings of providing training to increase teacher's and students' technological competence, strengthen the technical infrastructure, and make changes in the curriculum. Suggestions offered to teachers are for them to improve themselves in technological competence. In the recommendations presented to the researchers, it was stated that the intervention designs whose effects will be tested in the studies to be carried out, the focused skills, research methods, sample size, and type could be differentiated.

The following recommendations are made in line with the results of the study:

1. The low number of studies published in journals indexed by Web of Science (WoS) indexes and dealing with digital technologies in Turkish education is seen as a negatively. Accordingly, it is recommended to introduce more severe incentives and progress criteria for the publication of WoS data-based studies.

2. When the studies are examined according to learning areas, it is noteworthy that the number of studies on speaking and listening learning areas is quite limited. It will be beneficial to focus on the relevant learning areas in the research that the researchers will carry out in this direction.

3. Compared to quantitative, qualitative, and descriptive studies, it has been determined that mixed-method studies are performed in less number in the investigated studies; For this reason, it can be said that mixed-method studies should be increased.

4. It is noteworthy that studies on the use of digital teaching technologies in Turkish language education are generally carried out with similar types of technology. In this direction, it is recommended to work on different digital technologies.

5. It is noteworthy that there are very few studies on the first reading and writing processes in the conducted studies. It is known that it is quite tricky to compensate for the possible lack of education in the primary school period. Because digital technologies are more involved in learning-teaching processes than the past, and that the educational processes of young children are more affected by this situation, it can be stated that first reading and writing should be supported more with digital technologies-especially today, where the Covid-19 pandemic is significant.

6. The results of the studies discussed within the study's scope show that the competencies of teachers and teacher candidates in using digital technology are at a low level, and this situation results in the digital divide. In this framework, it is recommended that in-service and pre-service training activities for increasing teachers' and teacher candidates' technological competence be carried out by the MoNE and Education Faculties.

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The effect of gamification on young mathematics learners' achievements and attitudes

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Abstract

This study aims to investigate the effect of gamification on fifth-grade students' academic achievements and attitudes towards mathematics course. For this purpose, the teaching process of the "fractions" as a subject of the mathematics course is equipped with gamification elements. The quasi-experimental design is preferred as the research design. Achievement test and attitude scale were used as data collection instruments. The participants of the study consisted of fifth-grade students (n = 46). The Pyramidal Design Model was preferred as the gamification design model in this study. Elements of this model were adapted to the class level of participants in this research. As a result of the study, a remarkable statistical difference was observed in the achievement test in favor of the experimental group. However, no major difference was observed in the attitude scale results. This study contains suggestions for the educational use of gamification based on research findings.

1. Introduction

The technological opportunities of the 21st century have led to differentiation in the learning profiles of today's students (Balakrishnan & Lay, 2016; Eleyyan, 2021; Liu et al., 2020; Ndibalema, 2020). The learning profiles have differentiations according to learners' ages (Avcu & Er, 2020; Cevher & Yıldırım, 2020). However, educational games are considerable for every learning profile (Garber Jr et al., 2018; Gök, 2020; Ruiperez-Valiente et al., 2020; Umay, 2002). In addition, educational contributions of games and game-like formations have been proven by researchers, especially for primary and secondary school students (Asan & Çeliktürk-Sezgin, 2020; Eltem & Berber, 2020; Uğurel & Moralı, 2008; Yaşar, 2018). Accordingly, teachers should choose contemporary teaching methods and techniques for these different profiles increase to students' interest in teaching processes (Kiryakova et al., 2014). One of these game and game-like methods that aim to have a more enjoyable interaction for the participants in their work (Wood & Reiners, 2015) is "gamification" (Lee & Hammer, 2011). Gamification aims to improve participants' personal qualities such as permanence, creativity, and flexibility by targeting their motivations (Lee & Hammer, 2011).

Gamification can be part of student's educational lives in the years to come. It is thought that gamification can be successful in directing students' motivations towards learning activities and this situation can positively contribute to students being successful individuals in their academic and social lives (Lee & Hammer, 2011). Accordingly, the studies show that gamification affects students' academic achievement

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and attitudes (Barata et al., 2013; De-Marcos et al., 2014; Dominguez et al., 2013; Hanus & Fox, 2015; Mekler et al., 2013; O'Donovan et al., 2013). When the related literature (Kim & Castelli, 2021; Klock et al., 2020; Lister, 2015; Manzano-Leon et al., 2021; Swacha, 2021) is reviewed, it is seen that gamification can be used in the fifth-grade mathematics course. From this point of view, it was thought that gamification might have an effect on students' performance and attitudes towards the course. Thus, this research has been conducted in this direction. Therefore, this study performed to be an answer for the following research questions:

- Does Gamification affect fifth-grade students' academic achievement in mathematics?
- Does Gamification affect fifth-grade students' attitude towards the mathematics course?

2. Theoretical Framework

2.1. Mathematics Education and Games

Throughout history, games that take place in human life are not contradictory to mathematics (Uğurel & Moralı, 2008). According to Umay (2002, p. 280): "Games are mostly mathematics and mathematics is completely game". Ratiocination, creative thinking, making inferences and similar interactions in the basic structure of mathematics are seen in the structure of games. This situation makes it convenient to include games in the mathematics teaching process (Hacısalihoğlu-Karadeniz, 2017; Ke & Clark, 2020; Tokac et al., 2019).

Using games in the mathematics teaching process is one of the methods that can assist students to learn mathematics with enjoyment (Beyhan & Tural, 2007). The enjoyable world of games; positively affects students' attitudes towards mathematics, learning motivation, and active participation in the course. In this way, learning environments become interesting for students (Deng et al., 2020; Gök, 2020; Moon & Ke, 2020).

2.2. What is Gamification?

The concept of "gamification", which has become popular since 2010, is revealed itself in the business world, health, and education areas (Deterding et al., 2011). There are different definitions of gamification in the literature.

Deterding et al. (2011) defined gamification as the inclusion of game design materials in non-game environments. Likewise, Dominguez et al. (2013) defined gamification as including game elements in a non-game implementation to increase user experience and interest. In addition, Kim & Lee (2015) defined gamification as applying game design to the non-game processes.

When the definitions in the Turkish studies are examined, Bozkurt & Genç-Kumtepe (2014) described gamification as the implementations regarding the game philosophy that increase individual motivation and convert the process interesting for the participants. Furthermore, Sezgin et al. (2018) defined gamification as it is the planned addition of game elements to processes that do not have game factors. In addition, Gökkaya (2014) defined gamification as an educational platform that aims to internalise the extrinsic motivations of individuals and rewards along with feedback. When the definitions were examined, gamification can be defined as equipping non-game processes with game design elements.

There are approaches in the literature that are confused with gamification. The first of these is game-based learning. The use of the expression "game" in gamification, just like in game-based learning, may cause this similar perception problem. Unlike game-based learning; in gamification, "game" finds its place not as an actor but as a philosophy. Therefore, gamification and game-based learning are different and should not be confused (Bozkurt & Genç-Kumtepe, 2014; Sezgin et al., 2018).

2.3. Gamification in Education

Although gamification is a new term that emerged recently, it has been used in the educational areas, the economy, marketing, advertising, and production sectors (Yıldırım & Demir, 2014). One of the main goals of gamification is to increase participants' motivation and assist them to have positive experiences in life events (Kim & Lee, 2015). Most students do not view traditional classroom activities at school as enjoyable experiences (Dursun & Dede, 2004). Therefore, it is thought that the enjoyable world of gamification can assist to overcome the motivation and contribution problems of today's education systems (Lee & Hammer, 2011).

Education researchers have taken a keen interest in gamification (Dominguez et al., 2013). Lee & Hammer (2011) have described assembling education and game elements as combining peanut butter with chocolate to create a wonderful taste. Studies show that gamification can make a positive contribution to the education process (Kim & Castelli, 2021; Klock et al., 2020; Lister, 2015; Manzano-Leon et al., 2021; Swacha, 2021). In addition, the adaptation of gamification to learners is considered a remarkable point in the use of gamification in education. Thus, it will be easier for learners with different abilities to participate effectively in the learning environment (Sezgin et al., 2018). Students who increase their active participation can establish new bonds to understand their learning process. This situation can encourage students to participate in educational processes more effectively (Lee & Hammer, 2011). With this respect, it was thought that gamification could also be effective for fifth-grade mathematics education and this study's aim was determined with this mind.

3. Methodology

3.1. Research Design

The matching-only pretest-posttest control group quasi-experimental design, which is one of the experimental research models was preferred in this study. In this design, experimental and control groups are tried to be matched based on a specific variable (Büyüköztürk et al., 2018; Fraenkel et al., 2011).

The purpose of the quasi-experimental design method is to determine the amount of change between the experimental and the control group (Büyüköztürk et al., 2018). This method aims to divide the students into two equal groups based on their academic averages related to the mathematics lesson. Assigning process of those students to the experimental and control groups was carried out by matching (Fraenkel et al., 2011). At the beginning and the end of the process, the academic achievement test on the subject of the mathematics lesson of "fractions" was applied to both groups. In addition, the attitude scale towards the mathematics lesson was studied as pre-test and post-test to both groups. The experimental design of this study is shown in Table 1.

Table 1.

The matching-only pretest-posttest control group design

Group		Pre-Test	Process	Post-Test
E	M	O_1	X	O_3
C	M	O_2	C	O_4

E: Experimental group.
C: Control group.
M: Matching according to academic achievement in mathematics.
O_1: Experimental group pre-test.
O_2: Control group pre-test.
X: Gamified teaching process.
C: Non-gamified teaching process.

O_3: Experimental group post-test.
O_4: Control group post-test.

Table 1 shows the processes in the quasi-experimental designs used in the research. The experimental and control groups teaching process was performed based on the Fifth-Grade Mathematics Curriculum (Milli Eğitim Bakanlığı [Ministry of National Education] [MEB], 2018). Unlike the control group, the teaching process in the experimental group was supported by gamification elements. By this way, gamification elements were performed in the experimental group during six weeks of the experimental process. No features and items related to gamification were included in the teaching process of the control group. Both groups were tested with pre-test and post-test in terms of academic achievement and attitudes towards mathematics.

3.2. Study Group and Ethical Considerations

This research consists of fifth-grade students of a school in the West Black Sea region of Turkey. Participants are divided into two equal groups in terms of academic achievement and class size (Table 2). Experimental and control groups were determined by random selection between two classes. Both groups were consisting of 23 students.

The research process was carried out by following appropriate ethical merits (Lodico et al., 2010). Participation in research occurred on a voluntary basis and students had the right to leave the process whenever they wanted. Written consents for the research have been obtained from the relevant institutions. Since the participants were under 18 years of age, written consent forms of the students were received from the parents. In addition, students and parents were informed that their personal information regarding the research data will be kept confidential and the collected data will only be used for this research.

3.3. Data Collecting Tools

The first author of this study prepared the academic achievement test used in this study. In the test development process, multiple-choice test development steps specified by Turgut & Baykul (2015) were followed.

The application of the 32-item trial form, of which items were written in accordance with the subject of "fractions", was performed in the 2017-2018 academic year. After the trial form results obtained, expert opinions were requested to assess the propriety of the test items. For this purpose, six experts who are researchers in Curriculum & Instruction and Mathematics Education were consulted for their opinions. The test was revised according to the experts' opinions. According to the statistical analysis results of this 24-item form; the test variance was 33.39 and the standard deviation value was 5.77. The Cronbach Alpha reliability coefficient and the average difficulty value were measured respectively as .87 and .59. The average discrimination power was .66.

Students' attitudes are tested with the "Attitude Scale Towards Mathematics" developed by Önal (2013). This scale aims to determine secondary school students' attitudes towards mathematics lessons. The scale consists of 21 Likert-type items rated between Strongly Agree (5) and Strongly Disagree (1).

In line with the factor analysis results applied by the researcher who created the scale, the scale items were divided into 4 subcategories (Interest, Anxiety, Study and Necessity). According to validity and reliability analysis, the variance explained by the scale constitutes 55.12% of the total variance. In the reliability calculations of the scale, the Cronbach Alpha coefficient was determined as .90 (Önal, 2013).

3.4. Data Analysis

In the analysis process of this study, the data collected with the achievement test and attitude scale were analysed. In the process of creating the academic achievement test, the "Iteman" item analysis program was used to perform the item analysis. Also, the SPSS Software (The Statistical Packet for the Social Sciences) was used in the analysis of the data collected from the experimental process.

Considering the size of classes that are less than 30, non-parametric tests "Mann-Whitney U" and "Wilcoxon Signed Rank Test" were decided to be used for analysis. "Wilcoxon Signed Rank Test" and "Mann-Whitney U" are non-parametric tests used in behavioral and social sciences when data are not normally distributed or the sample size is less than 30 (Gravetter et al., 2020; Kraska-Miller, 2013; Pagano, 2012; Pett, 2015; Salkind, 2016; Siegel, 1956; Sokal & Rohlf, 2009; Turgut, 2014). The Wilcoxon Signed Rank Test is used for dependent groups and Mann-Whitney U Test is used for independent groups in order to examine the statistical difference (Kraska-Miller, 2013; Pagano, 2012; Salkind, 2016; Turgut, 2014). Accordingly, both tests were used in the analysis process of this study.

3.5. Gamification Design in This Research

Pyramidal Design Model, which Werbach & Hunter (2012) developed, is preferred as the gamification design model of the research. Considering Pyramidal Design Model's elements were adapted fifth-grade students' level. This model was considered appropriate in terms of participations' level and the selected subject. Elements of the Pyramidal Design Model are shown in Figure 1.

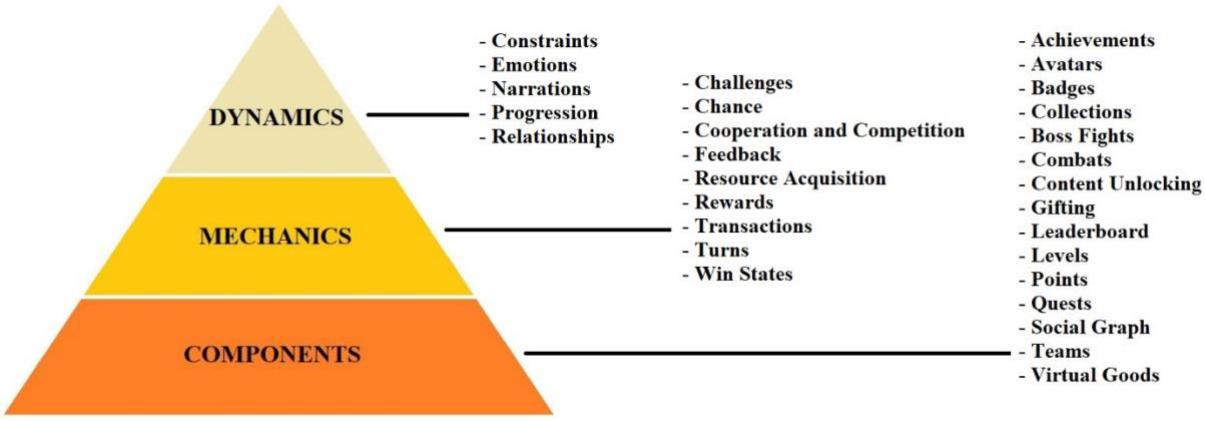

Fig. 1. Pyramidal design model

As shown in Figure 1, there is no obligation to use all elements of dynamics, mechanics, and components in gamification designs. The elements of this model can be determined according to the characteristics of the educational environment (Bozkurt & Genç-Kumtepe, 2014; Werbach & Hunter, 2012). Accordingly, grade level and school characteristics were taken into consideration.

It can be said that the "Do not worry, try again!" idea is the main idea of the gamified processes. (Werbach & Hunter, 2012). This idea was intended to extend into the process. In addition, the gamification process was designed and implemented that each student could gain affective, cognitive, and social gains from the process (Lee & Hammer, 2011). In this direction, the elements were adapted and coordinated. Considering that the study will be conducted at this age level, interpersonal competition is not included in the system. Accordingly, all situations that could lead to the "Loser" phenomenon were excluded from the process. Thus, the "Leaderboard" element, in which the students are ranked according to their general scores, is not included in this research. However, instead, a new element called "Progress Map" is included in the process. The Progress Map element is formed by combining the "Narrations" and "Progression" elements. "Progress Map" and other elements that were selected and adapted for the process are shown in Figure 2.

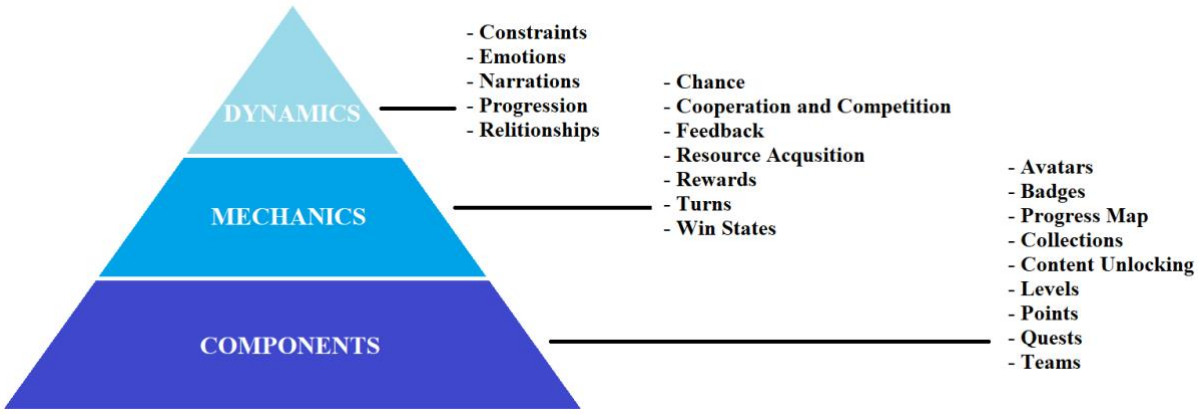

Fig. 2. Gamification elements of this research

Figure 2 shows the gamification elements used in the study. Considering that the elements will be used for the fifth-grade level, the selected game elements are not given in the digital environment and have been concretised as much as possible. It is thought that this situation will increase the usefulness of the elements for fifth-grade students.

3.6. Implementation Process

In order to maintain an equal teaching environment, this study's first author decided to be the mathematics teacher of both groups. The application process started with pre-tests of both groups. Achievement test and attitudes scale were applied to the experimental and control groups to determine their prior knowledge of Fractions lesson and attitudes towards the mathematics course. The first author was also the exam supervisor in the testing processes. Students were informed about the implementation details of the testing process (pencil, eraser, test period, etc.).

The experimental implementations based on researching process were carried out for six weeks in five-course hours per week. In both groups, the teaching process was performed based on the Fifth-Grade Mathematics Curriculum (MEB, 2018). Contrary to the procedure in the control group, the experimental group's teaching process included gamification components that were modified and tailored for the fifth-grade level. The visuals containing explanations for some of these elements are shown in Figure 3, Figure 4 and Figure 5.

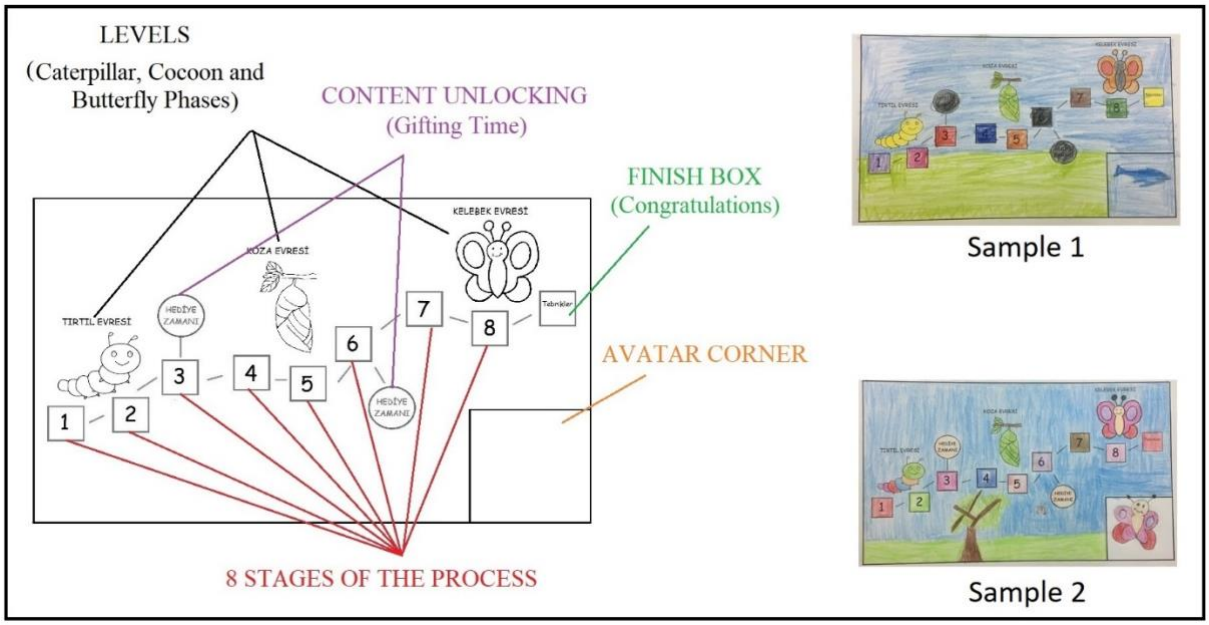

Fig. 3. Progress map

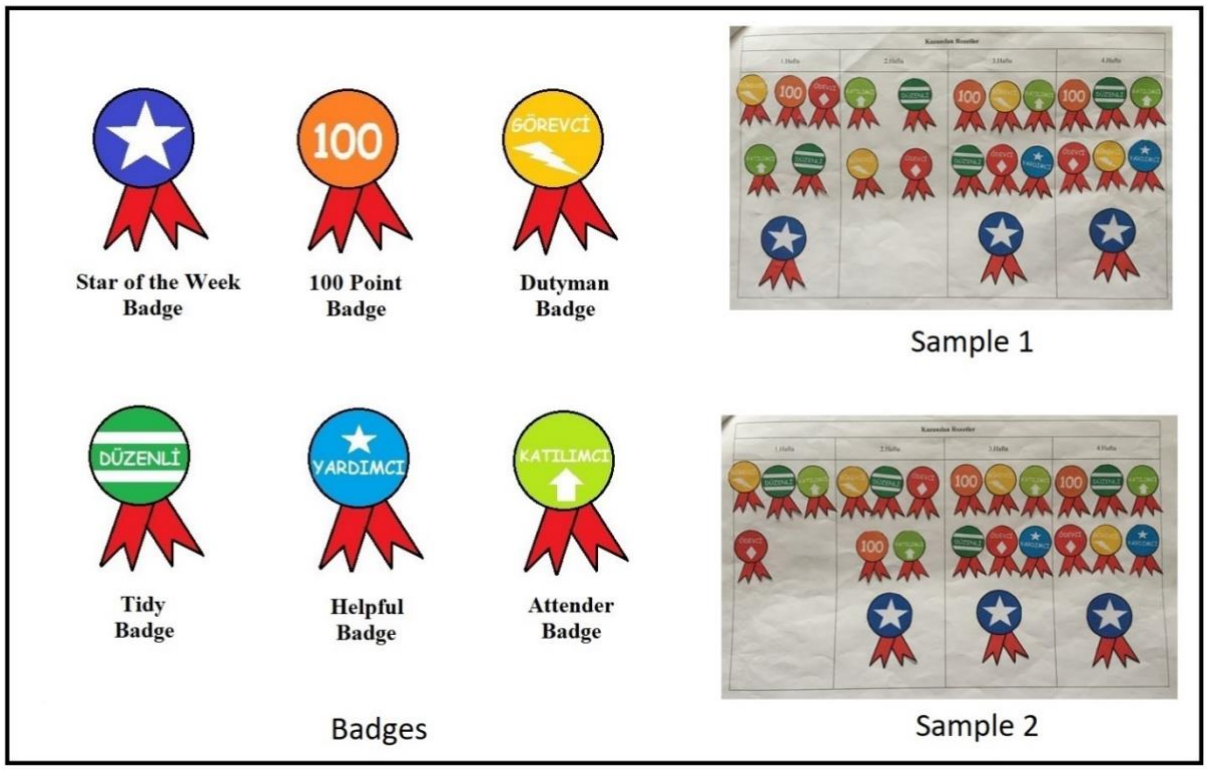

Fig. 4. Badges and collections

Fig. 5. Avatars

Figure 3, Figure 4, and Figure 5 show visuals of the gamification elements that were used in the research. In the first weeks of the application, the students were informed about these elements. After this stage, the progress maps were delivered to each student in the experimental group. And then, each student was requested to customise their maps and identify their avatars. Badges are given to students in the last lesson of each week, according to their weekly achievements. Following the weekly feedbacks, information was given about the next week's tasks and homework. In this way, the gamified process continued for six weeks from the first week to the last week, adhering to the Fifth-Grade Mathematics Curriculum (MEB, 2018) and using the defined gamification elements.

4. Findings

4.1. Pre-Test and Post-Test Values of Achievement Test Scores of Experimental and Control Group Students

Before and after the gamified process, an academic achievement test was applied to the participants. Score statistics for these tests are shown in Table 2.

Table 2.

Pre-test and post-test values of achievement test scores of experimental and control groups

	Pre-test			Post-test		
Group	**N**	$\bar{X}$	**S**	**N**	$\bar{X}$	**S**
Experimental	23	27.89	6.93	23	60.14	19.21
Control	23	27.17	10.87	23	47.10	19.92

Table 2 shows the pre-test and post-test statistics of the experimental and control groups. According to these statistics, the achievement test pre-test mean scores of the experimental and control groups were found to be close and the statistical significance of this proximity was tested. With respect to the analysis results, the means of the two groups were statistically verified. By this mean, it can be said that the experimental

research conditions were satisfied. At the end of the process, the statistical significance of the difference among the post-test mean scores between the experimental and control groups was analysed. Analysis results regarding all data are presented below.

4.2. Examination of the Relationship Between Achievement Test Scores of Experimental and Control Group Students

The Mann Whitney U Test was used to statistically analyse the difference between the achievement test scores of the experimental and control groups in this study. Test results are presented in Table 3.

Table 3.

Mann Whitney U Test results of achievement test scores according to experimental and control groups

Group	**N**	**Rank Mean**	**Rank Sum**	**U**	**P**
Experimental	23	28.78	662.00	143.00	.007*
Control	23	18.22	419.00		
Total	46				

*$p < .05$.

Table 3 shows the results of the Mann Whitney U Test of achievement test scores. Accordingly, as a result of the six weeks experimental study, it was seen that there was a significant difference between the achievement test scores of the experimental and control groups ($U = 143.00$, $p < .05$). Considering the mean ranks, it is understood that the achievement test scores of the experimental group are higher than the achievement test scores of the control group. Based on this finding, it can be said that gamification is effective in increasing students' achievement in the mathematics course.

4.3. Examination of the Relationship Between Experimental Group Students' Pre-Test and Post-Test Achievement Test Scores

The Wilcoxon Signed Rank Test was used to statistically analyse the difference between the achievement test scores of the experimental group. Test results are presented in Table 4.

Table 4.

Wilcoxon Signed Rank Test results of achievement test scores according to experimental group

Post-Test - Pre-Test	**N**	**Rank Mean**	**Rank Sum**	**Z**	**P**
Negative Ranks	0	.00	.00	4.20	.000*
Positive Ranks	23	12.00	276.00		
Equal	0	-	-		
Total	23				

*$p < .05$.

Table 4 shows the results of the Wilcoxon Signed Rank Test of the experimental group achievement test scores. Analysis results indicated that the experimental group students' achievement test scores have a significant difference between the pre-test and post-test scores ($Z = 4.20$, $p < .05$). Considering the results that are shown in Table 4, it is understood that the difference is in favour of the positive ranks. According to these results, it can be said that gamification has an important effect on increasing students' achievement in the mathematics course.

4.4. Examination of the Relationship Between Control Group Students' Pre-Test and Post-Test Achievement Test Scores

The Wilcoxon Signed Rank Test was used to statistically analyse the difference between the achievement test scores of the control group. Test results are presented in Table 5.

Table 5.

Wilcoxon Signed Rank Test results of achievement test scores according to control group

Post-Test - Pre-Test	N	Rank Mean	Rank Sum	Z	P
Negative Ranks	0	.00	.00	4.20	.000*
Positive Ranks	23	12.00	276.00		
Equal	0	-	-		
Total	23				

*$p < .05$.

Table 5 shows the results of the Wilcoxon Signed Rank Test of the control group achievement test scores. Analysis results show a significant difference occurred in the control group students' achievement test scores ($Z = 4.20$, $p < .05$). Considering Table 5, it is understood that the difference is in favour of the positive ranks. According to these results, it can be said that the control group students' achievement increased without gamification elements.

4.5. Pre-Test and Post-Test Values of Attitude Scale Scores of Experimental and Control Group Students

The attitude scale was applied to the experimental and control group students to determine their attitude scores towards the mathematics course. This scale score statistics are presented in Table 6.

Table 6.

Attitude scale pre-test and post-test results of experimental and control groups

	Pre-test			Post-test		
Group	**N**	$\bar{X}$	**S**	**N**	$\bar{X}$	**S**
Experimental	23	3.97	.71	23	3.98	.87
Control	23	4.19	.64	23	4.11	.69

Table 6 shows the attitude scale pre-test and post-test statistics of the experimental and control groups. The significance of the statistics was tested with Mann Whitney U and Wilcoxon Signed Rank Test.

4.6. Examination of the Relationship Between Attitude Scores of Experimental and Control Group Students

The Mann Whitney U Test was used to statistically analyse the difference between the attitude scale scores of the experimental and control groups in this study. Test results are presented in Table 7.

Table 7.

Mann Whitney U Test results of attitude scale scores according to experimental and control groups

Group	N	Rank Mean	Rank Sum	U	P
Experimental	23	24.41	561.50	243.50	.644
Control	23	22.59	519.50		
Total	46				

*p >.05.

Table 7 shows the results of the Mann Whitney U Test of the attitude scale scores according to the experimental and control groups. Accordingly, as a result of the six weeks experimental activities, there was no noticeable difference between the attitude scale post-test scores of the experimental and control groups (p> .05). Based on this finding, it can be said that gamification is not effective in changing students' attitudes towards the mathematics lesson.

4.7. Examination of the Relationship Between Experimental Group Students' Pre-Test and Post-Test Attitude Scale Scores

The Wilcoxon Signed Rank Test was used to statistically analyse the difference between the attitude scale scores of the experimental group. Test results are presented in Table 8.

Table 8.

Wilcoxon Signed Rank Test results of attitude scale scores according to experimental group

Post-Test - Pre-Test	N	Rank Mean	Rank Sum	Z	P
Negative Ranks	9	14.61	131.50	.198	.843*
Positive Ranks	14	10.32	144.50		
Equal	0	-	-		
Total	23				

*p > .05.

Table 8 shows the results of the Wilcoxon Signed Rank Test of the attitude scale scores according to the experimental group. Considering the results of the analysis, there is no remarkable difference between the attitude scale scores of the experimental group students before and after the experimental activities (p> .05). According to these results, it can be said that there was no statistically significant change in the experimental group students' attitudes towards the mathematics.

4.8. Examination of the Relationship Between Control Group Students' Pre-Test and Post-Test Attitude Scale Scores

The Wilcoxon Signed Rank Test was used to statistically analyse the difference between the attitude scale scores of the control group. Test results are presented in Table 9.

Table 9.

Wilcoxon Signed Rank Test results of attitude scale scores according to control group

Post-Test - Pre-Test	N	Rank Mean	Rank Sum	Z	P
Negative Ranks	12	11.46	137.50	.357	.721*
Positive Ranks	10	11.55	115.50		
Equal	1	-	-		
Total	23				

*p >.05.

Table 9 shows the Wilcoxon Signed Rank Test results of the control students' attitude scale scores. Considering the analysis results, there is no remarkable difference between the pre-test and post-test attitude scale scores (p>.05). According to these results, it can be said that there was no statistically significant change in the control group students' attitudes towards mathematics course.

5. Discussion, Conclusion and Suggestions

This study aims to determine the effect of gamification on fifth-grade students' academic achievement and attitudes towards the mathematics course. For this purpose, experimental procedures of the current study were carried out in the fifth-grade mathematics course teaching process for six weeks. The research process was conducted with a quasi-experimental design and research data were collected with the academic achievement test and attitude scale. Participants of this research were 46 fifth-grade students. The study results show that gamification positively affects the mathematics achievement of fifth-grade students, but it has no effect on attitude towards mathematics course.

The principal strength of this study is the tangible use of main gamification elements. When the literature is examined, it is seen that digital platforms are mainly used for gamification applications in education (Kim & Castelli, 2021; Klock et al., 2020; Lister, 2015; Manzano-Leon et al., 2021; Swacha, 2021). The current study findings show that gamification can also be beneficial in mathematics education when not conduction with digital tools. In this respect, it is hoped that this study results will contribute to the mathematics education literature.

The experimental applications were performed with two equal classes in terms of academic achievement (U=236.50, p>.05) and attitudes towards the mathematics course (U=216.50, p>.05). Gamification can be defined as briefly, equipping non-game processes with game design elements. Thus, the experimental group's teaching process was equipped with the gamification elements which designed and adapted from Pyramidal Design Model (Werbach & Hunter, 2012) in this study. After the six weeks of the experimental process, the data collection process was completed with post-tests applications.

When the pre-test and post-test scores of the experimental and control groups were compared statistically, the results show that gamification positively affected the students' academic achievement in the mathematics course (U = 143.00, p <.05). In addition, the achievement test pre-test and post-test scores of the experimental and control groups were also compared within themselves and it is seen that the academic achievement of both groups statistically increased. However, it is clearly seen that the increase in the achievement test scores of the experimental group in which the gamification elements were used is significantly higher than the increase in the control group in which the gamification elements were not used. Likewise, the attitude scale scores were compared, and there was no statistically major difference between the scores of the experimental and control groups (U = 243.50, p> .05). Furthermore, the attitude scale pre-test and post-test scores of the experimental and control groups were also compared within themselves, but

there is no statistical difference was found (p> .05). In this respect, it is thought that the gamification elements are interesting for students and thus increase their active participation in the course. This situation may have caused this academic achievement differentiation. Thus, this study confirms Ar (2016), Fidan (2016), Yürük (2019), Kumar & Khurana (2012), Cozar-Gutierrez & Saez-Lopez (2016), Yıldırım (2016), Gonzalez et al. (2016), Barata et al. (2013), O'Donovan et al. (2013), Mekler et al. (2013), and Dominguez et al. (2013)'s studies in terms of the positive effects on performance. On the other hand, this study's findings do not support Karatekin (2017), Sağlık (2017), Şahin (2015), Hanus & Fox (2015), De-Marcos et al. (2014), and Haaranen et al. (2014)'s study findings on participant's performance.

On the other hand, considering the attitude scale scores, it can be said that gamification did not have a positive or negative impact on students' attitudes towards the mathematics course. In other words, the gamified teaching process did not create a statistically significant difference in students' perspectives on mathematics course. The findings clearly indicate that the attitude scale pre-test mean scores are 3.97 for the experimental group and 4.19 for the control group. So that the scale is a five-point Likert type, it is seen that the students' attitudes towards the mathematics course were also at a high level before the research process. Hence, it can be seen that the students' attitudes towards the mathematics course are already at a high level. This situation may have caused no statistical difference to be encountered in the analysis of the attitude scale scores. Therefore, this study findings confirm Haaranen et al. (2014), Şahin (2015), Berkling & Thomas (2013), and Mekler et al. (2013)'s studies in terms of observing no significant statistical difference in the participant's attitudes. However, this study differs from Karatekin (2017), Sümer (2017), Fidan (2016), Cozar-Gutierrez & Saez-Lopez (2016), Sağlık (2017), Kingsley & Grabner-Hagen (2015), Gonzalez et al. (2016), Polat (2014), Hamzah et al. (2015), Hanus & Fox (2015), De-Marcos et al. (2014), Abramovich et al. (2013), Yıldırım (2016), Brewer et al. (2013), and Li et al. (2013)'s studies in terms of the participant's attitudes.

There are two major limitations in this study that could be addressed in future research. First, this study is restricted to 46 fifth-grade students at a secondary school located in Turkey's West Black Sea region in the 2018-2019 academic year and the effect of gamification was tested only for mathematics education. Second, since this study was performed with young learners, game elements were concretised as much as possible in order to determine the effect of gamification better. For this reason, digital media tools were not used in this study. It was thought that this condition would provide ease of use of the game elements for young learners. Samples of this situation are included in this study's methodology section. In this respect, some suggestions that may inspire future work are presented below.

- This research is limited to 46 participants. Studies examining the effect of gamification can be conducted with more participants.
- In this research, the effects of gamification on mathematics course were examined. Studies can be conducted to examine the effect of gamification in different courses.
- Participants in this research are limited to the fifth-grade level. Studies that examine the effects of gamification at different grade levels can be conducted.

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An exploratory holistic analysis of digital gamification in mathematics education

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Abstract

This paper presents an explorative holistic analysis of digitally-constructed gamification processes in mathematics education. The main aim of this study is to identify the key-issues, intentions and trends by examining peer-reviewed publications using a combination of social network analysis (SNA), computerized lexical analysis and content analysis. Research findings indicate that there is a growing trend in gamification in mathematics education (GIME) research. GIME is mostly employed in primary school level. It was also found that, numbers is the most gamified math topic. Another research finding reveals that the researchers mostly use gamification to improve mathematical problem-solving, math achievement and math performance apart from the motivation and engagement. According to SNA findings, the most strategic terms in GIME research are as follows; geometry, fractions, mobile-learning, gender-studies, human-computer interaction, intelligent tutoring systems and tangible user-interfaces. GIME research is mostly influenced by USA and Brazil hence, the developing countries have an increasing interest in GIME research. Finally, findings on general research discourse implies that the general discourse among the sampled papers is positive. The findings obtained in this study may be useful to improve mathematics education by mapping a research agenda for researchers and educators with the exploration of potentials of GIME research.

1. Introduction

One of the general and accepted definitions of gamification is that, it is the use of game designs elements in non-game contexts (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011). Therefore, game-design elements are used to support individuals' daily actions and acts from different points (Huotari & Hamari, 2017). Thus, playful experiences can be provided for learning (Koivisto & Hamari, 2014). Hence, in order to understand and sympathize gamification with many educational concepts such as entertainment, problem solving, strategy development, and socialization, it must be recognized primarily that playing is a "basic learning instinct" for homosapiens (Huizinga 1955). The concept of gamification of learning-teaching, which basically includes the act of playing, was first coined by game designer Nick Pelling in 2002 (Werbach & Hunter, 2012) and took its place in Gartner Hype Cycle in 2011. However, we can evaluate the history of gamification together with the history of the games that the inclusion of games in daily life is as old as the history of humanity.

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The gamification approach is mainly used to support individuals' learning through motivation and engagement (Kapp, 2012). Gamification does not intend to provide learning directly, but it has an impact on many other learning variables through motivation, and engagement. Also, it can be assumed that gamification, together with many variables mentioned in the literature and in this study, may also have an effect on right brain skills or soft skills (Elayyan, 2021) such as "critical thinking, coordinating with others, verbal communications, and time management". In this context, it can be stated that gamification supports learning through many channels. Structural components of gamification are game mechanics, game dynamics and aesthetics. These components become a learning design language within the gamification thinking philosophy. One of the outputs of this design language, especially in the subject of this study, is to create intriguingly cleverly designed experiences (Kim, 2011). Another outcome is to provide problem solving skills and engagement to a learning situation (Zichermann & Cunningham, 2011).

Gamification can be analogue or digital, nevertheless, gamification is often “thought about as a digital realm” (Marczewski, 2019). We use only generic “gamification” term instead of “digital gamification” through this paper. The first starting point of this research is the assumption that gamification is a very appropriate approach to mathematics education with its features and learning variables that it affects. However, gamification, which is a very generous approach in terms of the use of technology, can be expected to offer solutions to the difficulties or constraints encountered in the field of mathematics education. At this point, it will be useful to summarize the difficulties encountered in mathematics education.

Mathematics is an intellectual query system aimed at solving problems encountered in the fields of “quantity, structure, space and change”, increasing the existing knowledge and finding the universal facts (Lameras & Moumoutzis, 2015). This system attempts to explain the balance and harmony in the background of every occurrence in nature or created by human hand. The assumption that “the language of the nature” is mathematics (Lakoff & Núñez, 2000), is a result of such a reasoning system. The word mathematics has its origin in the Greek word; “mathesis” and, the word mathesis means “learning”. In general, mathematics can be described as a tool with its own rules, processes and symbols used to explain the relationships existing in nature and to solve the problems encountered, and sometimes to pose a new problem. The interdisciplinary and central position of mathematics in many fields of knowledge such as education, technology is about the strong relationship between mathematics and pedagogy, its utilitarian nature and the nature of its subjects (i.e., quantity, structure, space and change) (Lameras & Moumoutzis, 2015). Therefore, it can be said that mathematics is the basic learning subject that people must internalize in the process of understanding and changing the world and providing benefits to others. Hence, the development of mathematics education for the individual and society is also a component of social development and progress. Mathematics should activate the mathematical thinking of individuals through proper examples which are consistent with their knowledge and skills. It should address their discovery sense and make them to ask questions about the effects of mathematics on daily life.

Although the term “school mathematics” differs from one country to another, it mainly deals with the learning domains such as numbers, algebra, geometry, measurement, data analysis (statistics) and probability (MONE, 2018; NCTM, 2000). Research suggests that the reasons for learning difficulties encountered in the field of mathematics are; the deficiencies in mathematics teaching, the abstractness of mathematics topics, the inability of the students to interpret the verbal expressions and the inadequate learning readiness levels of the students. In addition, studies on the efforts to eliminate difficulties are less frequent compared to studies on the identification of such difficulties. In the former type of the studies, it has been stated that computer programs for eliminating difficulties, visualization, using appropriate materials and redesigning teaching can be employed in line with learning difficulties (Tatar & Dikici, 2008).

Under the circumstances indicated above, it is clear that, nowadays, there is a need for the implementation of innovative approaches in teaching and learning of mathematics to eliminate the ongoing difficulties. Also, it can be claimed that, the long-used traditional in class teaching and learning methods in mathematics

teaching are insufficient now to meet the needs of the new generation of learners. In this context, the aim of this study is to provide a systematical overview of the gamification in mathematics education (GIME) research by identifying trends and patterns through a systematic review of the related literature. In line with this aim this study addresses the following research questions.

- Is there a growth tendency in the number of studies published about GIME?
- What is the most used publication type among the sampled papers?
- What are the most used independent variables in GIME research?
- What are the characteristics of the target participants/samples in the related research?
- What are the most researched mathematical domains/topics?
- What are the trends in research design (or models) in studies on GIME research?
- Which keywords have the highest betweenness centrality and degree centrality?
- What is the countrywide distribution of related research?
- What is the general research discourse among the studies?
- What are the trends in GIME research in terms of lexical analysis?

2. Methodology

2.1. Research Model/Design

This paper is a hermeneutically-oriented (Boell & Cecez-Kecmanovic, 2014; Watson & Webster, 2020) explorative systematic review that seeks to arrive a holistic overview of digital gamification approach in mathematics education. The main aim to choose this type of research method was to identify the current state of the art, intentions and patterns of GIME research to guide researchers in future work (Petticrew & Roberts, 2008). Systematic reviews aim to summarize and thus, syntheses the results of previous studies in a specific field. This type of research seeks to inform the readers on the effectiveness of particular programs, approaches or methods by analyzing larger amounts of empirical studies that focus on the similar research topic (Van Klaveren & De Wolf, 2015). Setting predefined questions and inclusion & exclusion criterias are the typical prerequisites for systematic reviews. Systematic reviews can be regarded as "small scaled independent research projects in itself" (Denyer & Tranfield, 2009) that lead and direct trends for planning future breakthroughs.

For the purposes of this current systematic review, social network analysis (SNA), lexical thematic analysis, inferential descriptive statistics and discourse analysis were used to answer the research questions. Triangulation of analysis techniques used in this study helped authors to gain a multidimensional perspective and increase the validity of the research. A set of softwares were used in this study as follows: NodeXL (SNA-network visualization and computing centrality metrics), VOSviewer (Lexical analysis), Microsoft Word & Excel (descriptive and content analysis).

2.2. Sample and Inclusion Criteria

In this systematic review, to screen the peer reviewed papers, the Scopus database was used. Before conducting the screening process, authors also checked the other scientific databases such as Web of Science, ERIC, Science Direct and Google Scholar with predefined search keywords. Authors recorded the search results and formed a research inventory to Excel to check the search results between the selected databases. However, it was identified that the Scopus database provided the most comprehensive results between them.

The following search query of keywords were used to select the congruent articles for the research focus: "math OR mathematics AND gamification". This query was searched in "abstract, title or keywords" sections of related papers. The search was not limited to a specific time period however the year 2020 was not included to research corpus to accurately map out the possible research trends. Initially, the searched papers were not limited to specific gamification modes as analogue or digital for not narrowing down the scope. Hence, surprisingly, researchers noticed that all sampled papers were digital gamification studies. The initial inclusion criteria for a research to be included to the scope of review are as follows: has predefined keywords in abstract, title or keywords, is peer reviewed, is written in English, has online full-text accessibility. The following criteria were used to exclude the studies from the scope of review: papers which are not written in English, studies that were abstracts (one or two pages) or opinion papers, white papers, reflection papers etc. The overall research design is shown in Figure 1.

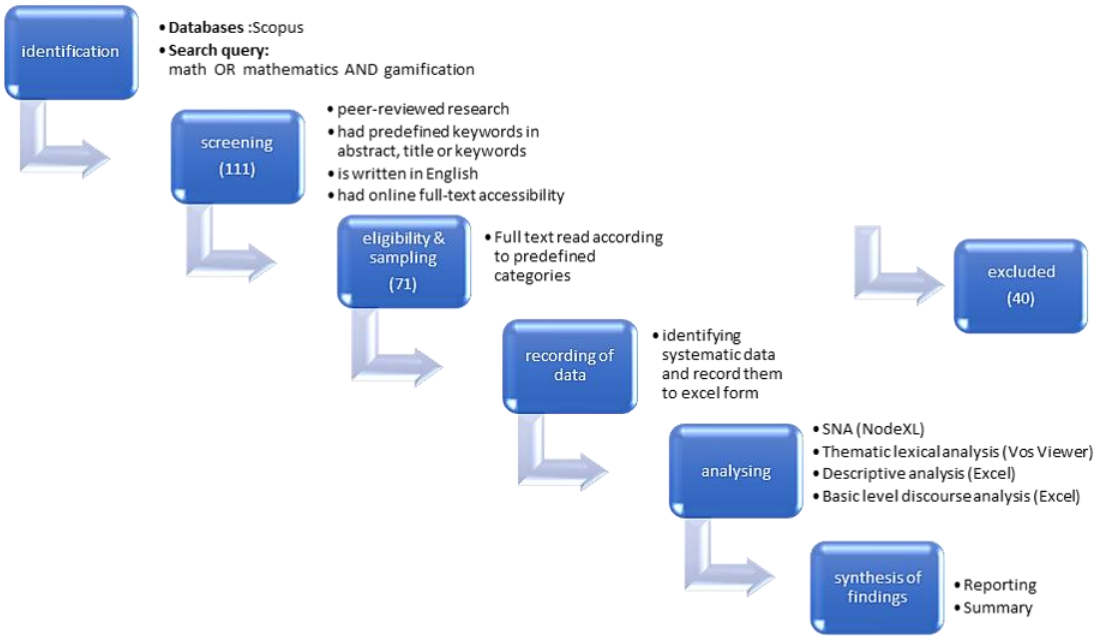


Fig. 1. The overall research design

2.3. Data collection and an analysis

After the initial screening process, we reached 111 papers. We then read all the paper abstracts, (and full texts where abstracts were unclear), to identify the papers relevant to our research focus. After removing duplicates, 40 papers were excluded and in the final research corpus, 71 peer reviewed papers were identified for the double review. After this screening phase, we read each papers' full texts of the included articles in an attentive manner in line with the predefined systematic data categories. An Excel file, a NodeXL template and database metadata CSV files were used to record the data. In the Excel file, different data recording categories were defined by the authors namely; document type, year of study, country, keywords, participants, methodology, independent variables, dependent variables, math topic/domain and general research discourse. To arrive a comprehensive and reliable overview of GIME research and also to identify trends & patterns, this research benefits from multiple approaches to data analysis, as described below.

2.3.1. Descriptive analysis

In this systematic review, predefined systematic data categories; document type, year of study, country, participants, methodology, independent variables, dependent variables and math topic/domain were identified via descriptive statistics. Results of analysis were also presented with descriptive tables and a cartographic graph to clarify the results.

2.3.2. SNA based keyword network analysis

We used SNA, a conceptual data analysis method, to identify and map the relationships between the keywords used in sampled publications. SNA is a novel approach that analyses associational data within a network of actors (nodes), inter-related concepts or patterns (Crossley et al, 2015; Marin & Wellman, 2011). The philosophy behind SNA; decentralization in a network (Çulha, 2021), helps to uncover strategic knowledge/concepts within distributed information on a network. In this study, keywords were analyzed according to their co-occurrences. Hence, each keyword was identified as a node, while their co-occurrences were identified as ties. Understanding the effects and meanings of ties within a network of nodes (members) is the main focus of SNA. In this study, SNA conducted based on betweenness centrality (BC) metric and analysis of keyword network was visualized using the Harel Koren fast multiscale algorithm.

2.3.3. Lexical analysis

We used lexical thematic analysis to define core thematic codes among sampled publications. Lexical analysis is a statistical analysis of textual data (Hanks, 2013) which aims to explore and reveal the hidden topics in it. In this study, VOSviewer text-mining software, which constructs and visualizes bibliometric networks (Van Eck & Waltman, 2010) was used to create a thematic map of sampled publications' titles, abstracts and keywords. Thematic map was presented in the findings section.

2.3.4. Discourse analysis

Discourse analysis is a basic level content analysis that aims to identify the practical meaning of utterances (Johnstone, 2018). In this study, the conclusion sections (and also full texts where necessary) of sampled papers were analyzed in an attentive manner by the authors. Based on the discourse analysis carried out by Bozkurt, Akgün-Ozbek, & Zawacki-Richter (2017), the conclusion sections of the sampled papers were examined according to their concluding tones. Four clusters were defined to analyze the conclusion sections: "positive", "negative", "no significant effect" and "not applicable". General research discourse in a peer reviewed paper, is also a possible determinant of the effectiveness of gamification in mathematics education.

2.4. Reliability

To augment the reliability of this research, a double review process was implemented by the authors. In this type of systematic reviews, analyzing and recording data according to predefined systematic data categories properly, is a vital requirement. In line with this requirement, all sampled papers in this study were coded by two field experts respectively. Hence, Cohen Kappa statistic was used to determine the coefficient of interrater reliability. In Cohen Kappa statistic, a value of between 0.81 and 1.00 reflects almost perfect agreement between the coders. The interrater reliability coefficient was calculated as $\kappa = 0.915$ for descriptive parts of the analysis process. For the discourse analysis process, an interrater reliability coefficient was computed separately and found $\kappa = 0.980$, which indicates a perfect fit between the coders (Landis & Koch, 1977).

2.5. Significance of the Study

This study provides multiple perspectives of GIME research by identifying research tendencies, different patterns of usage and rising topics. The main aim of this current research was to examine the one of the most well fitted approaches to mathematics education, gamification, from different aspects. This examination may provide a holistic perspective to researchers, experts, teachers or teacher candidates. Also, to the best of our knowledge, this study is a unique research that attempts to identify the trends and possible direction of gamification usage in mathematics education. In other words, the study not only identifies specific patterns in GIME research, but also provides a prescient research agenda for future directions. Another strength of this study is the analyzing techniques used. These multiple techniques provide authors to triangulate the data to present more reliable synthesis and report.

In addition to its significance, this study has some limitations. First and foremost, the sampled papers are limited only to Scopus database. There may be a couple of significant publications in other databases but they may also be contributive to the current literature. In addition, however, Scopus is one of the largest and efficient databases in social sciences, it indexes only peer-reviewed documents such as articles, conference proceedings, and book chapters, thus grey literature such as expert blogs, project reports, positioning papers or white papers were not included to the research corpus. This may be count as a main limitation for this study.

3. Findings and discussion

3.1. Time Trend- Source/Research type

The studies reviewed were selected without any limitation in regard to the date of publication. However, it is observed that the studies on the GIME began from 2012. The gamification approach has its roots in the past, but the word gamification was first used officially in 2002 (Marczewski, 2013; Werbach & Hunter, 2012). However, by 2011, it officially became a buzzword when Gartner added it to its 'Hype Cycle' list. It can be argued that this situation increased the use and awareness of the gamification approach in different fields since 2011. When the time series is analyzed (Figure 2), it is observed that there is an increase in the studies on the GIME from 2012 to 2019. It is interesting that such studies on the GIME had the highest number in 2014 and had the peak point in 2018 even though Gartner (2014) positioned gamification at the "Trough of Disillusionment" stage.

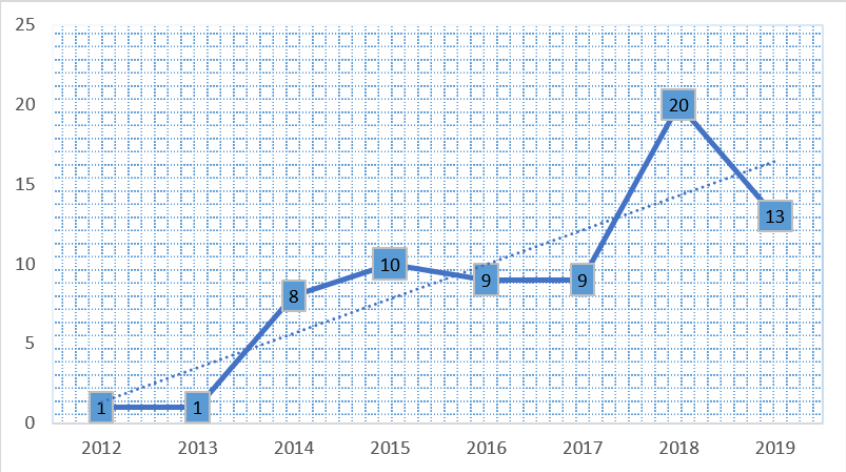


Fig. 2. Time trend series of GIME research

It can be thought that due to the assumption that gamification is an "effective learning-teaching approach" that appeals to the instincts of individuals in regard to games, and the that the role of technology in gamification practices is very significant such an increase occurred. It has been frequently observed in many

systematic review studies that the cut-off dates related to the technological development or the introduction of new approaches also show the effect of those technologies or approaches in the educational processes as multi-disciplinary manner (Bozkurt, Akgün-Özbek, & Zawacki-Richter, 2017; Bozkurt & Göksel, 2018; de Sousa Borges, Durelli, Reis, & Isotani, 2014). Time trend analysis suggests that gamification is increasingly being studied in mathematics education starting with 2012 and moreover, it is subject to various experimental and practice-based studies, as stated in the "methods used" section in the sampled researches. On the other hand, out of seventy-one studies reviewed, fifty-one are articles (71,83 %) and twenty are conference papers (28,17 %).

3.2. Independent Variables Focused in the Studies

In the studies on GIME, when the potential effects of gamification independent variable on the dependent variables are analyzed, the variables of motivation, engagement, problem solving, math achievement and math performance become much more significant.

variables	n	f (%)	variables	n	f (%)
motivation	9	11,11	distraction	1	1,23
engagement	8	9,88	extrinct motivation	1	1,23
problem solving	7	8,64	interaction	1	1,23
maths achievement	6	7,41	interest	1	1,23
math performance	4	4,94	learning at higher levels	1	1,23
intrinsic motivation	3	3,70	learning styles	1	1,23
learning process	3	3,70	learning success	1	1,23
academic achievement	2	2,47	procedural knowledge	1	1,23
learning performance	2	2,47	process of studying mathematics	1	1,23
performance	2	2,47	response accuracy	1	1,23
student learning outcomes	2	2,47	response time	1	1,23
learners anxiety levels	2	2,47	self-regulation	1	1,23
autonomy	1	1,23	social participation	1	1,23
cognitive overload	1	1,23	spatial skills	1	1,23
collaboration	1	1,23	speed	1	1,23
communication	1	1,23	strategic efficiency	1	1,23
computational thinking	1	1,23	strategic fexibility	1	1,23
concentration	1	1,23	student achievement	1	1,23
conceptual knowledge	1	1,23	student attitudes	1	1,23
correctedness of entries	1	1,23	task completetion	1	1,23
creative abilities	1	1,23	test performance	1	1,23
			user involment to e-learning	1	1,23

Fig. 3. Independent variables in the sampled publications

In many studies, it is stated that gamification approach is mainly effective on student motivation and engagement variables instead of direct learning performance (Deterding, 2012; Hamari, Koivisto, & Sarsa, 2014; Marczewski, 2013). One of the interesting findings obtained in this study is that gamification can be an effective independent variable especially in problem solving, mathematics achievement and performance in the field of mathematics education. However, although student motivation and engagement are the target variables of gamification, the fact that the researchers who integrate gamification into mathematics education especially include these two variables which indicates that these variables are also important-problem solving variables in mathematics education.

3.3. Population and/or Participant Groups

The categorization of students' education levels may differ by country. For this reason, in this study, which age group is referred to at which education level is clearly stated in Table 1. Participants outside these groups are categorized in the "other" category, and in this category, there are studies with individuals with

special needs (n = 3), adult learners (n = 2) and teachers (n = 1). The frequency of the studies conducted of which participants are stated is given in Table 1.

Table 1.

Educational levels and grades of participants

Educational Level	Age	Grade	f
Preschool	4-5-6	Kindergarden	5
Primary School	7-8-9-10-11	1,2,3,4,5	24
Middle School	12-13-14	6,7,8	8
High School	15-16-17-18	9,10,11,12	9
Higher Education	18 +	Undergraduate	13
Other	-	-	6

When the education levels of the participants are examined in the studies dealing with gamification in mathematics teaching, it is seen that studies involving the participants who are at the primary school level are the most frequent. It is observed that the other studies were respectively carried out of with the participants from the higher education, high school, secondary school, others and pre-school level participants.

3.4. Math topics focused with regards to participants' grade

The subject area classification specified in the National Council of Teachers of Mathematics (NCTM) was used to classify the mathematics topics addressed in the gamification research. Distribution of subject areas by grade levels according to the NCTM standards is given in Figure 4 (NCTM, 2000). Accordingly, the subject domains covered in the field of mathematics from preschool to high school can be classified as numbers, algebra, geometry, measurement, data analysis and probability.

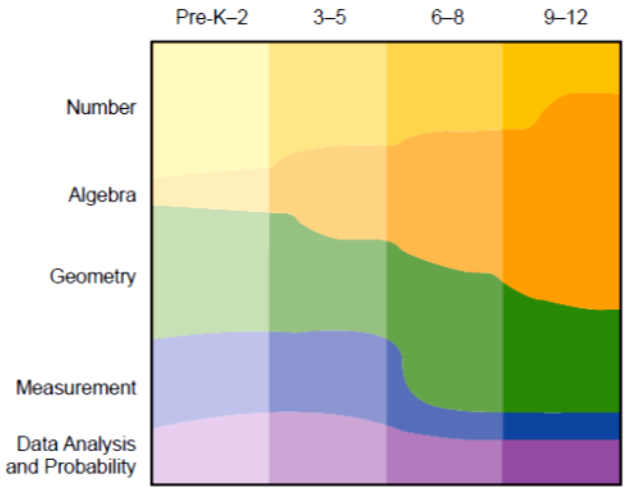


Fig. 4. Distribution of mathematics subject areas by grade levels according to the NCTM standards (NCTM, 2000, p.30)

In some of the sampled studies, the subject of mathematics courses was not specified, and in some of the cases, the subject area was not clearly defined and instead, was given unclear such as "math comprehension". These studies are marked as N / A. In some studies, cases/activities related to more than one subject area were found. These studies are coded to be more than one for each mathematics subject area. The findings regarding the distribution of gamification research according to education level and mathematics subject areas are summarized in Table 2.

Table 2.

Math domains of sampled papers with regards to educational level of learners

		Educational Level			
		Preschool (n=5)	Primary School (n=24)	Middle School (n=9)	High School (n=9)
Maths Domain	Number	2	13	3	1
	Algebra	-	3	-	2
	Geometry	-	2	2	2
	Measurement	-	-	-	-
	Data analysis and probability	-	1	-	-
	N/A	3	8	5	5

The findings in Table 2 indicate that when the subject areas of the studies are taken into consideration, it is seen that majority of the studies at pre-school level are on "numbers". It is also seen that the gamification studies are carried out mostly on "numbers" (f = 13) at primary school level. Apart from eight studies in which the subject of mathematics could not be determined clearly, three studies including algebra field, one containing geometry field and one research involving data analysis and probability were carried out.

When the mathematics subjects of studies carried out at the middle school level were examined, it is observed that there were three studies on number and two studies on geometry. It was not possible to determine what the mathematics subject of five studies at middle school level. At the high school level, one study is found to address the number issue and two studies focus on the algebra and geometry areas. At the high school level, the subject of mathematics of five studies could not be determined.

Therefore, it is safe to argue that "numbers" seem to be the dominant research topic for the preschool level. It has been determined that the gamification studies carried out are also in this domain. At primary school level, it is seen that especially in 3-5 grade levels, the focus is on the "numbers and geometry" area, following this, on "algebra" and "measurement", and less predominantly on the "data analysis" and "probability" domains (NCTM, 2000, p.30). Although the number of the studies on the topics of "numbers" and "geometry" are the same, it is seen that gamification research concentrates mostly on numbers.

In mathematics education, it is seen that the effects of gamification on students' motivation, attitudes, mathematical engagement and mathematical knowledge and skills are examined, and gamification is used in eliminating various mathematical difficulties (Cunha, Barraqui & De Freitas, 2018; Jagust, Boticki & So, 2018; Widodo & Rayahu, 2019; Toda, do Carmo, Mesquita, da Silva, & Brancher, 2014). Given that gamification studies are an approach to eliminate learning difficulties, the question of whether gamification research is focused on numbers mostly due to the fact that there is more difficulty in numbers occurs. However, it is also emphasized in studies conducted in different countries that geometry is one of the most challenged and unsuccessful subjects among the students (Aldolphus, 2011; Bartoni-Bussi & Baccaglini-Franck, 2015; Clements, Sarama, Swaminathan, Weber, & Trawick-Smith, 2018; Koçak & Soylu, 2018). Then it can be argued that the studies of gamification have not been focused on algebra yet, however, this literature inference sheds light on it and mean that such studies can be implemented.

Similarly, the frequent study topics for the middle school level (grades 6-8) is found to be algebra followed by the topics of geometry, numbers, data analysis and measurement. However, when the studies of which the subject area was specified, were examined, a gamification study focusing on the field of algebra was not found. It is a known fact that the subject of area of algebra is very difficult to understand from the perspectives of students, and it is a basic subject area for the high school level (Dubinsky & Wilson, 2013; Kaya & Keşan, 2014). Considering the importance of the subject of algebra, it can be said that there is a

need for gamification studies to increase the motivation of learning in relation to algebra and to eliminate difficulties. Mathematics education at the high school level generally focuses on the algebra. Following this, the topics related to the fields of geometry and the trace of the numbers, the measurement and the data analysis (NCTM, 200, p. 30). It is seen that the subject areas that can be determined in the gamification research conducted at the high school level are dominantly in algebra and geometry, and then numbers.

Another remarkable finding is that any gamification study in the measurement area has not been reached. One of the reasons for this situation, although it varies according to the countries, is thought that the measurement subject in the education programs may have less significance and emphasis than other mathematics subject areas. It is thought that examining the reasons for not having the need to use gamification for increasing motivation and success in the field of measurement can contribute to the mathematics education field.

There are eleven studies determined to be carried out with participants who were at the higher education level. More specifically, it is seen that four studies focused on the analysis, two on the algebra, two on geometry, one focuses on discrete mathematic and another one focuses on statistics. The subject area of one study could not be determined. On the other hand, it is found that some studies include more than one subject area. In two studies, it was aimed to develop spatial skills which are part of the mathematical skills. Regardless of the education levels, there are five studies grouped in the "other" category. The subject area of mathematics in one study could not be identified. Some studies include more than one mathematical subject. Three studies include the topic of numbers, three studies dealt with the algebra topics, one study includes mathematical literacy, one study focuses on geometry, and one study focuses on logic.

3.5. Research methods used

When the methods of the sampled studies are examined, it is seen that the experimental studies are highly preferred (39, 44%). However, it is also observed that the majority of the studies do not have a specific method, but these studies can be described as practice-based research in general which is also preferred considerably (35, 21%).

Table 3.

Research methods / approaches used in the sampled publications (adapted from Bozkurt, Akgün-Ozbek, & Zawacki-Richter (2017))

Type	**n**	**F**	**Type**	**n**	**f**	**Type**	**n**	**f**
Quantitative	**29**	**40,85**	**Mixed**	**2**	**2,82**	**Practice based**	**25**	**35,21**
Survey	1	1,41	Explanatory sequential	1	1,41	Action research	0	0,00
Correlational	0	0,00	Convergent parallel	1	1,41	Design-based research	3	4,23
Experimental	28	39,44	Exploratory sequential	0	0,00	Game development	9	12,68
Meta-analysis	0	0,00	Embedded	0	0,00	System / Tool / Prototype development	7	9,86
Causal comparative	0	0,00	Multiphase	0	0,00	Instructional design development	3	4,23
			Transformative	0	0,00	application development	3	4,23
Qualitative	**6**	**8,45**	**Conceptual/Descriptive /Other**	**9**	**12,68**			
Descriptive	1	1,41	Literature review	2	2,82			
Case Study	4	5,63	Position paper	0	0,00			
Content Analysis	0	0,00	Opinion paper	0	0,00			
Ethnography	1	1,41	Report	1	1,41			
Phenomenology	0	0,00	Comparative	0	0,00			
Narrative	0	0,00	Technical paper	3	4,23			
Delphi	0	0,00	Reflection paper	1	1,41			
Grounded theory	0	0,00	Field notes	2	2,82			
Meta-Synthesis	0	0,00						

Historical	0	0,00
Heuristic	0	0,00

Among the practice-based researches, there are game development studies (12, 68%), system architecture creation / a learning-teaching tool or prototype development studies (9, 68%), teaching design development studies (4, 23%) mobile application development studies (4, 23%) and other design-based processes (4, 23%). The rate of conceptual-descriptive studies is 12, 68 %, and the qualitative research is the least preferred research method (8, 45%). It is not possible to evaluate these findings together with similar research results since there are no similar review of the GIME studies in the literature. However, findings obtained in systematic literature reviews related to gamification, or systematic reviews performed in different disciplines (Martí - Parreño, Méndez - Ibáñez, & Alonso - Arroyo, 2016; Ortiz Rojas, Chiluiza, & Valcke, 2016), are parallel to the findings of this research. Accordingly, gamification is an approach that mostly has been tested in experimental environments (39.44%) with its various effects on different learner groups. It can be said this situation is caused by genetic inheritance of gamification from games: Games are systems consisting of many components.

3.6. SNA based keyword network analysis

In order to better understand the research topics and trends in the studies reviewed, a SNA was carried out in with the keywords of sampled publications. The SNA is an analysis method that can make a meaningful summary of the relationships in a network by examining the actors in a social network and the connections between them. In addition, SNA is an approach that can be used in the analysis of relational data derived from an interdisciplinary network of related concepts, theories or techniques (Crossley et al, 2015). In the SNA process, each keyword was identified as a node, while their co-occurrences were identified as ties. NodeXL, a social network analysis software was used to analyse and visualize these nodes. A co-occurrence network was created among the nodes. The network graph created represents 178 nodes with 557 ties between them. Also, the nodes which have degrees under 4 were not shown on the network map to clarify the general visualization (Figure 5).

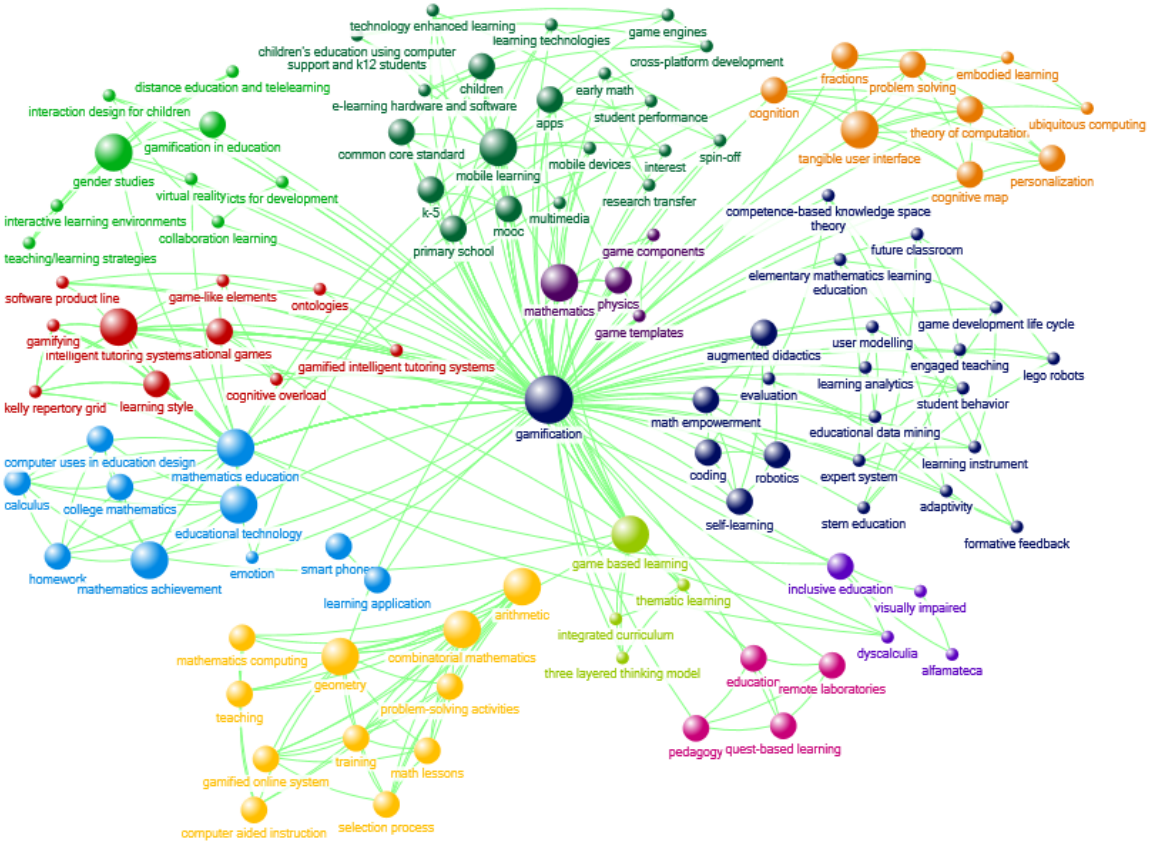


Fig. 5. Network graph of sampled keywords

Keywords were laid out using the Harel-Koren Fast layout algorithm and grouped by cluster using the Girman-Newman-Moore cluster algorithm. The analysis was based on betweenness centrality of nodes. Betweenness centrality metric in a SNA, is based on how important a node is, in terms of connecting to other nodes (Rusinowska, Berghammer, De Swart, & Grabisch, 2011). In other words, in a specific study of domain, betweenness centrality identifies the strategically important concepts/topics which controls the relationship among others or has ability to bridge over diversified topics.

node	betwenness centrality	degree centrality	frequency
gamification	15095,8452	148	49
game-based-learning	2383,4000	18	6
mathematics-education	2081,2524	37	7
geometry	2006,9000	14	3
mobile-learning	1357,0143	24	6
gender-studies	891,0000	11	3
human-computer-interaction	812,0000	10	3
kahoot	760,0000	8	2
inclusive-education	744,0000	8	2
educational-technology	608,5000	9	2
fractions	403,7500	7	2
tangible-user-interfaces	387,7500	12	2
children-education	349,0000	4	4
mathematics	326,7333	15	5
gamification-in-education	224,5000	6	2
educational-games	201,6667	9	3
cross-platform development	151,3476	4	1
e-learning-hardware&software	151,3476	4	1
game-engines	151,3476	4	1
arithmetic	147,8333	12	2
learner-engagement	48,0000	15	2
intelligent-tutoring-systems	35,5000	17	8
mathematics-achievement	14,3333	11	3
combinatorial-mathematics	5,0000	11	2
e-learning	4,5000	10	3
education	3,0000	8	3
primary-school	1,3333	8	3
apps	1,2500	6	2
learning-style	0,66667	10	2
physics	0,66667	6	2

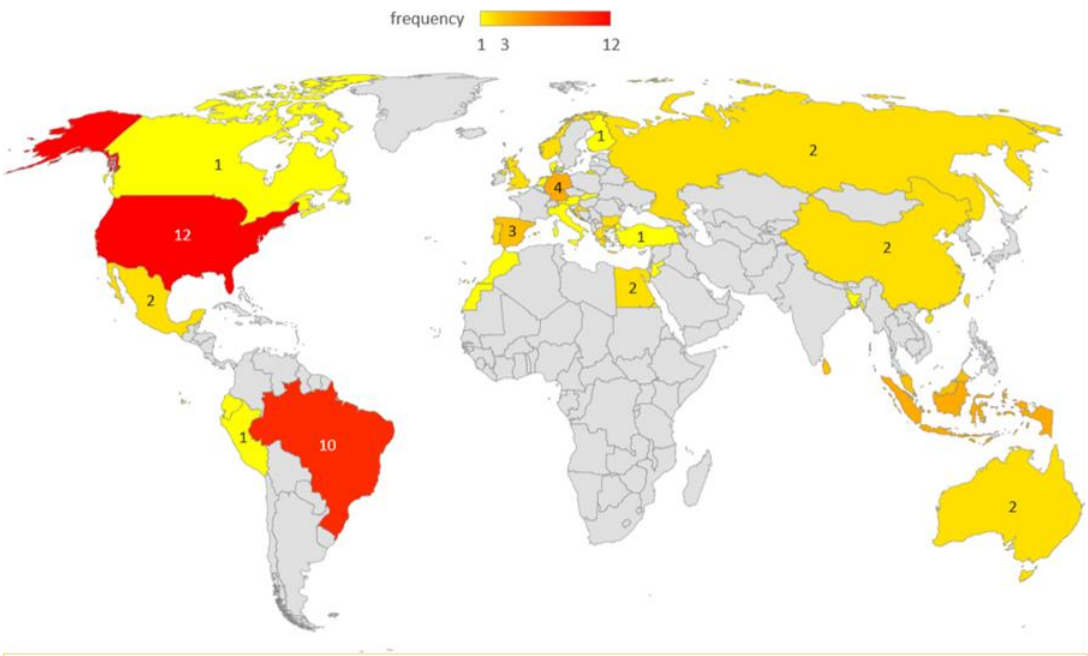
Fig. 6. The nodes with high betweenness centrality scores

Unsurprisingly, gamification emerges as the central node (Figure 5-6). Another strategic nodes are found to be game based learning, mathematics education, geometry, and mobile learning. As a result of the analysis, it is found as expected that the game-based learning as well as gamification has a high BC value. Gamification and game-based learning are two frequently confused approaches in the literature. Here, there may be a similar situation/confusion. One of the remarkable findings in the SNA is that geometry and mobile learning subjects stand out as mediators, together with mathematics education, among different special mathematics topics. In addition, in mathematics; gender research, human computer interaction, fractions, and tangible user interfaces are the important topics of GIME research. Intelligent tutoring systems is another GIME subject that is the most frequently used and relatively high BC in keyword analysis

of the studies reviewed. This finding indicates that artificial intelligence-based ITS systems have become an important topic in mathematics education and the GIME research as in other fields.

3.7. Countrywide distribution

When the country distribution of the sampled publications is examined, it is seen that the USA (16.22%) and Brazil (13.52%) stand out in terms of the number of the GIME studies. Germany (5.41%) and Indonesia (5.41%) follow them. In general, it is seen that the USA leads the way in innovative mathematics teaching practices. Herein, the number of productions of Brazil, a developing country, in this area is another remarkable point to be examined.



United States	12	Greece	2	Egypt	2	Netherlands	1
Brasil	10	Norway	2	Mexico	2	Slovakia	1
Germany	4	Portugal	2	Russia	2	Bangladesh	1
Indonesia	4	Taiwan	2	Denmark	1	Jordan	1
Spain	3	UK	2	Austria	1	Morocco	1
Malaysia	3	Bulgaria	2	Canada	1	Peru	1
Sri Lanka	3	China	2	Finland	1	Turkey	1
Australia	2	Croatia	2	Italy	1	Ecuador	1

Fig. 7. Main contributors in GIME research

In similar studies, it is generally stated that the number of publications carried out in the developed countries is higher than that carried out in the developing countries. The interesting finding that emerged here; if we keep the data from the USA apart, it is observed that there are more GIME studies in the developing countries compared to the developed countries. Therefore, it is possible to argue that mathematics education is perceived as an important challenge that needs to be solved in the developing countries. In addition, it provides an indication that innovative approaches such as gamification, especially suitable for mathematics education, are tried to be integrated as an approach that can accelerate mathematics education by providing solutions to problems in mathematics education.

3.8. General research discourse- Does gamification work in mathematics education?

When the conclusion parts of the studies reviewed are examined in detail, gamification in mathematics education is often reported to be of high usefulness/beneficialness (Figure 8). Only seven studies do not report any effects (10%), and only one study (1%) did not show any significant effects of the gamification. In order to monitor the effects of the gamification approach in mathematics education more clearly, those learning variables which have positive effects on gamification should be investigated in future meta-analytic or experimental studies.

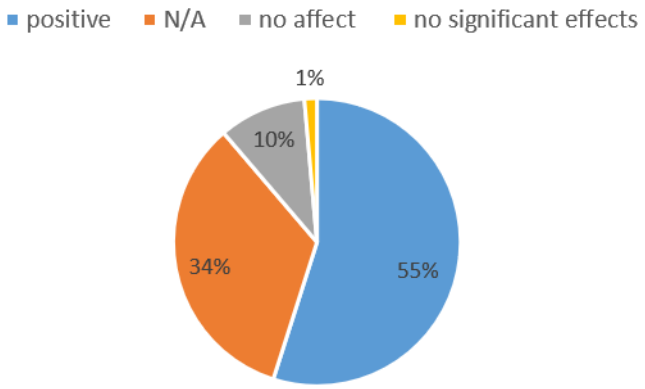


Fig. 8. General research discourse among the sampled publications

The findings of this study related to the general research discourse coincide with the findings of various systematic review studies on gamification in education. In the study of Dicheva, Dichev, Agre, & Angelova (2015) it is revealed that gamification has positive effects on education in the majority of the analyzed studies. Similarly, in the study of Ortiz Rojas et. al. (2016), it is stated that the number of studies reporting the negative effects of gamification in education is very low. Based on the general research discourse findings obtained in this study, it is concluded that gamification has a positive effect on mathematics education. Especially the studies in which there is no specific result are generally application-based. Considering that there are studies for developing a product and system, it can be said that the rate expressing the positive effects of using gamification in mathematics education will be higher than the rates given in Figure 8. As a result, the finding sheds light on the fact that the use of gamification in mathematics education may have important positive effects in terms of educational beneficialness.

3.9. Thematic /lexical-text mining analysis

Another analysis carried out within the scope of the study is text mining based computerized lexical analysis. The VOSviewer program was used for the analysis (Van Eck & Waltman, 2010), and the article data obtained from the Scopus database were analyzed at the level of summary and titles with full counting method. The VOSviewer has "text mining functionality that can be used to construct and visualize co-occurrence networks of important terms extracted from a body of scientific literature" (Van Eck & Waltman, 2010). The lexical analysis map produced in this study is presented in Figure 9.

In the analysis process, minimum number of occurrences of a term was determined as 9 (default value is 10) to clarify the visualization and the number of terms to be selected was automatically reported as 41. Analysis revealed 5 clusters and each cluster was visualized with different colors and ties. Accordingly, the terms; system, technology, activity, teacher, child, level, development, engagement and performance have the highest occurrence numbers hence, the terms; educational video game, leaderboard, question, time and control group have the highest relevance coefficients.

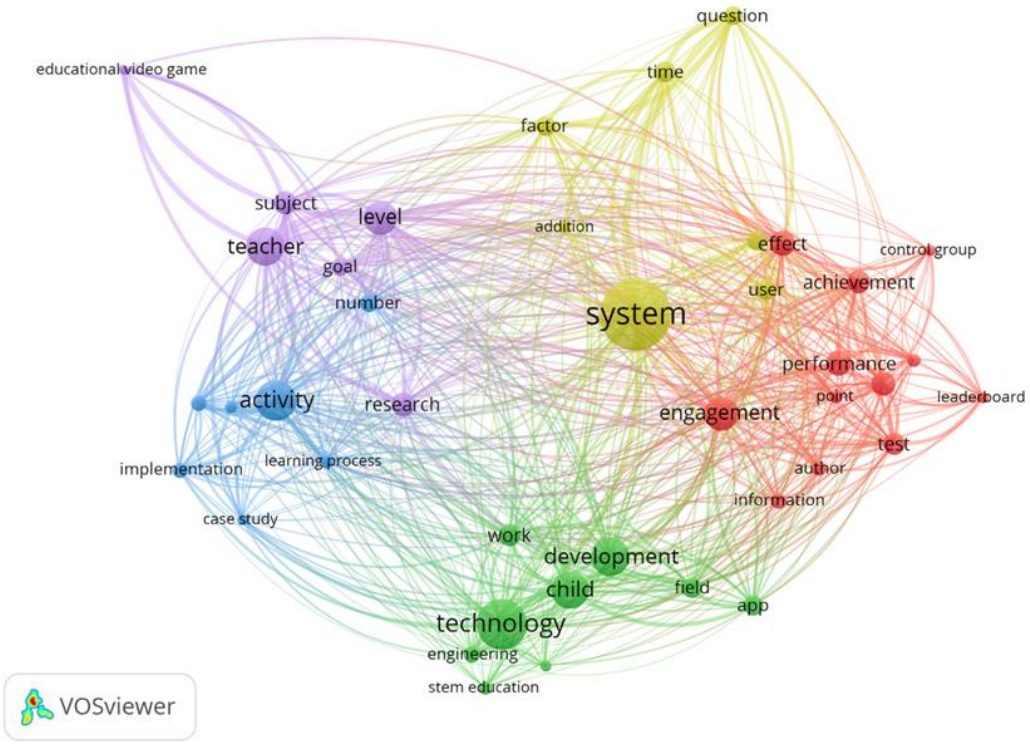


Fig. 9. Bibliometric map of sampled publications derived from lexical analysis

Figure 9 presents some intriguing results. Firstly, it was interesting to see that studies mostly focused on gamified or mathematical systems. These systems need to be created and tested experimentally. Thus, this finding supports the concluding arguments in "research methods" section of this paper. In addition, performance and engagement are the common variables in gamified experimental settings. This finding also supports the general research outcomes of gamification of learning. Accordingly, engagement and learner performance are the most investigated variables in gamification studies (Faiella & Ricciardi, 2015; Nah, Zeng, Telaprolu, Ayyappa, & Eschenbrenner, 2014; Ortiz Rojas, Chiluiza, & Valcke, 2016). Another finding of lexical analysis indicates that in GIME studies; leaderboards, points, achievements, levels and tests are said to be the most mentioned gamification components. Also, technology appears to be a common and standardized concept in GIME research.

4. Conclusion and future implications

In this paper, we conducted an explorative systematic analysis of peer-reviewed publications on gamification approach in mathematics education. The main aim of was to identify the trends, intentions and patterns of current body of GIME research literature. Key issues and trends in mathematics education with regards to gamification were identified through a triangulation of social network analysis, content analysis and lexical analysis (computerized text mining).

The findings of the study first, reveal an increasing trend towards the use of the gamification approach in mathematics education research. This situation can be interpreted as the recognition of the researchers in relation to the fact that gamification can be a very effective approach to enrich mathematics education. On the other hand, gamification can offer unique learning experiences to learners of all ages. This study has found that gamification is more studied especially in relation to the mathematics education at primary school level. It is followed by the levels of the undergraduate education and other educational levels. This situation can be attributed to the experiments aimed at eliminating the attention and motivation deficiencies

experienced by the new generation learners, who are studying at primary school level. However, the results of this study reveal that gamification may be considered as an educational problem solver that can be used in mathematics education at various grade levels.

Another important result obtained in this study is related to the distribution of mathematics subject areas analyzed in GIME research. When these studies are analyzed in terms of mathematics subject areas, it is seen that the focus is mostly on teaching of numbers, and then, on geometry and algebra. When the mathematics subjects are examined in terms of education levels, it does not seem possible to talk about a general tendency regarding the weights of the subjects in the curriculum or the subjects that have difficulty in mathematics.

Within the scope of the study, the dependent variables in which GIME researches dealt with the possible effects of gamification independent variable were examined. Accordingly, as expected, the variables of student motivation and engagement, as well as the variables of problem solving, math achievement and math performance, have significance and dominant. It is known that gamification has mostly significant effects on student motivation and engagement. The descriptive data obtained in the study were also supported by discourse analysis. These findings also reveal that gamification can be used in the context of the above-mentioned variables in the field of mathematics, with a focus on student achievement and knowledge gain.

Another research finding suggests that the methods of the investigated studies were predominantly based on experimental methods. There are also some other studies that do not have a specific method, but that can be described as practice-based research in general. Accordingly, empirical observation of gamification in mathematics is carried out with the help of experimental research designs. This indicates that gamification is accepted by mathematical researchers in terms of its theoretical background. Another takeaway suggested by this research is that the systematic structure of gamification is compatible with the systematic structure of mathematics. In other words, the determination of the effectiveness of the systems can be easily supported with the help of quantitative methodology.

According to the results of the SNA carried out within the scope of the study, some strategic subject areas in the GIME research include the concepts such as geometry, mobile learning, gender research, human computer interaction (HCI), fractions, tangible user interfaces, intelligent tutoring systems (ITS). Each of these concepts actually reflects the trends in the GIME research, which are important topics that directed another research. The surprising result is that gender studies in mathematics education are still being studied, albeit with different approaches. This may also be caused by the difference in motivation of individuals of different genders in regard to games. Another remarkable result within the scope of the SNA is the fact that geometry and fractions are prominent in the GIME research area as field specific. In addition, its emergence as an important concept in tangible user interfaces explains that the use of manipulative and models is taken into account in mathematics teaching. The concepts of HCI and ITS are also important conceptual findings that point to the future direction of GIME research.

Within the scope of the study, influencer countries were examined in terms of the GIME researches. Although USA and Brazil are at the forefront, when the USA is kept separate, it has been determined that more GIME studies are carried out in the developing countries. Good economic conditions can be achieved with good mathematicians. In this context, innovative approaches such as gamification in mathematics education will enrich mathematics education and may provide solutions to some basic education problems especially in the developing countries. Therefore, it can be thought that the developing countries mentioned in the research are on the right path by giving importance to the GIME researches.

Discourse analysis of the studies examined within the scope of the study shows that the use of gamification in mathematics education has positive effects. In other words, it was concluded that gamification "works" in mathematics education. However, it seems that the use of gamification and technology together in mathematics education is also important.

One of the important features of gamification is that the success of gamification is highly context based (Hamari, Koivisto, & Sarsa, 2014). In other words, different gamification thoughts can be realized in different fields or subjects. Based on the results of the research, the following recommendations can be given for researchers, teachers, prospective teachers or experts working in the field of mathematics education:

- As stated above, gamification is a highly context-based approach. At this point, researchers should know the context to be gamified well, moreover, they should have sufficient TPACK skills.
- Gamification is an approach that has different components and requires design experience and creativity. However, the educational power of the games is quite high. From this point of view, increasing gamification education and gamified content may cause positive effects in mathematics education as in other disciplines. However, at this point, subjects such as motivation, attention, engagement, etc. that affect students' learning of mathematics should be determined. In this way, more effective solutions can be offered for the mathematics subjects, which are difficult to teach, through gamification.
- Supporting GIME researches with qualitative data collection and analysis methods in addition to experimental designs will provide researchers with deeper insights.

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What does emergency remote education tell us about home-schooling?

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Research Article

Abstract

The study aims to examine parents' opinions about Emergency Remote Education (ERE) during the pandemic and the feasibility of home-schooling in Turkey. The study uses a causal-comparative model. 654 parents took part in the study. ERE for Home-schooling Questionnaire developed by researchers is used to collect the data. Descriptive statistics, independent samples t-test, and ANOVA tests are used to analyse the data. The results of the study show that ERE during the pandemic is not effective enough. However, having someone at home to support the education of children can make ERE more effective. Parents have partial health anxiety about face-to-face education. Although parents have partially positive opinions about the feasibility of home-schooling, they also emphasize the need for support for home-schooling. As the parents' education level increases, both the challenges of home-schooling and the need for support for home-schooling decrease. Parents with low income have higher health anxiety than those with high income, and parents with low income need more support for home-schooling than those with high income. Parents who support their children's learning find ERE more effective and they find home-schooling more feasible. Parents who do not support their children's learning at home need more support for home-schooling. To practice home-schooling successfully, parents must have high level of education and must support their children's learning at home. Besides, institutions and organizations support parents for home-schooling.

1. Introduction

The Covid-19 epidemic, which spread rapidly all over the world after emerging in the Wuhan province of China, was declared a pandemic by the World Health Organization. To minimize the spread of the Covid-19 epidemic, all places, including schools where human-to-human contact may occur, were closed (Bozkurt et al., 2020; Bozkurt & Sharma, 2020; Doghonadze et al., 2020; Gupta & Goplani, 2020). COVID-19 is the greatest challenge for national education systems have ever faced last 50 years (Crawford et al., 2020; Daniel, 2020). Nearly 200 countries shut down schools with over 90% of these learners ranging from early years through higher education facing some sort of disruption to their education (UNESCO, 2020). Education politicians have moved from face-to-face learning to online and distance education to solve the emerging education crisis (Can, 2020). Distance education during the pandemic was called Emergency Remote Education (ERE) since distance education was switched to very quickly without the necessary preparations because of necessity (Bozkurt, et al., 2020). This emergency has been experienced all over the world and its educational effects have been felt by all stakeholders from

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kindergarten to higher education. However, unlike other distance education, the ERE provided during this period mostly took place from home. ERE at home has caused families, teachers and students concern because families have to play a serious role in the education of their children. ERE at home has emerged as one of the alternative ways, as the global pandemic forced educators to find alternative ways to traditional face-to-face education. Although distance education is offered as an alternative to face-to-face education, the education in the process is a kind of experience of home-schooling practice. Home-schooling is one of the alternative education practices that offer opportunities to meet the students' qualified education needs by minimizing the risk of illness.

Home-schooling is an issue that has been raised and discussed in many countries. Although home-schooling practices first appeared in America, there are home-schooling practices in many countries in Europe (Ole, 1995: as cited in Kartal, 2014; Petrie, 1995: as cited in Kartal, 2014). There are no legal regulations on home-schooling in Turkey, although home-schooling practices are spreading rapidly, many countries adopt a policy of providing education in schools, which guarantees the future and continuity of societies. However, the COVID-19 pandemic revealed obstacles to the sustainability of face-to-face education in schools. Educational practices have been reshaped as home-schooling is mediated by technology tools, education-businesses, and other institutions (Williamson, Eynon & Potter, 2020). In this process, alternative practices have been used within ERE at home in Turkey. One of them is separate TV channels that are rapidly established and broadcast for each educational level. Another is the Education Information Network (EIN) used by teachers, students, and parents before. Another is the Education Information Network (EIN) created by the Ministry of National Education (MoNE) in 2012 to ensure technology integration in education, which was previously used by teachers, students, and parents. During the pandemic process, the EIN has been used more comprehensively and intensively by the stakeholders. Another option was the use of applications that allow making live lessons faster, easier, and more smoothly. Applications such as Zoom, Teams, were actively used for online lessons. WhatsApp was also used to communicate teacher-parent / teacher-student. During the pandemic process, education took place at home as ERE, thus increasing the responsibilities of parents regarding the education of their children. For this reason, it is necessary to reveal the opinions of the parents about the ERE at home.

There are few studies related to home-schooling in Turkey. Some of these studies are literature studies about home-schooling practices in different countries (Aydin & Pehlivan, 2000; Aydogan, 2007; Kaya, 2015; Sad & Akdag, 2010; Tasdan & Demir, 2010; Tosten & Elcicek, 2013) others are field survey (Oz, 2008). Some studies examine the views of stakeholders regarding the feasibility of home-schooling in Turkey (Dogan Kilic & Onen, 2012; Kartal, 2014; Korkmaz & Duman, 2014; Memduhoglu, Mazlum & Alav, 2015; Tasdan & Demir, 2013). Because there are no legal arrangements in Turkey regarding home-schooling, these studies, in which stakeholders' views on the feasibility of home-schooling are determined, are related to practice. However, the ERE practices during the pandemic enabled parents, who played an important role in their children's education, to experience home-schooling, albeit indirectly. In this context, the parents' views on ERE practices at home will provide both evidence for the feasibility of home-schooling and important inferences to educate politicians and researchers regarding future educational practices.

2. Literature

2.1. Concept of Home-schooling and Types of Home-schooling

Home-schooling is a practice where individuals at the age of compulsory education take all or desired part of the responsibility for learning at their homes without going to public or private schools, and are the teacher's parents or those determined by the parents (Aydin, 2015; Basham, Merrifield & Hepburn, 2007; Hess, 2002, as cited in Farrell & Ryan, 2006; Kaya, 2015; Mulyadi, Rahardjo & Basuki, 2016; Reich, 2005; Sad & Akdag, 2010; Sumardiono, 2007). The teacher chosen by the parent can be another member of the family or a tutor. In home-schooling practices, where it is emphasized that education can

be much better than schools (Molsbie, 1996), learning and teaching are planned to a certain extent (Fields Smith & Williams, 2009).

While homeschools are classified by Van Galen (1988) in two types as ideological and pedagogical mobility, Nemer (2002) added environmental mobility besides these. Families, who adopt home-schooling in terms of ideological mobility, sustain suitable home-schooling for their children because of the differences in their religious beliefs, cultural characteristics, world views, power balances, and social status (Nemer, 2002; Olivos, 2009). Families who adopt home-schools in terms of pedagogical mobility generally sustain home-schooling because of the inferior quality of education in schools. Families, who think that financial difficulties in schools will affect the quality of education (Nemer, 2002) aim to raise their children better and effectively. Families who adopt home-schooling in terms of environmental mobility prefer home-schooling because they are uncomfortable with the school environment (Nemer, 2002).

2.2. History of Home-schooling

The history of home-schooling dates back to a few thousand years ago because in the periods when schooling was not developed, education was mostly carried out at home and in the family. Specially hired teachers provided the education, which was more for the rich groups. Also, the limited number of educational institutions educated a few people, as they had limited opportunities. However, with the industrial revolution, enormous masses of people have gained the opportunity of an education. For some ideological, pedagogical, and environmental reasons in the 20th century, the practice of home-schooling came back to the agenda. Some studies show the 1960s and some studies the 1980s as the beginning of home-schooling practices. The reason the 1980s were accepted as the beginning for home-schooling is that home-schools were legally accepted in these years. However, to better understand the practice of home-schooling, it has to be studied since 1960.

Since there was no legal obligation in education in America until the 1960s, education was obligatory for families. However, after the 1960s, when education became a legal obligation, this responsibility of the family was given to schools (Kaya, 2015). Home-schooling has emerged as a necessity when the number of schools is limited in America (Lines, 1991: as cited in Aydin & Pehlivan, 2000). In this period, it is possible to say that home-schooling practices were far from contemporary home-schooling understanding, and were based on necessity. Until the early 1960s, home-schooling was not supported because it was an alternative to compulsory public schools (Basham, Merrifield & Hepburn, 2007) and as a movement against the government. This home-schooling movement started under the influence of its theoretical traces concerning the liberal left (Tasdan & Demir, 2010). However, the number of conservative families trying to implement home-schooling is quite high. Even though the schools reached sufficient numbers after the 1960s, some traditional - conservative - groups preferred that their children continue their education at home (Lines, 1991: as cited in Aydin, & Pehlivan, 2000). While these conservative families maintained the same attitude in the 1970s (Isenberg, 2006), with the adoption of the "child-centred learning" philosophy, families who adopted this philosophy preferred their children to be educated at home (Lines, 1991: as cited in Aydin, & Pehlivan, 2000). In 1980, the supporters of home-schooling practices attempted to make home-schooling legal, but no positive results were achieved. In 1983, the national organization of the Home School Legal Defence Association (HSLDA) was established (Isenberg, 2007). Besides, home-schools were legally recognized in four states in the USA in 1983 (Vender, 2004). In the following years, many states except Texas accepted home-schools as legal (Nelson, 1985). With the legal acceptance of home-schools, the spread of practices related to home-schooling on the Internet sped up in the 1990s. Thus, home-schooling has been effective not only in traditionally conservative families but also in a large part of society (Stevens, 2001, as cited in Isenberg, 2006). In 1994, home-schooling became an alternative education that could be legally applied in all states of the USA (Howell & Sheran, 2008). In the following years, a rapid increase was observed in the number of families who preferred home-schooling (Basham, Merrifield & Hepburn, 2007; Jackson, 2007). Home-

schooling has been practiced in many countries in Europe as well as in America and has become legal (Ole, 1995: as cited in Kartal, 2014; Petrie, 1995: as cited in Kartal, 2014). In Turkey, there are no legal regulations on home-schooling. However, as a non-governmental organization, the "Education Home and Home School Association", which was established in 2017, plans activities to meet the needs of both students and families.

2.3. Why home-schooling is preferred by families?

The reasons home-schools are preferred by families vary. These reasons can be listed as follows:

• Ensuring the physical safety of children (Mayberry et al., 1995; NHES, 2012; Princiotta, Bielick & Chapman, 2006),

• Belief in the inadequacy of education that children receive at school and ensuring that they reach high academic standards at home (Mayberry et al., 1995; NHES, 2012 Princiotta, Bielick & Chapman, 2006),

• Providing the religious and moral education of children (NHES, 2012; Princiotta, Bielick, & Chapman, 2006),

• Having physical and mental health problems of the child (NHES, 2012; Princiotta, Bielick, & Chapman, 2006),

• Children have different special needs (learning style, learning speed, etc.), (NHES, 2012; Princiotta, Bielick, & Chapman, 2006),

• Families wanting to be together with children and supporting individual education (Mayberry et al., 1995; NHES, 2012; Princiotta, Bielick & Chapman, 2006),

• Families not being able to allocate sufficient funds for their children's education at school (Green & Hoover-Dempsey, 2007; NHES, 2012).

2.4. Advantages and limitations of home-schooling

It is possible to say that the primary reason for the spread of home-schooling is the benefits it provides. The benefits of home-schooling are parallel to why home-schooling is preferred. We can list the benefits of home-schooling and the factors in these benefits as follows:

• Academic achievement: Studies conducted in many countries report that children who are educated at home are more successful than their peers who are educated in both public and private schools (Basham, Merrifield & Hepburn., 2007; Rothermel, 2011). However, the education level of parents matters in children's achievement (Basham, Merrifield & Hepburn, 2007; Ray, 2006). Accordingly, children educated at home by more educated parents are more successful than children educated by less educated parents (Basham, Merrifield & Hepburn, 2007). However, in the comparison between children who were educated at home by parents with the same educational level and those who were educated at school, it was observed that children who were educated at home were more successful (Basham, Merrifield & Hepburn, 2007). Also, one-to-one education enables their children to show high academic performance (Farrel & Ryan, 2006; Rothermel, 2011; Fields Smith & Williams, 2009).

• Opportunity for students to gain certain values or beliefs (Basham, Merrifield & Hepburn, 2007).

• Opportunity to develop closer and stronger parent-child relationships (Basham, Merrifield & Hepburn, 2007; Ray, 2006; Romanowski 2001).

• Opportunity to interact with peers or adults in a more qualified way (Basham, Merrifield & Hepburn., 2007; Ray, 2006; Rothermel, 2011).

• Not being affected by the negativities caused by the lack of discipline in public schools (Basham, Merrifield & Hepburn, 2007).

• Being able to be protected from negative peer behaviours (drugs, alcohol, premarital sexual intercourse, etc.) (Basham, Merrifield & Hepburn, 2007).

• The disappearance of the financial burden of public or private schools (Basham, Merrifield & Hepburn, 2007; Ray, 2006).

• Having a safer physical learning environment (Basham, Merrifield & Hepburn, 2007).

• It is easy and cheap to access many materials for teaching via the internet (Farrel & Ryan, 2006).

• Providing a high level of self-perception without peer pressure is far from being compared (Farrel & Ryan, 2006; Ray, 2006).

Home-schooling has advantages and limitations. We can list the limitations of homeschools as follows:

• Home-schooling negatively affects the socialization of the child (Farrel & Ryan, 2006; Reich, 2005; Romanowski, 2001).

• Families who practice home-schooling are not well-educated and inadequate for teaching qualification negatively affect the development of the child (Farrel & Ryan, 2006).

• Home-schools require families to invest resources in terms of time, energy, money, knowledge, and skills (Green & Hoover Demsey, 2007).

• If a parent does not have a job to take care of the child, it negatively affects the family economy (Farrel & Ryan, 2006).

• Accreditation is one of the biggest problems of home-schooling (Aydin, 2015).

• Home-schooling has an educational practice far from eliminating social inequalities (Apple, 2000; Crowson, 2000).

• There are serious doubts that children who do not attend formal education institutions will grow up as good citizens (Lubienski 2000).

2.5. Aim of the Study

The general aim of the study is to examine parents' opinions about ERE during the pandemic and feasibility of the home-schooling in Turkey. In this context, we seek answers to the following questions:

1. What are the levels of the parents' opinions about ERE for home-schooling?

2. a. Is there any significant difference among the level of the parents' opinions about ERE for home-schooling regarding their gender?

2. b. Is there any significant difference among the level of the parents' opinions about ERE for home-schooling regarding their education levels?

2. c. Is there any significant difference among the level of the parents' opinions about ERE for home-schooling regarding their partner's education levels?

2. d. Is there any significant difference among the level of the parents' opinions about ERE for home-schooling regarding their income?

2. e. Is there any significant difference among the level of the parents' opinions about ERE for home-schooling to support their children's learning?

3. Methodology

The causal-comparative model is used in the study. Causal comparison is a research model that examines the causes and effects of a previously realized or existing event as it exists without intervention in its conditions (Fraenkel, Wallen & Hyun, 2011; Sozbilir, 2014).

3.1. Sample

The sample of the study is selected using two stage sampling methods. The first stage is the purposeful sampling method which comprises the parents whose children continue to be K-12 during the pandemic in Turkey. The second stage is the snowball sampling method. With this method, it is ensured that the parents, who are selected with purposeful sampling, conveyed the questionnaire to the parents with similar characteristics. Thus, the sample of the study comprises 654 parents. In the selection of parents taking part in the study, we try to represent different demographic characteristics in the sample. The sample of the study comprises parents living in 18 different provinces in Turkey. We show descriptive information about the sample in Table 1.

Table 1.

Descriptive statistics of the participants

Variable	Categories	N	%
Gender	Female	469	71,7
	Male	185	28,3
Employment status	Unemployed	350	53,5
	Employee	304	46,5
Education level	illiterate	23	3,5
	Primary-secondary school degree	260	39,8
	High school degree	137	20,9
	Associate/ bachelor degree	193	29,5
	Postgraduate degree	41	6,3
Partner's education level	illiterate	18	2,8
	Primary-secondary school degree	274	41,9
	High school degree	144	22,0
	Associate/ bachelor degree	184	28,1
	Postgraduate degree	34	5,2
Level of income	Low	285	43,6
	Medium	259	39,6
	High	110	16,8
The person who supports child learning at home	No	527	80,6
	Brother/sister	121	18,5
	Other	6	,9
Lesson support for the child	No	380	58,1
	Yes	274	41,9

72% of the parents taking part in the study are female and 49% are male. 54% of the parents are unemployed and 46% of them are employed. 3% of the parents are illiterate, 40% of them have a primary-secondary school degree, 21% have a high school degree, 30% have an Associate/ bachelor degree, 6% have a post-graduate degree. 3% of the partners are illiterate, 42% of them have a primary-secondary school degree, 22% have a high school degree, 28% have associate/ bachelor degrees, 5% have a post-graduate degree. 44% of parents have low income, 40% middle income, and 16% high income. 81% of the parents stated that there is no one at home to support their children's learning, and 19% stated that there is. 58% of the parents stated that they can teach at least one lesson to their children, while 42% cannot.

3.2. Data Collecting Tools

The personal information form and the ERE for the home-schooling questionnaire are used to collect the research data. The ERE for home-schooling questionnaire developed by the researchers is used to determine the parents' opinion about the effectiveness of ERE and home-schooling. The item pool containing 25 items is created by the researchers in the first stage of the ERE for the home-schooling questionnaire development process. To ensure the content validity of the questionnaire, we consult the opinions of 4 experts on these items. Since the questionnaire includes items related to distance education, anxiety, and home-schooling, 4 experts studying distance education, anxiety, home-schooling, and curriculum evaluation are chosen. In line with the opinions of the experts, corrections were made in the items and a 20-item ERE for home-schooling questionnaire is created. To determine the comprehensibility of the questionnaire items, we consulted the opinions of two experts in the Turkish language. Besides, we took the opinions of 5 parents in the sample regarding the comprehensibility of the items.

Exploratory Factor Analysis (EFA) is conducted to determine the construct validity of the ERE for the home-schooling questionnaire. EFA, which is one of the multivariate analyses to test construct validity of measurement tools, is used to reveal structures of which structure is not known exactly because it comprises different components (Can, 2014). EFA is carried out using 654 data collected for the study and providing the prerequisites for factor analysis. Kaiser-Meyer-Olkin's (KMO) coefficient is calculated as ".793". Bartlett's sphericity test (3252.064; p = .000) is found significant. This finding shows that the sample size is good enough for factor analysis (Buyukozturk, 2010). The principal components analysis method is used in EFA. In EFA, the following criteria (Buyukozturk, 2010; Cokluk, Sekercioglu & Buyukozturk, 2010) are considered in the extraction of items and in determining the factors:

- Items in each factor must be coherent in terms of meaning and content,
- Factor eigenvalues must be 1 or above 1,
- The item in a factor must have a factor load of ".40" or more,
- The gap between the factor loading values in the factor of the items and the factor loading values in the other factors must be at least ".10" and higher.

The scree plot and the criteria mentioned above are considered to determine the number of factors. It is thought that the 5-factor structure is appropriate for the questionnaire. After the first two-factor analysis, one item in the scale (item 8) is eliminated because it is not meeting the criteria above. As a result of EFA, the ERE for home-schooling questionnaire comprising 19 items and 5 factors and explaining 56% of the total variance is obtained. In multi-factor measurement tools, the total variance explained should be over 30% (Buyukozturk, 2010). Therefore, it can be said that the total variance explained by the scale (56%) is sufficient. The factor loads of the items vary between ".417" and ".854". Considering that the factor load of an item on a factor should be a minimum of 0.32 (Tabachnick & Fidell, 2013), it can be said that the obtained factor loadings are sufficient. The content of the items is considered when naming the factors. In this context, factors are named as Effectiveness of ERE, Health anxiety, Feasibility of home-schooling, Challenge of home-schooling, and Need of home-schooling support. The total score is not calculated for the ERE for the home-schooling questionnaire, as the factors that occurred were prepared in a slightly correlated. In this context, the factors are seen as subscales.

Cronbach's Alpha internal consistency coefficient is calculated to determine the reliability of the ERE for the home-schooling questionnaire because the Cronbach's Alpha coefficient shows how consistent the test items are in their entirety (Buyukozturk et al., 2010). The Cronbach's alpha coefficients of the scale are calculated ".79" for Feasibility of home-schooling, ".69" for Effectiveness of ERE, ".73" for Health anxiety, ".65" for Challenge of home-schooling, ".85" for Need of support for home-schooling, and ".80" for the entire scale. Kline (2011) states that the reliability coefficient is excellent around home-schooling

support ".80", sufficient around ".70", and insufficient under ".50". The results show that the ERE for home-schooling questionnaire is a valid and reliable measurement tool that can measure parents' perception of ERE for home-schooling.

3.3. Data Collection Processes and Ethical Issues

Due to the pandemic, research data are collected using Google Forms. In this form, firstly, it is asked whether the parent have a child or children continue to be K-12 during the pandemic or not. The parent who answers "Yes" proceeds to the next step of the form. The parent who answers “No” cannot proceeds to the next step of the form and the form is terminated for that parent. Participation in the study is voluntary. Thus, the Google docs form created includes the voluntary informed consent form, personal information form, and questionnaire form for the participants. The Google form link is delivered to the parents using WhatsApp, e-mail, and social media tools. The data collected through Google Forms were downloaded and transferred to the statistical analysis program.

3.4. Data Analysis

Descriptive statistics (mean, standard deviation), t-test, and ANOVA test is used in the analysis of the data. Before the analyses are carried out, it is checked whether the data met the prerequisites of the analyses to be conducted. The data should be at least in the range scale, show normal distribution, and assumptions of equal group variances should be ensured to use parametric tests such as t-test and ANOVA test (Can, 2014). To provide these assumptions, the data were reviewed and descriptive statistics are conducted to determine whether the items' skewness and kurtosis values are between "∓1 ", and whether z scores are between "∓3.28" (Cokluk, Sekercioglu & Buyukozturk, 2010; Field, 2009). Skewness and kurtosis values and z scores of the items are calculated. Besides, the distribution of the data is examined visually through histograms and P-P graphics. 96 data were excluded from the analysis. The analysis of the research is carried out using 654 data that met the prerequisites for the analyses to be conducted.

4. Findings

In this section, the levels of the parents' opinions about ERE for home-schooling are compared separately in terms of their gender, education levels, partners' education levels, income, and supporting children's learning.

R.Q.1. What are the levels of the parent's opinions about ERE for home-schooling?

Mean and the standard deviation are calculated to determine the level of parents' opinion about ERE for home-schooling. The analysis results regarding the level of parents' opinion about ERE for home-schooling are shown in Table 2.

Table 2.

Descriptive Statistics of the ERE Questionnaire for Home-schooling

Factor	N	Mean	Std. Deviation
Effectiveness of ERE	654	2,31	,73
Health anxiety	654	2,74	,86
Feasibility of home-schooling	654	3,29	,77
Challenge of home-schooling	654	2,45	,70
The need for support for home-schooling	654	2,87	1,21

As seen in Table 2, the mean of parent's opinion about "Effectiveness of ERE" is M = 2.31 standard deviation SD = .73. This finding indicates that the effectiveness of ERE is strikingly low. In other words, parents point out that ERE applications do not meet the educational needs of their children. The mean of

parent's opinion about "Health anxiety" is M = 2.74 standard deviation SD =.86. This shows that parents have partial health anxiety regarding face-to-face education. The mean of parent's opinion about "Feasibility of home-schooling" is M = 3.29 standard deviation SD =.77. This finding shows that the parents' views on the practice of home-schooling are partially positive. But the mean of parent's opinion about "Need for support for home-schooling" is M = 2.87 standard deviation SD = 1.21. This suggests that parents need some support for home-schooling practice. The mean of parent's opinion about the "Challenge of home-schooling" is M = 2.45 standard deviation SD =.70. The findings show that the challenges of home-schooling for parents are low. In other words, parents think that they can overcome the difficulties they encounter in home-schooling practice.

R.Q.2.a. Is there any significant difference among the level of the parents' opinions about ERE for home-schooling regarding their gender?

Independent samples t-test is used to determine whether the level of parents' opinion about ERE for home-schooling differs significantly in terms of their gender. T-test results are shown in Table 3.

Table 3.

The Comparison of the ERE Questionnaire for Home-schooling Sub-Dimensions In terms of Gender Variable

Sub-Dimensions	Gender	N	Mean	Std. Deviation	p	t
Effectiveness of ERE	Female	469	2,31	,71	,876	-,155
	Male	185	2,32	,76		
Health anxiety	Female	469	2,81	,87	**,000**	**3,536**
	Male	185	2,56	,77		
Feasibility of home-schooling	Female	469	3,28	,75	,747	-,322
	Male	185	3,30	,81		
Challenge of home-schooling	Female	469	2,43	,73	,578	-,556
	Male	185	2,46	,62		
The need for support for home-schooling	Female	469	2,93	1,21	**,025**	**2,247**
	Male	185	2,70	1,20		

A significant difference is found in favour of mothers in the factors of "health anxiety" [t (652) = 3.536, p <.05] and "Need for support for home-schooling" [t (652) = 2.247, p <.05] in terms of gender variable. While the mean of mothers' health anxiety is M = 2.81, the mean of fathers is M = 2.56. While the mean of mothers' need for support for home-schooling is M = 2.94, the mean of fathers is M = 2.70.

R.Q.2.b. Is there any significant difference among the levels of the parents' opinions about ERE for home-schooling regarding their education levels?

One-way analysis of variance (ANOVA) is used to determine whether the levels of the parents' opinions about ERE for home-schooling differ significantly in terms of their education level. The ANOVA results are shown in Table 4.

Table 4.

The Comparison of the ERE Questionnaire for Home-schooling Sub-Dimensions In terms of Education Level Variable

Sub-Dimensions		Sum of square	df	Mean square	F	p	Difference Groups
Effectiveness of ERE	Between Groups	2,003	4	,501	,951	,434	
	Within Groups	341,678	649	,526			
	Total	343,681	653				
	Between Groups	4,529	4	1,132	1,542	,188	
Health anxiety	Within Groups	476,608	649	,734			
	Total	481,137	653				
Feasibility of home-schooling	Between Groups	3,387	4	,847	1,417	,227	
	Within Groups	387,803	649	,598			
	Total	391,190	653				
Challenge of home-schooling	Between Groups	14,968	4	3,742	7,867	,000	*0>4,

	Within Groups	308,694	649	,476			1>2, 1>3,
	Total	323,663	653				1>4
	Between Groups	85,654	4	21,414	15,857	,000	*0>3,
The need for support for home-schooling	Within Groups	876,418	649	1,350			1>3, 1>4,
	Total	962,072	653				2>3, 2>4

*0=illiterate, 1=Primary-secondary school degree, 2=High school degree, 3=Associate/ bachelor degree, 4= Postgraduate degree

The ANOVA results reveal that the levels of the parents' opinions about ERE for home-schooling differ significantly in the "challenges for home-schooling" factor (F= 7,867; p=.000) in terms of their education levels. While the mean of illiterate parents regarding the difficulties of home-schooling is M= 2.68, the mean of parents with a postgraduate degree is M= 2.15. Besides, while the mean of parents with primary school degrees regarding the challenge of home-schooling is M= 2.60, the mean of parents with a high school degree is M= 2.37, a bachelor's degree M= 2.32, a postgraduate degree is M= 2.15.

The other results revealed the levels of the parents' opinions about ERE for home-schooling differ significantly in the "the need for support for home-schooling" factor (F= 15,857; p=.000) in terms of their education levels. While the mean of illiterate parents regarding the need for support for home-schooling is M= 3.57, the mean of parents with a bachelor's degree is M= 2.57. Also, while the mean of parents with primary school degrees regarding the need for support for home-schooling is M= 3.14, the mean of parents with a high school degree is M= 2.37, a bachelor's degree M= 2.32, a postgraduate degree is M= 2.15.

R.Q.2.c. Is there any significant difference among the level of the parents' opinions about ERE for home-schooling regarding partner's education levels?

One-way analysis of variance (ANOVA) is used to determine whether the levels of the parents' opinions about ERE for home-schooling differ significantly in terms of the partner's education level. The results are shown in Table 5.

Table 5.

The Comparison of the ERE Questionnaire for Home-schooling Sub-Dimensions In terms of Partners' Education Levels Variable

Sub-Dimensions		**Sum of square**	**df**	**Mean square**	**F**	**p**	**Difference Groups**
Effectiveness of ERE	Between Groups	5,287	4	1,322	**2,535**	**,039**	*1>2
	Within Groups	338,394	649	,521			
	Total	343,681	653				
	Between Groups	3,374	4	,844	1,146	,334	
Health anxiety	Within Groups	477,763	649	,736			
	Total	481,137	653				
Feasibility of home-schooling	Between Groups	1,270	4	,317	,528	,715	
	Within Groups	389,921	649	,601			
	Total	391,190	653				
Challenge of home-schooling	Between Groups	14,057	4	3,514	**7,367**	**,000**	*1>3, 1>4
	Within Groups	309,606	649	,477			
	Total	323,663	653				
The need for support for home-schooling	Between Groups	86,272	4	21,568	**15,983**	**,000**	*1>2, 1>3, 1>4
	Within Groups	875,800	649	1,349			
	Total	962,072	653				

*0=illiterate, 1=Primary-secondary school degree, 2=High school degree, 3=Associate/ bachelor degree, 4= Postgraduate degree

The results reveal the levels of the parents' opinions about ERE for home-schooling differ significantly in the "effectiveness of ERE" factor (F= 2,535; p=.039) in terms of partners' education levels. While the mean of illiterate parents regarding the effectiveness of ERE is M= 2.68, the mean of parents with a postgraduate degree is M= 2.15.

The other results revealed the levels of the parents' opinions about ERE for home-schooling differs significantly in the "challenge for home-schooling" factor (F= 7,367; p=.000) and the "need of support for home-schooling" factor (F= 15,983; p=.000) in terms of partners' education level. While the mean of parents with primary school degrees regarding the challenge of home-schooling is M= 2.60, the mean of parents with a bachelor's degree is M= 2.47 and a postgraduate degree is M= 2.24. Besides, while the mean of parents with primary school degrees regarding the need for support for home-schooling is M= 3.27, the mean of parents with a high school degree is M= 2.76, a bachelor's degree M= 2.46, a postgraduate degree is M= 2.35.

R.Q.2.d. Is there any significant difference among the level of the parents' opinions about ERE for home-schooling regarding their income?

One-way analysis of variance (ANOVA) is used to determine whether the levels of the parents' opinions about ERE for home-schooling differ significantly in terms of their income. The results are shown in Table 6.

Table 6.

The Comparison of the ERE Questionnaire for Home-schooling Sub-Dimensions In terms of Parent's Income Variable

Sub-Dimensions		Sum of square	df	Mean square	F	p	Difference Groups
Effectiveness of ERE	Between Groups	1,888	2	,944	1,798	,166	
	Within Groups	341,793	651	,525			
	Total	343,681	653				
Health anxiety	Between Groups	4,954	2	2,477	**3,386**	**,034**	Low>High
	Within Groups	476,183	651	,731			
	Total	481,137	653				
Feasibility of home-schooling	Between Groups	,661	2	,331	,551	,576	
	Within Groups	390,529	651	,600			
	Total	391,190	653				
Challenge of home-schooling	Between Groups	2,528	2	1,264	2,562	,078	
	Within Groups	321,135	651	,493			
	Total	323,663	653				
The need for support for home-schooling	Between Groups	85,825	2	42,912	**31,881**	**,000**	Low>Medium
	Within Groups	876,247	651	1,346			Low>High
	Total	962,072	653				

The results revealed that the levels of the parents' opinions about ERE for home-schooling differ significantly in the "health anxiety" factor (F= 3,386; p=.034) in terms of their income level. While the mean of low-income parents regarding the "health anxiety" is M= 2.81, the mean of high-income parents is M= 2.56.

The other results revealed the levels of the parents' opinions about ERE for home-schooling differ significantly in the "need of support for home-schooling" factor (F= 31,881; p=.000) in terms of their income level. While the mean of low-income parents regarding the need for support for home-schooling is M= 3.27, the mean of medium-income parents is M= 2.63, and high-income parents M= 2.87.

R.Q.2.e. Is there any significant difference among the level of the parents' opinions about ERE for home-schooling to support their children's lessons?

Independent samples t-test is used to determine whether the level of parents' opinion about ERE for home-schooling differs significantly to support their children's lessons. T-test results are shown in Table 7.

Table 7.

The Comparison of the ERE Questionnaire for Home-schooling Sub-Dimensions to Support Their Children's Lessons Variable

Sub-Dimensions		N	Mean	Std. Deviation	p	t
Effectiveness of ERE	No	380	2,24	,70	**,003**	**-2,955**
	Yes	274	2,41	,74		
Health anxiety	No	380	2,73	,81	,935	-,082
	Yes	274	2,74	,92		
Feasibility of home-schooling	No	380	3,14	,75	**,000**	**-5,770**
	Yes	274	3,49	,75		
Challenge of home-schooling	No	380	2,48	,73	,077	1,774
	Yes	274	2,38	,64		
The need for support for home-schooling	No	380	3,01	1,14	**,000**	**3,573**
	Yes	274	2,66	1,27		

A significant difference is found in the factors of "Effectiveness of ERE" [t (652) = -2.955, p <.05], "Feasibility of home-schooling" [t (652) = -5.770, p<.05], and "Need of support for home-schooling" [t (652) = 3.573, p <.05] in terms of whether parents support their children's learning at home.

While the mean of parents who supports their children's learning at home regarding the factor "Effectiveness of ERE" is M= 2.41, the mean of parents who do not supports their children's learning at home is M=2.24. In other words, parents who support their children's learning at home find ERE more effective than parents who do not supports their children's learning at home.

While the mean of parents who supports their children's learning at home regarding the factor of "Feasibility of home-schooling" is M=3.49, the mean of parents who do not support their children's learning at home is M=3.14. In other words, parents who support their children's learning at home have a positive opinion regarding the feasibility of home-schooling than parents who do not support their children's learning at home.

While the mean of parents who supports their children's learning at home regarding the factor of "Need for support for home-schooling" is M= 2.66, the mean of parents who do not support their children's learning at home is M=3.01. In other words, parents who support their children's learning at home need less support for home-schooling than parents who do not support their children's learning at home.

5. Result and Discussion

The results of the study show that ERE is not effective, but parents have partial health anxiety about face-to-face education. Although parents have partially positive opinions about the feasibility of home-schooling, they also need support to overcome the challenges of home-schooling. Also parents' emphasis on the low challenges of home-schooling can be considered as an important evidence for the feasibility of home-schooling. Parents need support to cope with the challenges of home-schooling. In the study of Yurtbakan and Akyildiz (2020), parents state that ERE is partially sufficient, but its quality is low due to reasons such as short course time and lack of feedback. For this reason, parents prefer face-to-face training. There are other national and international studies showing the inferior quality of ERE (Cakin & Kulekci Akyavuz, 2020; Can, 2020). Also, the pandemic has shown that the open and distance education system in Turkey should be strengthened in terms of infrastructure, access, security, content, design, implementation, quality, legislation, and pedagogical (Can, 2020). It is expected that the quality of the ERE is low because of the rapid and unprepared transition to ERE. However, all education stakeholders have gained important experiences regarding ERE in this process. It is thought that these experiences of the parents positively affect their opinion on the feasibility of home-schooling, but it can be said that home-schooling has partial challenges for parents. Therefore, parents need support for home-schooling. Parents have more responsibilities for managing their children's learnings (Greenhow, Lewin & Staudt Willet, 2020) in this process. Therefore, parents having difficulties with balancing responsibilities, learner

motivation, accessibility, and learning outcomes (Garbe et al., 2020). However parents' health anxiety can make them more eager for their children to receive home-schooling. Because home-schooling ensures the physical safety of children (Mayberry et al., 1995; NHES, 2012; Princiotta, Bielick & Chapman, 2006). Therefore, parents strive to cope with these responsibilities. To fulfil these responsibilities, parents need support such as financial support, providing educational resources, providing information technology infrastructure (internet, tablet, computer, etc.), and educational consultancy support. Because Home-schooling requires families to invest resources in terms of time, energy, money, knowledge, and skills (Green & Hoover Demsey, 2007).

Results of the study show that mothers have higher health anxiety and need more support for home-schooling. Mothers can be more sensitive about their children's health than fathers because of their nature. They think that face-to-face education poses a risk to their children's health during the pandemic. Because home-schooling ensures the physical safety and health of their children (Mayberry et al., 1995; NHES, 2012; Princiotta, Bielick & Chapman, 2006), mothers prefer home-schooling. It is thought that mothers' need for support for home-schooling is related to both the cultural and educational level of mothers. In the traditional Turkish family structure, the mother is more responsible for the care and education of the children (Ozensel, 2004; Yavuzer, 2003; Yorukoglu, 2004). Although this understanding has changed in recent years, its effect partially continues. As ERE increases the responsibility of parents (Garbe et al., 2020), the responsibility of mothers in the education of their children has increased even more. Besides, the mothers in the sample have a low level of education and most of them are unemployed. The low level of education causes mothers to have difficulties in supporting their children's learning. Also, it is known that families who practice home-schooling are not well-educated and inadequate for teaching qualification negatively affect the development of the child (Farrel & Ryan, 2006). Therefore, mothers with low education levels need more support for home-schooling.

The results of the study show that as the education level of parents increases, both the difficulties of home-schooling and the need for support for home-schooling decreases. Because parents with a high level of education have more academic knowledge and experience, they can support their children's learning more. Therefore, they can contribute to students' learning-teaching processes. Another finding of the study supports this result. Another result of the study shows that as the education levels of partners decrease, both the challenges of home-schooling and the need for support for home-schooling increase. Also, as the education levels of partners increase, their opinions on the effectiveness of ERE become more negative. Parents prefer home-schooling to be with their children, to contribute to their education, and to provide them a better education (Mayberry et al., 1995; NHES, 2012; Princiotta, Bielick & Chapman, 2006). The education level of parents is very important to educate children because it is known that the education level of parents matters in children's achievement (Basham, Merrifield & Hepburn., 2007; Ray, 2006). As the parents' education level increases, their knowledge and awareness of their children's education also increase. The fact that parents with a high level of education find ERE less effective can be evaluated in this context. The results of the study show that the education level of the parents is very important in the practice of home-schooling.

The results of the study show that parents with low-income have higher health concerns than those with high-income and parents with low-income need more support for home-schooling than those with high-income. The education level of parents is an important determinant of their income level because the high level of education provides an advantage both in terms of job opportunities and high-income level (Alpaydin, 2008; Caliskan, 2007). Therefore, it can be said that parents with a high education level also have a high-income level. Parents with high income need less support for home-schooling, as their education level is also high. Because the education levels of parents matters in children's achievement (Basham, Merrifield & Hepburn, 2007; Ray, 2006) and home-schooling (Farrel & Ryan, 2006). As the education level of parents with low income is also low, they need more support for home-schooling. Higher health concerns of parents with low-income levels may be associated with both income level and

culture. Fathers generally work in families of parents with low income, and mothers are unemployment. This situation is the primary reason for the low-income level of the family. The unemployment of mothers is due to both their low educational level and cultural reasons (Ozaydinlik, 2014). According to the data of Turkish Statistical Institute (2020), the labor force participation rate of women with low education level in Turkey is quite low compared to women with high education level. The results of the study conducted by Yenilmez and Kilic (2018) also support this data. Since mothers with low income spend most of their days with their children, their bond with their children may be stronger. This bond may have made them more worried about their children's health. Also, the financial burden caused by the disease can worry low-income parents. However, this situation may have arisen only for the sample of the study.

Results of the study show that parents who support their children's learning both find ERE more effective and home-schooling more feasible. Parents who do not support their children's learning need more support for home-schooling. Home-schooling provides opportunities for one-to-one education of children. Also, one-to-one education increases the academic performance of children (Farrel & Ryan, 2006; Fields Smith & Williams, 2009; Rothermel, 2011). However, parents should allocate more time for one-to-one education of their children and they should be educated enough about education because it is known that parent support has shown significant contributions to the achievement of learners in a virtual learning environment (Borup et al., 2014; Feng & Cavanaugh, 2011; Lee & Figueroa, 2012; Makrooni, 2019; Woofter, 2019). If parents do not have the competencies to support their children's education, they need specialists or someone to support their children's education. In this context, the result of the study shows that having parents to support the education of the children at home makes home-schooling easier. Also parents who contribute to the education of their children at home emphasized ERE more effectively. Since these parents supported the children's learning during the ERE process, they enabled to their children to learn better. This result of the study shows that supporting the education of the children in the ERE process is crucial for both the effectiveness of ERE and the feasibility of home-schooling. Therefore, parents must take roles and responsibilities as their children participate in online education while experiencing increasing instructional responsibility for their child's learnings (Liu et al., 2010).

6. Conclusion

The study shows that ERE during the pandemic is not effective enough. But, having parents to support the education of the children at home can make distance and online education practices such as ERE more effective. Also the study shows that although parents have partial health concerns, their parents' opinions about the feasibility of home-schooling are positive. Parents' emphasis on the low challenges of home-schooling can be considered as an important evidence for the feasibility of home-schooling. But, the results indicate that parents need support for home-schooling to be feasible. Also parents with low educational and socioeconomic status need more support for home-schooling. This indicates that the education level and income level of parents are important for feasibility of home-schooling. The results of the study show that the parents' experience of the ERE process offers important opportunities for the practice of home-schooling. Because the responsibilities of the parents regarding the education of their children increased during the ERE process, they experienced home-schooling, although it was not planned. For this reason, parents have had experience of what is required for the successful implementation of home-schooling. Consequently, to practice home-schooling successfully, parents must have a high level of education, have support their children's education at home. Also institutions and organizations support parents for home-schooling practice. The support to be provided to parents for home-schooling should be diversified as financial support, expert/educator support, consultancy, technological infrastructure support.

7. Limitations and Further Studies

The study has limitations arising from both its sample and method. Therefore, the results obtained should be tested in larger samples and with different research methods. In this context, experimental studies should be conducted to determine the effectiveness of ERE. Mixed method studies should be conducted to determine parents' educational competencies and their level of contribution to the education of their children. Parents' support needs for home-schooling should be identified.

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The design framework for a mobile learning app on eating healthy: Connecting learner needs with app features

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Abstract

This paper aims to propose a design framework for learning technologist to design and develop a mobile learning app in the context of eating healthy. In other words, this study offers a number of theoretical and practical implications that can assist developers in creating more effective mobile apps. In exploring the research behind the foundational problem associated with this study, there are three main learning theories that provide a framework for the app design; the behaviorist perspective, the social constructivism, and the self-determination theory. Based on those theories behind the design, it can be said that personal profile, item search/scan, food snapshot, challenges, social, and resources might be the features of the app to support learning needs.

1. Introduction

It is safe to say that the majority of people are concerned about proper nutrition and eating healthy, probably more-so than ever. One might assume that with such a preoccupation on diet and nutrition our world would be full of healthy individuals. However, that couldn't be further from the truth. The latest statistics from the Centers for Disease Control and Prevention list that 600,000 individuals in the United States die from heart disease every year, that works out to 1 in every 4 deaths (U.S. Department of Health and Human Services, 2018). Similarly, the American Cancer Society reports that 585,720 people are expected to die from cancer in 2014 (U.S. Department of Health and Human Services, 2018). Furthermore, fewer people alive at 70 today survive until 90 than they did forty years ago (Fallon, 2011). It seems that instead of preventing deaths, the population is actually getting less healthy.

In addition to staggering disease rates, we live in a world where processed foods are the norm. Standard grocery stores are filled with hundreds of food items marketed as healthy with claims such as "all natural", "low fat", "low sodium" or "whole grain". If you take a close look at the back of many food items marketed as "natural" you might find a long list of ingredients, many of which are difficult to pronounce. To make matters worse, fad diets are prevalent in our mainstream and social media. Many of these popular diets are based on deprivation techniques (low carb, low fat, etc.) that make them difficult to consistently follow. So who can we trust? What are the real truths regarding healthy foods and our food industry? As consumers we're largely left to determine for ourselves what is healthy versus what is not and how to base our purchases on that knowledge.

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The Real Foodie app proposed in the enclosed paper is designed to calm some of these common confusions and to educate individuals, specifically young adults, on eating healthy. Real Foodie is a mobile application filled with a database of nutritional information on everyday items in food industry and offers a barcode scanning feature as well as a grading system for food items. In addition, the application will provide a profile that will allow users to track their buying habits, challenge their peers and additional activities that will provide scaffolds to support better eating habits. All of the information in the Real Foodie application is aligned with the movement to eat more "real food" and less processed food-like items.

To sum up, even the population is actually getting less healthy, it is getting easier to offer people learning opportunities anywhere and anytime by mobile apps. This paper aims to propose a design framework for learning technologist to design and develop a mobile learning app in the context of eating healthy. In other words, this paper offers a number of theoretical and practical implications that can assist developers in creating more effective mobile apps. The paper uses the example of Real Foodie to explain the design framework and features of the mobile learning app.

Beside, regarding the importance of the study, pedagogical factors have the greatest impact on students' success, intentions, and behavior when it comes to integrating mobile learning apps into learning process, which includes providing more diverse teaching contents/materials, strategies, and learning environments that can improve student learning performance (Suartama, Setyosari, & Ulfa, 2019). However, mobile app developers and instructional designers do not communicate well and do not work together most of the time. For this reason, most of the apps in the market lack of pedagogical factors. This causes learning losses. By providing a number of theoretical and practical implications in terms of pedagogical factors that can assist developers in creating more effective mobile apps. This paper bridges the gap in the learning technologies literature.

2. Theoretical Framework

In exploring the research behind the foundational problem associated with this study, there are three main learning theories that provide a framework for the Real Foodie app design. The first conceptual framework is the behaviorist perspective that stems from the work of Skinner (1974). At a very basic level, the theory suggests that rewarding a subject for particular behavior encourages the subject to behave in the same way in a similar situation (Clark, 2018). The reward reinforces behavior and conversely, if behavior is punished, the subject is less likely to repeat it. Behaviorists look at learning as a change in knowledge achieved through controlled stimulus/response conditioning. In behaviorism, people can learn not to do things as well as to do things (Skinner, 1974).

Driscoll (2000) distinguishes between two types of stimuli called primary and conditioned reinforcers. Based on this separation, primary reinforcers are stimuli whose reinforcement is biologically determined. Examples of primary reinforcers are food and sleep. Another type of stimulus, conditioned reinforcers are those that acquire reinforcement through an association with a primary reinforcer. Gold stars, money and points are all be examples of conditioned reinforcers (Seo & Lee, 2009).

Behaviorism, and conditioned reinforcers, are important elements of computer games and mobile apps (Paraskeva, Mysirlaki & Papagianni, 2010). Computer games are sometimes referred to as "skinner boxes" since they offer rewards or punishments for user behavior (Bogost, 2014). Computer games also typically rely on reinforcement, such as points, unlocks, power-ups and bonuses to increase the frequency and repetition of a desired behavior (Sümer & Aydın, 2018). Furthermore, Bogost (2014) argues that gamification is a simplistic behaviorist approach to game design. He states that, -ification involves simple, repeatable, proven techniques or devices: you can purify, beautify, falsify, terrify, and so forth. - ification is always easy and repeatable.

The second theoretical framework of this design is social constructivism. Constructivism, as a learning theory, stems from the burgeoning field of cognitive science, particularly the later work of Jean Piaget, and Lev Vygotsky (Fosnot & Perry, 2005). Constructivism, as perspective in education, is based on experiential learning through real life experience to construct and conditionalize knowledge (Tobin & Tippins, 1993).

The first aspect of constructivism is Piaget's Cognitive Constructivism (Wadsworth, 1996). He proposed and demonstrated through much research that the mechanism promoting change in cognition was the same as that in evolution - namely, equilibration. Equilibration was described by Piaget (1977) as "a dynamic process of self-regulated behavior balancing two intrinsic polar behaviors, assimilation and accommodation. Assimilation is activity, the organization of experience; it is the individual's self-assertive tendency, a tendency to view, understand, and act on the 'surround' with one's own activity or ideas in order to preserve one's autonomy as a part within a whole system." In addition, accommodation is comprised of reflective, integrative behavior which serves to change one's own self and explicate the object, in order to function with cognitive equilibrium in relation to it (Piaget, 1977).

The second aspect of the constructivist theory is Vygotsky's Social Constructivism. Vygotsky describe the Zone of Proximal Development as the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers (Vygotsky, 1978). One of the most important practical implications of social constructivism for education is Honebein (1996)'s seven goals for the design of constructivist learning environments. Here are Honebein's seven items that it has also used in the design decisions of Real Foodie;

- Providing experience with the knowledge construction process,
- Providing experience in and appreciation for multiple perspectives,
- Embedding learning in realistic and relevant contexts,
- Encouraging ownership and voice in the learning process,
- Embedding learning in social experience,
- Encouraging the use of multiple modes of representation,
- Encouraging self- awareness of the knowledge construction process.

After reading through Honebein (1996)'s seven goals for the design of constructivist learning environments, it was decided to use these goals in the design. For example, food snapshot feature is an example of embedding learning in both realistic and social content. The items in the food snapshot feature are real, and allow users to share them with their peers. Additionally, based on the item they scan, multiple modes of nutritional information are represented, which allows users to choose how they share the items they scan, or conversely, keep them in their profile.

Last theory that was taken into account in designing this application for learner needs was the self-determination theory, as depicted by Ryan and Deci (2000). The purpose of their study was to investigate extrinsic and intrinsic motivation in learners, as well as the importance of such supportive elements in effective learning environments. Extrinsic motivation is understood to be when learners are motivated to do tasks with the reinforcer being outside of themselves. An example of extrinsic motivation may be motivating oneself to write a paper in order to get a good. Conversely, intrinsic motivation, the ideal motivation in education, occurs when learners are motivated to do tasks because they innately want to do the tasks. The reward is realized from within themselves, and there is not an external reward necessary to motivate the learner to do a task. An example of intrinsic motivation may be motivating oneself to complete a project because you are innately interested in the topic and wish to do a good job. Furthermore, Ryan and Deci (2000) argue that in order to achieve the optimal intrinsic motivation, humans have innately psychological needs that should be cultivated in an environment in order for higher intrinsic motivation to exist. These psychological constructs are: autonomy, belonging and competence. These psychological

elements, when fostered in explicit design of educational environments, are thought to achieve higher intrinsic motivation within students. When designing Real Foodie application, it was known fostering a playful and collaborative learning environment would be difficult to achieve, particularly when trying to motivate young adults to change inherently difficult eating habits. After considering principles of self-determination (Deci & Ryan, 2008) in application design, it was tried to best support autonomy, belongingness, and competence by providing several platforms for learner to exercise these principles within the personal profile, social, and challenges features.

3. Method

3.1. Learning Goals

According to previous researches (Elfeky & Yakoub, 2016; Furio, Juan, Segoi, & Vivo, 2015), mobile learning can increase student participation and achievement while also assisting them in learning. Learners can learn not only in a formal learning environment, but also throughout their lives by using various tools and technologies. The Real Foodie mobile app is largely designed with two learning goals in mind. All of the features and activities built into the program are designed to support users of the system to achieve both goals. The two learning goals supported by the Real Foodie application are:

1. Users will be able to tell the difference between "real foods" and other less healthy options.
2. Users will demonstrate an effort to change buying habits away from processed and unhealthy options to more real, nutritionally-dense foods.

3. 2. Context and Target Audience

The Real Foodie mobile app is designed to be used in an informal learning setting with a self-directed learner. As most mobile applications is meant to be used anywhere with a cellular reception such as the grocery store, home, school, etc. It is not designed to be used in formal K-12 school environments, although it might be an interesting activity to work on with students with the right guidance and scaffolding.

The age range targeting with the Real Foodie application is mainly adults. According to one study, as children grow older, their eating habits become more similar to those of their parents (Birch, 1999). In addition, as young adults transition to living on their own and create their own lifestyle outside of their parents' home, new habits are formed and lay significant groundwork for future eating habits later in life (Birch, 1999). As a result, the application is hoping to support young adults during this crucial time in their lives by targeting users ages 18-35. Even though the target is young adults ages 18-35, the application is still appropriate for adults older than 35 and it could be useful for anyone trying to learn more about nutrition and changing their eating habits.

3. 3. Learner Needs

In exploring the nutritional research surrounding the target audience (ages 18-35), it was became aware of a study conducted by Deshpande, Basil and Basil (2009), which focused on the barriers to healthy eating that college students experience. Evidence from various other nutritional studies was cited that supports the need to establish healthy eating habits early on (Birch 1999). However, Deshpande et al. (2009), focused on what variables were best at predicting food selection in young adults. Specifically, how college students' health beliefs influence their eating habits. The study described how college is often the time at which young adults are transitioning to independent nutritional practices, and support for developing healthy eating habits is crucial. The behavioral model called the Health Belief Model (HBM) was studied as a model for determining eating behaviors in college students. The Health Belief Model (HBM) used by

Deshpande et al. (2009) took into account several features that were thought to be influential in student eating habits. All of these features operated within the psychographic understanding of perceived threat from a disease compared to perceived benefits from preventative health measures. The evidence from the study supports the understanding that the perception of healthy food benefits as compared to price, taste, ease of preparation, and convenience was far more effective at engaging students in a healthy diet. Deshpande et al. (2009) also suggested from their study that learners need to exercise a deeper understanding of certain foods, particularly the long term perceived threat or benefit, or else healthy habits may not form. Deshpande et al. (2009) concluded that it is not only important to make nutritional information accessible and understandable but it is also essential to provide activities, based in social strategies, that engage the learner in deeper understandings of nutritional content, preferably in contrast or active engagement with their peers.

Table 1.

Learner needs and scaffolding strategies to support those needs

Feature	Domain	Learner Needs	Scaffolding/Support Strategy
Personal Profile	Learners can struggle to reflect on eating habits or archiving digitally	Learner needs a space to set goals and track progress	Personal profile creates a space for the customization of goals and tracking of food behavior
Item Search and Scan	Learners often shop for food items without any support	Learner needs a tool for gaining access to resources with meaningful nutritional information	Item search and scan provides a quick and comprehensive way to pull up food resources
Food Snapshot	Nutritional labeling is confusing and learners do not understand it	Learner needs a space to gauge the holistic understanding of food items	Food snapshot creates a space to organize and understand complex real food information
Challenge	Developing new habits requires long-term motivation and support from peers	Learner needs a space to apply their real food knowledge and support for maintaining healthy lifestyle habits	Challenge feature creates a space for users to complete specific task against both the app and peers
Social	Engaging in complicated tasks with peers leads a deeper understanding of content	Learner needs a space to connect with content and collaborate in meaningful ways with their peers	The social platform in the app allows users to interact and connect with others using the app
Resources	Experienced users can maintain habits with access to additional resources	Learner needs a space to expand and access additional knowledge related to their interest	The resources section provides links to information outside of the app

Table 1 shows what learner needs are and how app designers and learning experience designers can support those needs in general with app features. When creating the design framework and deciding what features the app should have, Honebein (1996)'s seven goals for the design of constructivist learning environments, self-determination theory's principles in app design including supporting autonomy, belongingness, and competence (Deci & Ryan, 2008) and the behavioral model called the Health Belief Model (Deshpande et al., 2009) have been taken into account and were thought to be influential on young adults eating habits.

The following app features are recommended to scaffold/support learners in fulfilling their learning needs based on the theoretical framework discussed above.

4. App Features

The Real Foodie mobile app includes a variety of features to offer its users information and also scaffolds to support making healthy eating a habit. There are four key features in Real Foodie that are depicted in the screenshot designs in Appendix: barcode scan/item search, food snapshot, personal profile and social/challenges. These four main features also directly connect to the learning goals explained previously. In addition to these key features prototype designs are also provided to show additional Real Foodie application elements such as user log-in/account setup process, main application screen and resources section. All of the app features are explained below in the order of how a new users could move throughout the application.

4.1. User Login and Account Setup

Screenshot 1 shown in Appendix is the initial screen an individual would see after downloading the Real Foodie application from the store. If the individual is interested in making an account to use the Real Foodie application there are a few different options. The first option allows users to login using their current Facebook account. This will provide users the option of connecting with their pre-created network for the challenge and social features within the application. A user can also choose to create a new profile in Real Foodie separate of Facebook. These individuals may not have Facebook accounts or are not interested in using the application to connect with others. They might simply be interested in using the barcode scanner/search functionality to learn more about food items. The final option is for current Real Foodie users to sign in if they have previously created an account.

4.2. Real Foodie Main Screen

After completing the initial login, users will move into the application to view the main page, which is shown in screenshot 2 in Appendix. After the initial log-in for a new user, the Real Foodie character, shown at the bottom right of screenshot 2, will welcome users with an introductory message and a short explanation of a user's mission. It might display a message such as, "Welcome to Real Foodie! Your mission is to gain foodie points by adding items to your profile and winning challenges. Good luck!". This statement provides a brief explanation of real foodie points and the activity to accumulate points. Further instructions and basic application information can be found in the Resources section shown in screenshot 10.

In addition to offering a message to new users, the Real Foodie character also serves as a sort of a 'guide' whenever users visit the main screen. The character will give positive messages and grant rewards to users whenever they achieve certain pre-determined criteria, such as winning a challenge, scanning a streak of A+ items, gaining a certain number of points, and more. It will also deliver updates about Real Foodie, talk about news developments relating to real foods, and occasionally drop random suggestions about foods the user could try next. Poking his face will make him giggle and bounce with joy. The Real Foodie character exists to provide positive reinforcement and belonging to users and lends personality to the app.

The six white square graphics shown in the middle of the main screen serve as buttons to link to the six main options a user can take to move throughout the application. The first area is the user profile which serves as the main location for personal information and houses the history of scanned/searched food items. The second and third areas allow users to learn more about food items in the grocery store and around them. These two features are the item search and barcode scanning functionality. The final three areas in Real

Foodie include challenges, resources, and social. The challenge feature allows users to create, manage and complete challenges with themselves or others in their social network. The social feature is a news feed that shows all of the activity in your social network. Both of these social features are explained in more detail in the screenshots 7, 8, and 9. The resources section of the application is simply a listing of links for more "Real Food" information. This area would be helpful for experienced users or individuals that wanted to take a deeper dive in learning about real food and its benefits.

4.3. Personal Profile

After logging into Real Foodie, the user has the option to view their food history on the personal profile as seen on screenshot 3. Based on the nutritional value of the food, points are added to the user's food meter on their profile, and also detailed in their food history. Foods that contain higher nutritional content, in union with the "Real Food Manifesto", are given higher foodie points (FP) as seen on the food meter. Foods that are less nutritious are given little to no points. Receiving no points for a less nutritious food can be linked to a game- inspired learning principle known as "Productive Failure". Gee (2003) stated that productive failure is a crucial necessity for players or users to continue to stay motivated on the long-term goal. In many video games or apps, players make mistakes, but thanks to the productive failure mechanisms that many video games possess, the player continues playing and learns from his or her mistakes.

Similarly, the food history and food meter on the personal profile encourage this same sort of learning principle (Gee, 2003). In reality, many users may make mistakes while attempting to transition from a less healthy diet to a Real Foods diet. By combining learning principles from game theory into the personal profile history and food meter, the app design encourages users for good choices, but does not penalize for poor ones. The foodie points awarded for adding high-quality real food items to a user's personal profile or completing challenges exemplify conditioned reinforcers, offering positive reinforcement as part of the behaviorist learning theory perspective (Driscoll, 2000). Additionally, the algorithm used to award points would take into account appropriate weighting to not award users who attempt to cheat the point-system by eating homogenous foods in high quantities (ex: 3 or more granola bars in one day). This algorithmic weighting would eliminate the ability for users to abuse portion control and the Real Foodie game-inspired point system.

More importantly this point system would allow a user on Real Foodie can eat well on one day and receive corresponding points toward their food meter, and then make mistakes another day and learn from these choices. By including only positive points and showing detailed food history such as date, time, location and nutritional value in a brief text spot on the food history, the user is not discouraged by their mistakes but can instead contextualize how and why they happened and learn from these choices. The long-term nature of the food meter visual also encourages the user to stay focused on a long-term goal, whether it is a day, a week, a month, or a specific challenge.

4. 4. Item Search / Scan

The food item search option is one of the fundamental elements of Real Foodie, as seen in screenshot 4. The layout of the food search feature is consistent with other basic search bars which include recent search auto-fill options. Once a Real Foodie user types in a food name and hits the search button, a list of foods are shown and the user clicks on the one that best represents the food they searched for. After selecting the food item, a food snapshot is shown which details the food item's nutritional value with a letter grade (screenshot 5).

Similar to the item search functionality, a barcode scan feature is shown in screenshot 6 in Appendix. The layout of the barcode scanner is consistent with other barcode scanning applications. Upon focusing the

lens, the user can press the scan button and the barcode scanner takes a picture of the barcode and immediately links it with the food the barcode is associated with.

4. 5. Food Snapshot

After a user has searched for a food item or used the barcode scanner to identify an item of interest they are directed to the food snapshot screen (screenshot 5). A complex algorithm based on ingredients, food preparation, and "Real Food" legitimacy creates the letter grade each food item is given. Food grades are also color coded, green being a healthy choice, to red being a less healthy choice. Additionally, the food snapshot includes a simple overview of the food items ingredients, with harmful processed ingredients bolded with linking functions. In this way, a novice user may be able to obtain basic information and become familiar with common misunderstandings associated with food ingredients. However, the more expert user can also click on these bolded ingredients and receive more detailed research information on the ingredient if they so choose. The food snapshot (screenshot 5) is meant to scaffold real food information and make it accessible and easy to comprehend to various levels of users. This scaffolded information would be in agreement with effectiveness of the Health Beliefs model in college students as seen in research done by Deshpande et al. (2009).

Once a user has searched a food item, the "Add to Profile" button on the food snapshot allows the user to add the food to their history on their personal profile. This feature was designed with consideration to fostering autonomy, belonging, and competence (Ryan and Deci, 2000). In examining the best way to foster autonomy, it is found it easiest to cultivate learner autonomy by providing an option to add food history to a personal space in order to reflect on personal progress in the personal profile feature. Moreover, the design of the interaction between the food snapshot and the personal profile was also meant to be a landing page for the Real Foodie character to greet and encourage the learner when progress was made. This interaction between the food snapshot and personal profile cultivates the principles of self-determination theory by encouraging the learner to choose what foods they add to their profile, how they keep track of their progress, and how they become encouraged and engaged when making progress and interacting with the Real Foodie character.

Additional feature in the food snapshot is the "Suggested Alternatives". These smaller features compliment the functionality of the food snap-shot by providing contextualized information the user may not normally have access to. The "Suggested Alternative" links the searched food item from the food snapshot to healthier alternatives. This allows the users to become familiar with healthier options in a way that does not overburden the user. By giving healthier options juxtaposed against the personal choices of the user, Real Foodie uses the personal tastes of the user as a guiding function in transitioning the user to a healthier diet. These suggested alternatives are shown in screenshot 5 as green link so that a user can click to the product website to learn more about the items. Additionally, as Real Foodie becomes an established application with many users companies would be allowed to sponsor links to their products, thereby offering an income opportunity to support further development of the application. All of the features found on the food snapshot scaffold the nutritional information for the learner by including long-term effects of harmful processed ingredients, along with information healthful alternatives and their positive long-term benefits.

4. 6. Social and Challenge

Merely having access information is not enough to accomplish learning goal one and two. Not every user will be fully motivated to make long-term changes in their habits, nor do they have the time to sit down and consider their food choices. To further motivate users, the Social and Challenge features of the Real Foodie application focus on social media and gamification. These two areas allow users to import their pre-existing

contacts from Facebook and other social media sites into Real Foodie. Users can also choose not to opt into the social aspects of the application by clicking "No Thanks" as shown in screenshot 8.

As Deshpande et al. (2009) suggested in their research regarding the Health Beliefs model and young adult eating habits, the best method for influencing young adult's eating habits is through social marketing strategies that emphasize food benefits in relation to a learner's peers. Social feature is designed to provide a space for learners to interact with their peers within the real food content domain. This means that learners can voluntarily interact with peers through the language of real food content, in hopes of engaging the learners more effectively. The details of the social activity that it has proposed in the application is the combination of the news feed and the challenge functionality. The news feed shown in sketch 7 displays a possible list of updates that would show in a user's social application. The news would list when friends scan and add items to their personal profile or when they gain points for challenges. The social news feed also lists the amount of foodie points that individual users are gaining by scanning high-quality items or by participating in challenges.

Screenshots 8 and 9 depict the challenge feature. The challenges display options where users can put their real food skills to the test by completing time-sensitive tasks, individually or with other members of their social network. The app will input some pre-established challenges in the "View Real Foodie Challenges" link in addition to user-generated challenges can also be created or viewed. The challenges might be as simple as adding one A+ item per day to a user's personal profile for a week, or trying to be the first user to reach 1,000 foodie points.

The challenges have very few parameters or limits because users can create their own challenges and view other challenges currently occurring within the application. The ability to connect, track and challenge your social network within the Real Foodie application will hopefully serve as motivation for users to transition to a more healthy real foods lifestyle. These features closely align with the social change strategy by Deshpande et al. (2009) and will help support young adults in overcoming the barriers to eating healthy that many college students face.

By stimulating the interactions with nutritional content in gamified personal goal setting and peer-set challenges, Real Foodie will provide learners with the scaffolding they need to engage with nutritional content in a more intrinsically meaningful way (Ryan and Deci, 2000). Such a system will provide motivation for the user to continue healthy eating habits and ultimately, change them if they so desire. The activity embedded in the app functionality supports learning goal number two in an effort to modify users eating habits away from processed and unhealthy options, and toward more real, nutritionally-dense foods.

4. 7. Resources

The application feature titled "Resources" (screenshot 10) is simply a listing of real food nutrition information. These resources might include books, news, blogs, and a "real food index" with definitions with commonly used terminology. These resources are meant to support active users of the application that might want to further their exploration and research beyond Real Foodie. In the future, if the Real Foodie puts together their own blog this feature would also be a good avenue to share updates.

Table 2.

Connecting app features with the learning goals

Feature	Learning Goal 1: Users will be able to **tell the difference between** "real food" and other less healthy options	Learning Goal 2: Users will **demonstrate an effort to change** buying habits away from processed and unhealthy options to more real, nutritionally-dense foods.
Personal Profile		X
Item Search and Scan	X	X
Food Snapshot	X	X
Challenge		X
Social		X
Resources	X	

Table 2 shows us the connection between app features and learning goals of Real Foodie app. Based on Table 2, it can be said that if you want to design an app where your students/users tell the difference between "real food" and other less healthy options, you can use Item Search and Scan, Food Snapshot, and Resources features. On the other hand, if you aim your students/users to demonstrate an effort to change buying habits away from processed and unhealthy options to more real, nutritionally-dense foods, you need to use Personal Profile, Item Search and Scan, Food Snapshot, Challenge, and Social features in your design.

5. Conclusion and Suggestions

Chronic diseases such as heart disease, cancer, stroke, diabetes and asthma are commonplace in the world. In fact, chronic diseases cause 7 out of 10 deaths in the US and nearly 1 in 2 adults live with at least one chronic illness (U.S. Department of Health and Human Services, 2018). These statistics are not only striking they are also sad since everyone in the U.S. is either affected by a chronic illness themselves, or someone close to them has been affected. As Price documented in their groundbreaking research of traditional cultures, much of these chronic illnesses are due to an industrialized diet. In many western cultures nutrient-dense traditional foods have been replaced by processed items with harmful ingredients such as white flour and sugar. Companies in the food industry go to great lengths to promote their products as healthy using claims such as "all natural" on packaging, when these claims are far from the truth. This foundational problem led to the design of the Real Foodie application which seeks to calm many of the confusions surrounding diet and nutrition.

The Real Foodie mobile application offers many helpful features to users seeking to live a healthier lifestyle. By targeting young adults ages (18- 35), it is hoped to help these learners gain access to real food information and to support them in creating better eating habits. It is offered these supports through an item search/barcode scanner and the real food snapshot. Real foodie points are also awarded for adding high-quality foods to a user profile, which will hopefully motivate additional use of the application. The game-inspired point-leveling system of the application is one that the Real Foodie plans to expand in the future. Furthermore, the application offers social features such as a news feed and challenges to allow learners to connect with others interested in real food. It is a hope that once these habits are established they will put users on a path of healthier living to avoid chronic disease in the future.

Based on the theoretical discussion above, it can be said that if you want to design an app where your students/users tell the difference between "real food" and other less healthy options, you can use Item Search and Scan, Food Snapshot, and Resources features. On the other hand, if you aim your students/users to demonstrate an effort to change buying habits away from processed and unhealthy options to more real,

nutritionally-dense foods, you need to use Personal Profile, Item Search and Scan, Food Snapshot, Challenge, and Social features in your design. This can assist developers in creating more effective mobile apps.

6. Future Enhancements

During the development of Real Foodie, many features were considered for implementation. Currently, the Real Foodie design has a feature for users to challenge themselves and others, and ultimately to serve as motivation for individual users to accumulate foodie points. A global leaderboard is a planned enhancement for this feature which will display the usernames of healthy real food eaters worldwide with the most accumulated foodie points. The more competitive users of Real Foodie will be further incentivized to compete with others and gather the most foodie points so that they could appear in the "Top Ten" of the userbase.

It is also considered adding a 'badge' system to expand on foodie points feature. They would be icons that appear on the users' profile, representing certain milestones, levels, and goals the user has met through accumulation of foodie points and meeting certain criteria. Badges would range from the very basic— such as joining Real Foodie and accumulating your very first foodie points— to the mysterious and extremely arcane, where the exact criteria for earning those badges is unknown and hard to achieve. The badge system would give users more incentive to use the foodie points system.

The last enhancement includes a price locator tool. This feature, located under the Food Snapshot screen, would allow users a way to find real food at lower costs. This feature would use geolocation and available databases to search for the current food item and give users a list of additional places to shop for the food, and offer an instant price comparison. Shopping for real food can often be difficult, time consuming, and expensive. Such a feature would empower users to quickly make good food decisions and more easily support their habits over time.

Last but not least, this paper has proposed a design framework for learning technologist to design and develop a mobile learning app in the context of eating healthy. In other words, this study offers a number of theoretical and practical implications in the context of pedagogical factors that can assist developers in creating more effective mobile apps. For this reason, it is important to collect empirical data by implementing the mobile learning apps developed within this framework with the appropriate target audience.

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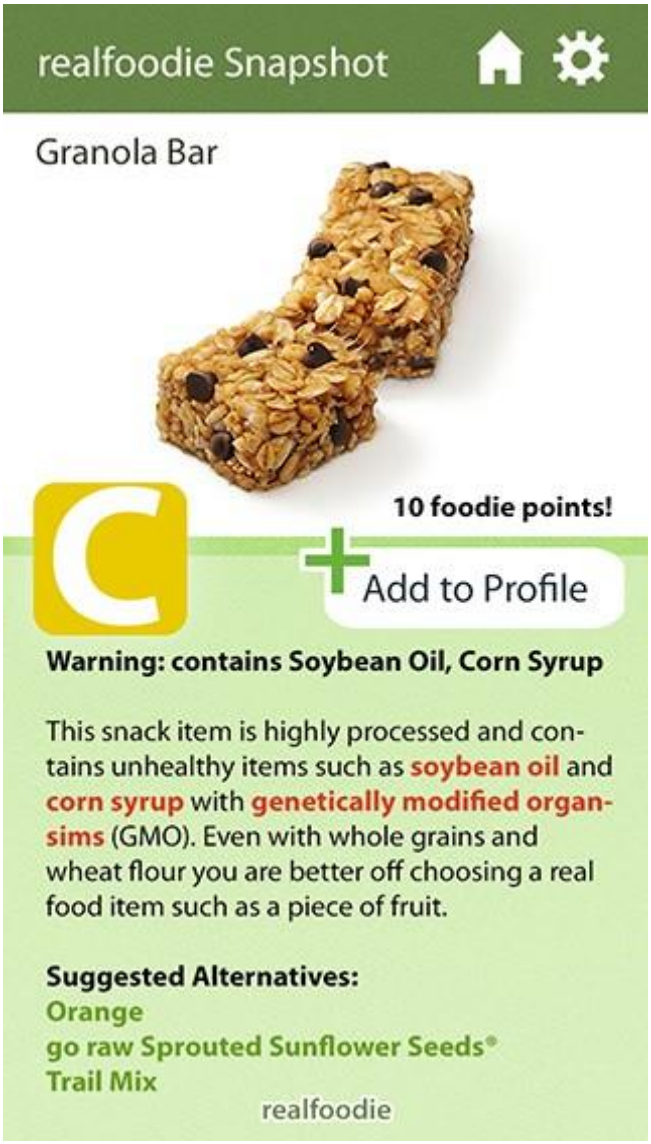
Appendix

Screenshot 1

Screenshot 2

Screenshot 3

Screenshot 4

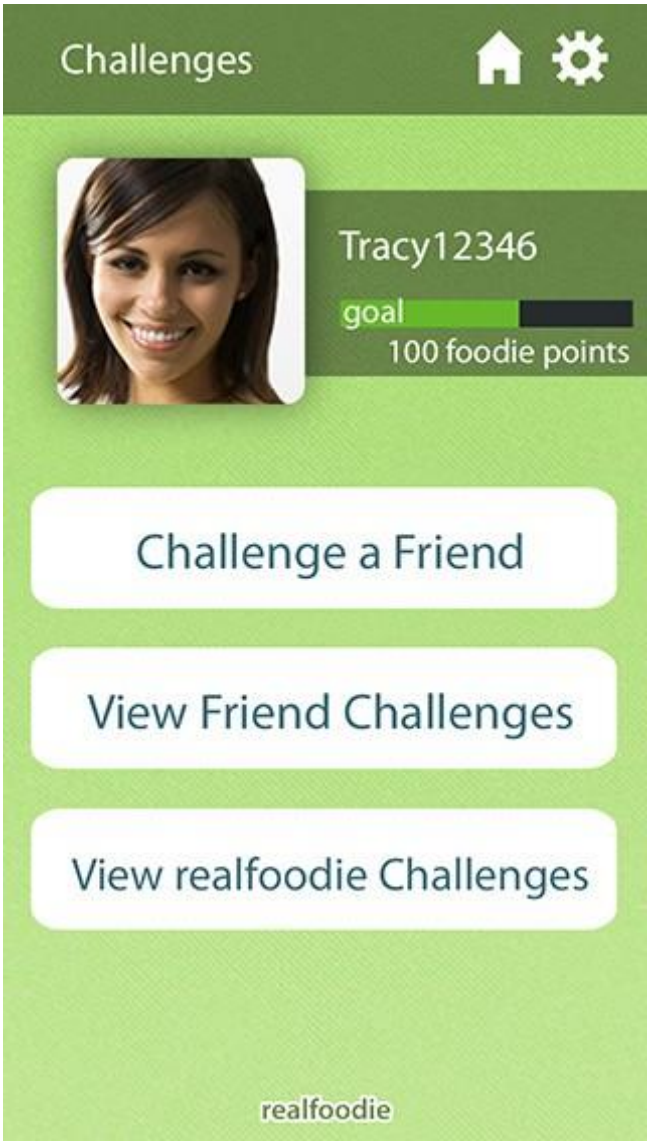


Screenshot 5

Screenshot 6

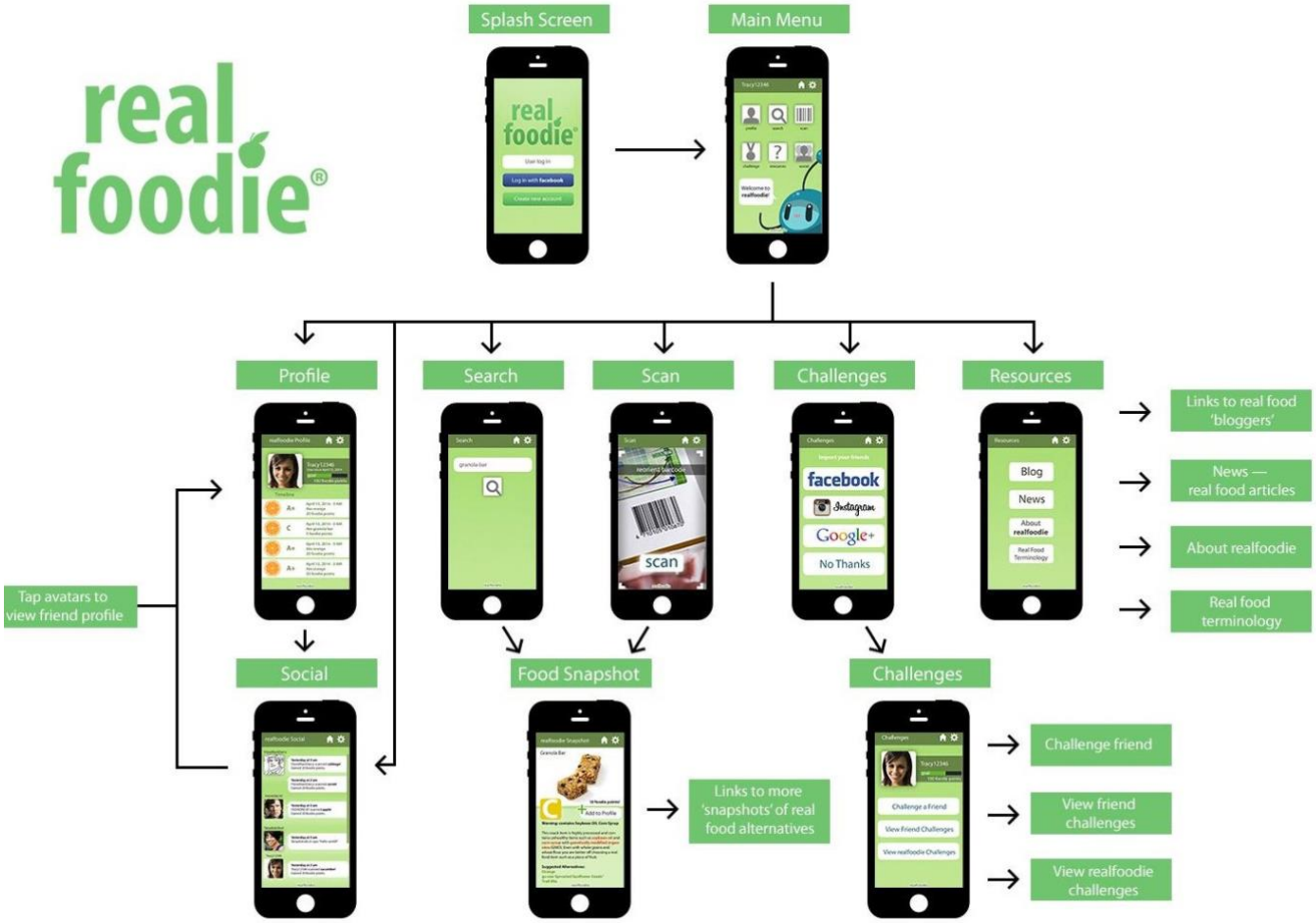
Screenshot 7

Screenshot 8



Screenshot 9

Screenshot 10



Screenshot 11

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Attached or not attached: Does different learning styles exist among students with or without sense of belonging amidst covid-19?

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Research Article

Abstract

This study was about peer attachment and learning styles being moderated by a sense of belonging among students during the COVID-19 era. Using an analytical cross-sectional survey design, 284 final-year undergraduates were selected through stratified-proportionate and convenient sampling procedures. Data was gathered from the respondents using Learning Preference Scale (Owens & Straton, 1980), Adolescent Friendship Attachment Scale (Wilkinson, 2008) and Psychological Sense of School Membership (Goodenow, 1993). The data was analysed using descriptive (Frequencies and Percentages) and inferential statistics (Multivariate Multiple Regression, Simple Moderation with Hayes Process Macro and Multivariate Analysis of Variance).The study revealed that most students engaged in less peer attachment, felt less sense of belonging while secure attachment predicted the individual learning style of students. Furthermore, secure attachment and anxious attachments predicted the cooperative learning style of students while anxious attachment and avoidant attachment predicted the competitive learning style of students. Further, a sense of belonging moderated not peer attachment and learning styles of students, while no significant differences were found between male and female students in terms of peer attachment, learning styles, and sense of belonging. Therefore, it was recommended that students should practice individual learning styles most often but could collaborate with a few colleagues in some academic situations during this period of COVID-19. This is to help foster closeness and belongingness among the students.

1. Introduction

One major aspect of human lives that had a huge impact from the pandemic was the education sector. The COVID-19 pandemic forced leadership of educational institutions (early childhood to tertiary) to forgo the traditional face-to-face academic engagement and resorted to online teaching and learning so that they could help contain the situation and to prevent its onward spread among vulnerable students in school. The timely migration from face-to-face to online teaching and learning was to help complete the academic calendar

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(Browning et al., 2021). In the advent of COVID-19 pandemic, the most applicable preventive strategy is social distancing among the human race. With this, it was evident that individuals in most countries around the world are expected to minimize interaction outside the home by observing and practicing social distancing (Anderson, Heesterbeek, Klinkenberg, & Hollingsworth, 2020).

In Ghana, all educational institutions were closed to avoid the escalation of the spread. With the tertiary institutions, online teaching and learning method was used. As a contemporary platform for sharing information in most advanced countries, this online teaching and learning became a new thing and problematic in most universities in Ghana, especially the University of Cape Coast in Ghana (Henaku, 2020; Agormedah, Henaku, Ayite, & Ansah, 2020). This eminent developmental shift of academic engagement between educational instructors and their students appeared to have created new tasks among students in terms of managing their peer attachments, making efforts to employ the best learning styles and consequently developing a sense of belonging to their respective universities. Being physically present in schools with normal academic and social activities occurring, creates a high sense of belonging among the students. When students are available on normal days in school, it has a implication on how attached the students get to their peers. The availability of peers in schools leads to a high sense of peer attachment. This significantly impacts on the learning styles that the students adopt. The choice of online method of teaching and learning as a means to curb the spread of Covid 19 led to students being away from school and their peers. This greatly affected peer attachment and sense of belonging. In view of this, the authors wish to find out if the absence of on-campus teaching and learning will affect students' attachment to their peers. Again the authors wish to find out if the affected students peer attachment will predict different learning styles with a moderation role of sense of belonging.

2. Literature Review

2.1. Peer Attachment

Attachment is normally perceived as a lasting affective link with major intensity for psychological fitness (Armsden & Greenberg, 1987). Nickerson and Nagle (2005) indicated that peer attachment is a deep connection, which happens when individuals internalize the awareness that a peer will be accessible and sensitive during distress times. The attached relationship is conceptualised as a continuum of emotional regulation for managing relationships, events and affect (Jacobite & Hazen, 1999). At the one end of the scale is the anxious–avoidant attachment relationship, where over-emphasis is placed on controlling and minimising affect whereas, on the other side of the scale lies the anxious–resistant style which is regarded as the relatively uncontrolled, poorly-managed affect. Secure attachment institutes an evenness between the two extremes of emotional regulation (Charalampous, 2018).

The study of peer attachment is of particular interest in situations where social interactions are highly complicated (Laible, Carlo, & Raffaelli, 2000; Allen, Grande, Tan, & Loeb, 2018). A secure peer attachment is characterized as a relationship based on trust and beliefs that the other person understands his or her own desires and wishes and that he or she will understand and respond if communicating his or her feelings (Stern & Cassidy, 2018). Healthy peer relationships are centered on mutual understanding, trust, and good quality of communication (Theisen, Fraley, Hankin, Young & Chopik, 2018). On the contrary, the impression of alienation and separation from the peer community defines unstable peer attachment. This sentiment may be attributed to the fear of rejection of a need for closeness and affiliation, poor communication and loss of trust (Roelofs, Onckels & Muris, 2013).

It is evident that students show different patterns of behaviours in their relationships; with males emphasizing independence and females emphasizing relatedness (Gorrese, & Ruggieri, 2012). Ma and Huebner (2008) found that female students can also receive support from other female peers rather than male peers. According to Gorrese and Ruggieri (2012), male and female students had similar numbers of peer relationships, but females were more strongly connected with their peers than their male counterparts.

Likewise, it is evident that female students are more attached to their peers than their male counterparts (Henrich, Sidney, Kuperminc, Zohar, & Leadbeater, 2001; Sund & WichstrØm, 2002; Gullone & Robinson, 2005; Nelis & Rae, 2009; Richards, McGee, Williams, Welch, & Hancox 2010). Precisely, female students display higher trust in their friends and a deep communication with them (Gullone & Robinson, 2005; Song, Thompson, & Ferrer, 2009; Ruijten, Roelofs, & Rood 2011). Although gender differences on general peer attachment as well as on trust and communication are well established, differences on alienation are less consistent (Song, Thompson, & Ferrer, 2009; Ruijten, Roelofs, & Rood 2011). Precisely, some studies reported that male students were more alienated than their female counterparts (Gullone & Robinson 2005; Pace, Martini, & Zavattini, 2011) while some other studies reported no significant gender differences in peer alienation (Muris, Meesters, van Melick, & Zwambag, 2001; Nickerson & Nagle 2004; Ridenour, Greenberg, & Cook, 2006; San Martini, Zavattini, & Ronconi, 2009; Guarnieri, Ponti, & Tani, 2010; Ruijten, Roelofs, & Rood, 2011) and few studies reported that female students were more alienated than their male counterparts (Song, Thompson, & Ferrer, 2009).

As the COVID-19 pandemic surged within the educational fraternity, majority of schools globally were momentarily closed, and students were compelled to vacate schools and stay away from their friends, teachers, and classrooms where their observations of peer attachment in terms of support were compromised despite its value as psychological resource for students' educational growth and development (Sun, Lin, & Chung, 2020). Again, such lengthy separation and changes of daily routine experienced by students possibly caused mental and physiological distress among students (Banna et al., 2020; Qiu et al., 2020) as they found it problematic in satisfying their needs of belongingness. According to Van Bavel et al. (2020), the need of belongingness plays two essential functions in people in terms of maintaining emotional well-being, and maintaining stable relationships with others. Projecting the value of peer attachment, Banks and Weems (2014), alleged that peer attachment helps reduce the undesirable effects of traumatic life events on individuals' well-being in periods of pandemic as it helps the affected to fight problems emanating from the pandemic. Likewise, inadequate peer attachment appears to have a negative effect on people during pandemic situations. Undeniably, a study conducted by Banks, and Weems (2014) among African American young people exposed to natural occurrence (Hurricane Katrina) found high levels of peer attachment, and recommended that perceived high level of peer attachment from colleagues related to low negative experience (Banks & Weems, 2014). Furthermore, Elmer, Mepham, and Stadtfeld (2020) recent study among students discovered that college students exhibited lower peer attachment with their colleagues during the COVID-19 pandemic than in pre-pandemic situation, where their levels of peer attachment increased astronomically to high levels. This imply that high peer attachment could lead to an increase in sense of belonging, which will in turn lead collaborative learning among students in the long-run.

2.2. Learning Styles

Learning style has been debated by many scholars in educational psychology. It some instances, learned is presumed to be popular in the global educational landscape but it lacks empirical backing (Gudnason, 2017). This is partly caused by the lack of a single statistical measure for the construct learning style. Numerous researchers have propounded various learning style measures with varied names but with a common focus (Pashler, McDaniel, Rohrer, & Bjork, 2008; Rogowsky, Calhoun, & Tallal, 2020). Reynolds (1997) also contends that learning style is practically taken for granted despite its authenticity problems in cognitive psychology and education. In spite of these contrasting views on learning style, it is important to note that no common learning style exist for every learner because people differ in their persons and approach in executing a common academic task. In this sense, learning style can be supported in some circumstances and could be refuted in other instances depending on the learning, learning task and the learning context. By definition, Woolfolk (2004) described learning style as the individual's favourite way of learning and studying, such as using pictures instead of books, interacting with others rather than working alone, learning in formal versus unstructured circumstances and so on. Learning style is a comparatively

constant cognitive, emotional and physiological activity that shows the actions and response towards the learning environment (Imamipour & Esfandabad, 2011). According to Chick (2010), learning style is an individual's preferred way to engage, process, understand and hold information. Learning styles is widely used to describe how learners gather information, sift through the information, interpret the information, organize the information, come to conclusions about the information, and "store" information for use. Researchers assume that each student has the best and lasting methods to understand, organize, and store knowledge (Imamipour & Esfandabad, 2011). The learning style tries to clarify the difference in the approach of learning among students (Vaughn & Baker, 2008). Grasha (1996) labelled six main learning styles dependent on how learners interact with their instructors and peers. The styles are independent, dependent, collaborative, avoidant, participant, and competitive. Independent learners desire to think for themselves and are self-assured about their learning capabilities. They desire to work alone, learning content that they consider important. Dependent learners display little intellectual curiosity and study only what is required. They look up to authority figures, teachers, and peers for definite plans on what needs to be done. Collaborative learners enjoy working with peers and teachers with the hope of sharing ideas. Avoidant learners are uninterested and seem stunned by the learning situation. They are not excited and show no effort in the learning process. Participant learners are noble citizens. They are eager to do as much as is required to meet the requirements. They partake in most learning activities and are likely to engage actively in the learning process. Competitive learners always compete with their peers for grades and prefer to be the centre of attention and always want to receive recognition for their deeds (Grasha, 1996).

Learning style is defined by characteristics such as age, gender, cognitive styles, personality, intellectual capacity, sensorial nature, academia, temperament, culture, or creative thought (Nuzhat, Salem, Quadri, & Al-Hamdan, 2011). One of the topics addressed several times in literature is whether gender differences exist in the learning style. A number of studies have shown gender differences in learning style preferences among students. Baneshi, Tezerjani and Mokhtarpour (2014) reported that females have inclinations for Cooperative learning styles, than males who score higher on Independent learning styles. Hamidah, Sarina, and Jusoff (2009) and Amir, Jelas, and Rahman, (2011) stated that females had higher preferences than males for Cooperative and Competitive learning styles. On the contrary, O'Faithaigh (2000) found that males had higher preferences than females for Independent and Competitive learning styles. Again, a study by Azarkhordad, and Mehdinezhad, (2016) based on gender and learning styles revealed that male students' dominant style was cooperative while female students' dominant style was competitive style.

According to Reynolds (1997), Curry (1999) and Gudnason (2017), the variable learning styles has some issues with respect to internal and external validity, reliability and participants inability to distinquish between the learning approaches. The research organised by the above authors clearly indicates the non reliance on the variable and the use of the scales as an indicator of the learning styles of individuals. Despite the critique on the variable of learning styles, the authors still dem ot fit to include the variable in the study because the learning syles was developed based on our genetics, life experiences and the demands placed on us by the environments. These reasons informd the use of the learning style in the study.

The COVID 19 crisis has brought some rapid changes to the nature of education worldwide. A significant aspect of this change is the shift of learning from the traditional face to face classroom to the online education (Lei & Medwell, 2021). The effects have greatly affected the styles in which students learn. Learning in a global pandemic has caused a change in the learning styles of students. Students who used to learn through the collaborative and cooperative learning style have shifted to the individialised learning style (Yu & Yuizono, 2021). Some students who are used to the collaborative learning style had to find ways of learning collaboratively online. This in effect caused most universities to help their students get acquainted to online learning and in particular, maximise collaborative online learning (Lei & Medwell, 2021).

2.3. Sense of Belonging

A sense of belonging is used as a sense of university community in this study. A sense of belonging denotes students' feelings of being accepted, included by and connected to their institutions (Goodenow, 1993). Tinto (2012) defined sense of belonging as a comprehensive sense of membership that emanates from students' view of their participation in a variety of surroundings and the support they receive from those around them. The sense of belonging is characterised as the subjective sense of being a valued and legitimate member of a particular environment and being incorporated into it (Walton & Cohen, 2007; Good, Rattan, & Dweck, 2012). A sense of belonging is considered a central construct, which has the capacity of orienting interventions aimed at increasing the well-being of members (Fisher, Sonn, & Bishop, 2002). Ghanaian universities, like other universities globally have historically provided individual programmes and resources to create a sense of community and reinforce connections between students and the university. Such university programs are not limited to campus-wide gatherings, one-on-one consulting appointments, professional and mentoring seminars that help students develop a sense of belonging to the school, which in turn enhance their learning experiences and educational advancements (Pascarella, & Terenzini, 2005; Kuh, Kinzie, Buckley, Bridges, & Hayek, 2006; Duran, Dahl, Stipeck, & Mayhew, 2020). The University of Cape Coast provides services and programs such as counselling, students support services, open communication, mentoring services, etc. These services and programs increases the sense of belonging among the students in the university.

A number of research studies have described the difference that exists in the sense of belongingness with respect to gender. Experimental research into the situation assessing the sense of belonging of students indicates that females felt less belonging than men (Good, Rattan, & Dweck, 2012). According to Murphy, Steele, and Gross (2007), female students reported a lower sense of belonging. This was as a result of the typical asymmetric gender ratios in universities. Hughes, Im and Allee (2015) indicated that female students had a lower sense of belonging than males. This is because they are more likely to fail in an academic environment and are often influenced by their subjective experiences. Walton and Cohen (2007) indicated that female students fall short of sense of belonging more than their male counterparts. Margolis and Fisher (2002), Margolis et al. (2008), Barker et al. (2009) and Strayhorn (2012) supported this by alleging that it results from the assertion that socially stigmatized groups are uncertain about their membership of a community. In other studies, it was found that female students had greater sense of belonging as compared to male students, where this difference is explained by the varying socialization processes for male and female students (Sanchez, Colon, & Esparza, 2005; Newman, Newman, Griffen, O'Connor, & Spas, 2007). Research has shown that female students ascribe more importance to group membership, as well as relatedness and connectedness, while male students are more inclined towards competition and autonomy (Sanchez et al., 2005). A sense of belonging is of great value for students. In one study, Murphy, Boucher, onend Logel (2021) found increased levels of belonging among students. The study further revealed that students who felt a strong sense of belonging were highly engaged and likely to join school organisations and make connections with peers, faculty, and staff. Not only that, students who feel like they belong in school earn higher grades and choose to succeed in more difficult courses. Belonging can be difficult to foster during the COVID-19 pandemic, with the need for social distancing and remote learning. Indeed, it takes more attentive and new strategies to support students' sense of belonging given these pandemic challenges (Murphy, Boucher, & Logel, 2021).

In the midst of natural occurrences, numerous remedies are often employed to leverage the situation. Indifferently, such remedies are equally adopted by educational stakeholders and consumers of the general educational process. As a result of COVID 19, several universities closed their campuses suddenly, prohibiting students and non-students from hosting any social activity that could bring people together (teaching of academic courses, sports and student-centred forums). In this period, the institutional focus was on moving teaching and learning to virtual and distance learning (The Chronicle of Higher Education, 2020). Efforts towards recreating out-of-class interactions and helping students in a virtual world is

important, but many educational institutions in the African continent seem to lack knowledge in practicing such an important alternative teaching and learning procedure. As a result, many students felt disconnected from their institutions, their peers and expressed the need for more contact and support, in particular from funding and academic consultants (Blankstein, Frederick, & Wolff-Eisenberg, 2020). In the case of the University of Cape Coast in Ghana, many students felt disconnected geographically, some also expressed problems of internet connectivity in their locations, while others lacked consistent electricity for any meaningful virtual learning, hence the call for stakeholder engagement between university management and students' leadership. Out of broad consultations among stakeholders, it was concluded that all online or virtual academic activities should be stopped but to be substituted with batch-to-batch on-campus teaching and learning procedures. Having COVID-19 present and glaring, there was the need for students who are called back to campus to observe and respect all preventive protocols. In this, students are obliged to observe social distancing, frequent hand washing, and incessant application of certified hand sanitizers. Coupled with this, students are to make personal decisions such as personalised learning (choosing a learning style) and peer group interactions (peer attachment) while having in mind their sense of being part of the bigger university community.

The study sought to determine the extent to which students become attached to themselves in the midst of the COVID-19 pandemic, their sense of being part of their university community in the midst of the COVID-19 pandemic, how their peer attachment could predict learning styles of students in the midst of COVID-19 pandemic, and how the students' sense of belonging moderate the influence of peer attachment on learning styles amidst COVID-19 pandemic and to determine gender differences in peer attachment, learning styles and sense of belonging among students.

3. Research Design

The design considered for this study was analytical cross-sectional survey design. This design was chosen over others because data was collected at one point in time from different groups within the target group. The analytical cross-sectional survey design allows associations and predictions among variables under investigation. Analytical cross-sectional studies aim to assess associations between different parameters such as attitudes and opinions of people concerning a situation or phenomenon (Kesmodel, 2018). Advantageously, analytical cross-sectional research may be conducted without the need for follow-up, making them easier to perform. However, the key drawback of analytical cross-sectional studies is that the sequential relation between variables cannot be determined since both are studied at the same time (Di Girolamo & Mans, 2019).

3.1. The Study Group

The population of the study was 4,758 (male students=2,612; female students=2,146). These students were final year regular undergraduates (level 400) who were called back to campus to complete the 2019/2020 academic calendar purposely for certification and graduation during the COVID-19 pandemic. These students cut across the four (4) colleges that run regular undergraduate programmes. These colleges were the College of Education Studies (N=2,149; n=128), College of Humanities and Legal Studies (N=1,251; n=75), College of Agriculture and Natural Sciences (N=823; n=49) and College of Health and Allied Sciences (N=535; n=32). The sample size for the study was two hundred and eighty-four (284) students. The sample size was derived based on Nwana (1992) suggestion of five percent of the target population as a required sample proportion for quantitative studies. The sampling procedures for the study were the stratified-proportionate and convenient sampling techniques. These sampling procedures were applied to all four (4) colleges that run regular undergraduate programmes, University of Cape Coast, based on their contributions to the target population. This technique ensured that individuals from all the subgroups in the population were given an equal chance to be selected and increases researchers' statistical precision. The students were divided into their various colleges which serves as the strata. It was from these strata that the respondents were selected for the study. Due to the observation of the COVID-19 protocols, the convenient

sampling procedure was appropriate for selecting the various respondents. This was done by visiting the selected lecture theatres assigned to each of the colleges in the university purposely to prevent the escalation of COVID-19 pandemic among students.

3.2. Data Collection Tools

The data for the study was gathered using adapted versions of Learning Preference Scale (32-items; α=.81) developed by Owens and Straton (1980) [Competitive=10-items, Coopertative=10-items and Individual=12-items. The instrument was on a 4-point Likert scale with numerical values of 4-3-2-1 basis, with 4 representing the strongly agree and 1 representing strongly disagree. Again, Adolescent Friendship Attachment Scale [AFAS] (30-items; α=.87) developed by Wilkinson (2008) [Secure Attachement=15-items, Anxious Attachment=6-items and Avoidant Attachment=9-items] was used. It was on a scale of ‘‘strongly disagree’’ (1) to ‘‘strongly agree’’ (5). Lastly, Psychological Sense of School Membership (18-items; α=.86) developed by Goodenow (1993) with a scale of Not at all true (1) to Completely true (5) was used. These scales were modified to suit the context of this study by changing some words and phrases to meet the understanding of the respondents. After this process, the scales were piloted on 40 responsdents from the Cape Coast Technical University, where the internal consistencies in terms of Cronbach Alpha were established each scale (Learning Preference Scale=.92; AFAS=.87; Psychological Sense of School Membership=.86). The scales were equally subjected to face, content, convergent and discriminant validities as it was necessary for the right information to be carried on each scale. The face and content validities of all the scales were ensured by experts in the field of scale development in the University of Cape Coast. In terms of convergent and discriminat validities, attachment scale produced correlation coefficients between .30 to .70 using Pearson Product-Moment Correlation and a compound reliability coefficient of .92, learning style scale produced correlation coefficicents between .40 to .60 using Pearson Product-Moment Correlation and a compound reliability coefficient of .87 and sense of belonging scale produced correlation coefficients between .30 to .60 using Pearson Product-Moment Correlation and a compound reliability coefficient of .86. These figures produced by the scales met the thresholds proposed for convergent and discriminat validity (Hair et al., 2017; Yu, 2012).

3.3. Data Analysis

The data gathered with the adapted scales from the students was analysed using descriptive (Frequencies and Percentages) and inferential statistics (Multivariate Multiple Regression, Simple Moderation with Hayes Process Macro and Multivariate Analysis of Variance).

3.4. Findings and Discussions

Research Question One: What is the level of students’ peer attachment during COVID-19 pandemic?

The question sought to to find the extent to which students become attached to themselves in the midst of the COVID-19 pandemic. It is assumed that the global pandemic may ruin the levels of attachment among students after being educated on social distancing when they returned to wrap up the academic year. Table 1 presents the results:

Table 1.

Level of Peer Attachment

Levels	**Frequency**	**Percent**
Low Peer Attachment	193	68.0
Moderate Peer Attachment	91	32.0
High Peer Attachment	0	0.0
Total	**284**	**100.0**

Field Data

Table 1 shows results of the levels of peer attachment among students. The study found that majority of the students experienced low level of peer attachment (n=193; 68.0%) while no student experienced a high level of peer attachment (n=0; 0.05). This implied that the the majority of the students cherished being on their own within the COVID-19 pandemic than associating or getting to be in the company of others. It further buttressed the point that social distancing was important. Despite the significant role social distancing could play in preventing the escalation of the COVID 19 pandemic, it has the chance to also re-orient student-to-student friendship from group-based to individual-based. With this, it could cause disunity among students and brew poor relationship among them. The findings imply that students might be disunited in the midst of future natural occurrences. The finding defeats the idea espoused by Theisen et al. (2018) that healthy peer relationship among students is centered on mutual understanding, trust and good quality of communication but corroborated the assertion of Roelofs et al. (2013) assertion that poor relationship brings about fear of rejection of a need for closeness and affiliation, poor communication and loss of trust among students. Furthermore, the study findings debunked those of Mepham and Stadtfeld (2020) and Banks, and Weems (2014), of found high levels of peer attachment, which reduced negative experiences of young people during a pandemic.

Research Question Two: What is the level of students' sense of belonging during COVID-19 pandemic?

The question sought to to find the extent to which students felt they are part of their university community in the midst of the COVID-19 pandemic. It is assumed that the global pandemic may ruin the levels of belonging among students after being educated on social distancing when they returned to finish the academic year. Table 2 presents the results:

Table 2.

Level of Sense of Belonging

Levels	Score Range	Percent
Low Sense of Belonging	97	34.2
Moderate Sense of Belonging	93	32.7
High Sense of Belonging	94	33.1
Total	**284**	**100.0**

Source: Field Data

Table 2 shows results of the level of sense of belonging among students. The study found that majority of the students had a low level sense of belonging (n=97; 34.2%) to the university community due to the distractions caused by the COVID 19 pandemic, followed by those with a high sense of belonging (n=94; 33.1%) and those with a moderate sense of belonging (n=93; 32.7%). It is clear in the revelation that quite a good number of students felt being part of the university despite the disruptions encountered as a result of COVID-19. The finding seems not to be surprising as students may reason that their stay at home could gurantee their expulsion from their university but it was an informed strategy to prevent and preserve their lives from contracting the deadly virus. As they continued to stay home, they could lose the trust for the educational system because nothing was pointing to the fact they may resume to academic work immediately. This low level sense of belonging among students could translate into getting low grades as they might not understand the difficult nature of studying at home. In fact, it is echoed by Murphy, et al (2021) that students who feel like they belong in school earn higher grades and choose to succeed in more difficult courses but same cannot be said about others who may not during pandemics. Such a low level sense of belonging occurs because of social distancing and remote learning, hence it requires extra commitment from students, which may seem difficult for them during the COVID-19 pandemic.

Hypothesis 1: Peer attachment among students predicts their learning styles

The hypothesis sought to test the extent to which peer attachment could predict the learning styles of students in the midst of COVID-19 pandemic. The multivariate multiple regression (MMR) was used because peer attachment being the predictor was multidimensional with sections such as secure attachment, anxious attachment and avoidant attachment while the criterion being learning styles was multidimensional with subscales such as individual learning style, cooperative learning style and competitive learning style. Before performing the test, normality tests, linearity, homoscedasticity and multicollinearity assumptions were certified. Because the test involved multiple dependent variables, it was necessary to set a higher alpha level so that the chance of committing Type error (rejecting the null hypothesis where indeed, there are no significant results) could be reduced. In doing this, the Bonferroni adjustment proposed by Tabachnick and Fidell (2013) was applied, where the researchers divided the number of dependent variables with the original alpha level thus, .05/3=0.017, which served as the new alpha level. Literature indicates that Bonferroni adjusted alpha helps minimizes the original alpha level from .05 so that the probability of committing Type I error can be curtailed (Todorov & Filzmoser, 2010). Table 3 presents the results:

Table 3.

Multivariate Multiple Regression (MMR) Results for Peer Attachment and Learning Styles

L. Styles	Parameter	B	S. E	T	Sig.	P E S	F	p
Individual	Intercept	14.375	2.244	6.406	.000	.128	5.226	.000
	Secure	.330	.088	3.757	.000	.048	5.226	.000
	Anxious	.168	.109	1.535	.126	.008	5.226	.000
	Avoidant	.089	.087	1.017	.310	.004	5.226	.006
Cooperative	Intercept	13.877	2.752	5.042	.000	.083	5.751	.000
	Secure	.321	.108	2.982	.003	.031	5.751	.000
	Anxious	.514	.134	3.833	.000	.050	5.751	.000
	Avoidant	-.137	.107	-1.283	.201	.006	5.751	.000
Competitive	Intercept	6.970	2.422	2.878	.004	.029	11.767	.000
	Secure	.157	.095	1.661	.098	.010	11.767	.000
	Anxious	.268	.118	2.271	.024	.018	11.767	.000
	Avoidant	.489	.094	5.196	.000	.088	11.767	.000

a. R Squared = .203 (Adjusted R Squared = .195)

b. R Squared = .260 (Adjusted R Squared = .252)

c. R Squared = .242 (Adjusted R Squared = .243)

Source: Field Data

Table 3 shows the results of the test of multivariate multiple regression (MMR), where secure attachment, anxious attachment and avoidant attachment served as predictors to the criteria in terms of individual learning style, cooperative learning style and competitive learning style. Using the Wilk's Lambda to test for the omnibus hypothesis, it showed that all beta values across the dependent variables equalled to zero, and was statistically significant, thus F (3, 278) =15.17, W=.859, $p < .017$. With individual learning as the criterion, R2 =.203, F=.5.226, $p < .017$. This shows that 20.3% of secure, anxious and avoidant attachments explained the variance in individual learning styles of students. With cooperative learning style as the criterion, R2 =.260, F=5.751, $p < .017$. This shows that 26.0% of secure, anxious and avoidant attachements explained the variance in cooperative learning styles of students. With competitive learning style as the criterion, R2 =.242, F=11.767, $p < .017$. This shows that 24.2% of secure, anxious and avoidant attachements explained the variance in competitive learning styles of students. With individual predictions using individual learning style as a criterion, only secure attachment (Beta=.330; t=3.757; p<.000; $\eta 2p$=.048) predict individual learning style of students with a small effect size while anxious attachment (Beta=.168; t=1.535; p>.126; $\eta 2p$ =.008) and avoidant attachment (Beta=.089; p>.310; $\eta 2p$ =.004) did not predict individual learning style of students. This implies that students were aware of the fact that their

colleagues could make them contract COVID-19, hence their choice of individual learning styles in school. In such situations, they strictly go by the protocols established to prevent the spread of the pandemic. Again, using cooperative learning style as a criterion, secure attachment (Beta=.321; t=2.982; p<.003; ɳ2p=.031) and anxious attachment (Beta=.514; t=3.833; p<.000; ɳ2p=.050) predict with small effect sizes, where anxious attachment predict higher than secure attachment but avoidant attachment did not predict cooperative learning styles of students (Beta=-.137; t=-1.283; p>.201; ɳ2p =.006). This implies that upon all COVID-19 restrictions imposed on students, they still have some trust among themselves and might cooperate in some learning situations and see themselves as indifferent in those situations. Furthermore, using competitive learning style as a criterion, anxious attachment (Beta=.368; t=2.271; p<.024; ɳ2p=.018) and avoidant attachment (Beta=.489; t=5.196; p<.000; ɳ2p=.088) predict with small effect sizes respectively, where avoidant attachment predict higher than anxious attachment but secure attachment did not predict competitive learning styles of students (Beta=.157; t=1.661; p>.098; ɳ2p =.010). This implies that students do communicate with their colleagues in the COVID-19 pandemic but see them to be different in a way, hence competing with them in learning situations. This is possible as one student might not know what a colleague is doing because there are restrictions in grouping, hence studying in a competitive mood.

Hypothesis 2: Students' sense of belonging moderating their peer attachment learning styles

The hypothesis sought to test the extent to which students' sense of belonging moderating their peer attachment learning styles amidst COVID-19 pandemic using Andrew Hayes Process model 1 (simple moderation). In this, a sense of belonging is anticipated to either act as an enhancer, buffer or antagonist. Although the scales used in this test were multidimentional, the focus was not dimensional moderation analysis but composite construct moderation test because no single dimension of the constructs used could be used to describe the composite contribution. Again, mediation test was sacrified for moderation test because the levels established on the moderator were not used as basis for performing the test. The running of moderation was based on random bootstrap samples of 5,000. Table 4 presents the results:

Table 4.

Students' Sense of Belonging Moderating Peer Attachment and Learning Styles

Variables	Coeff	Boot SE	Boot LLCI	Boot ULCI	t-value	P
Constant	96.544	1.160	94.260	98.828	83.204	.000
Peer Attachment	.584	.075	.436	.732	7.759	.000
Learning Styles	.669	.132	.410	.929	5.082	.000
Interaction	-.003	.006	-.015	.008	-.548	.584

Model summary: R^2=.385; F (3, 280) =58.534, p=.000
Interaction: R^2 *change*=.0007; F (1, 280) =.3004, p=.5841
Predictor: Peer Attachment
Criterion: Learning Styles
Moderator: Sense of Belonging

The result in Table 4 shows that in the period of COVID-19, students' sense of belonging to the university community did not moderate their peer attachment on learning styles, b=-.003, t=-.548, CI (-.015, .008). Figure 1 indicates the graphical representation of the moderation result:

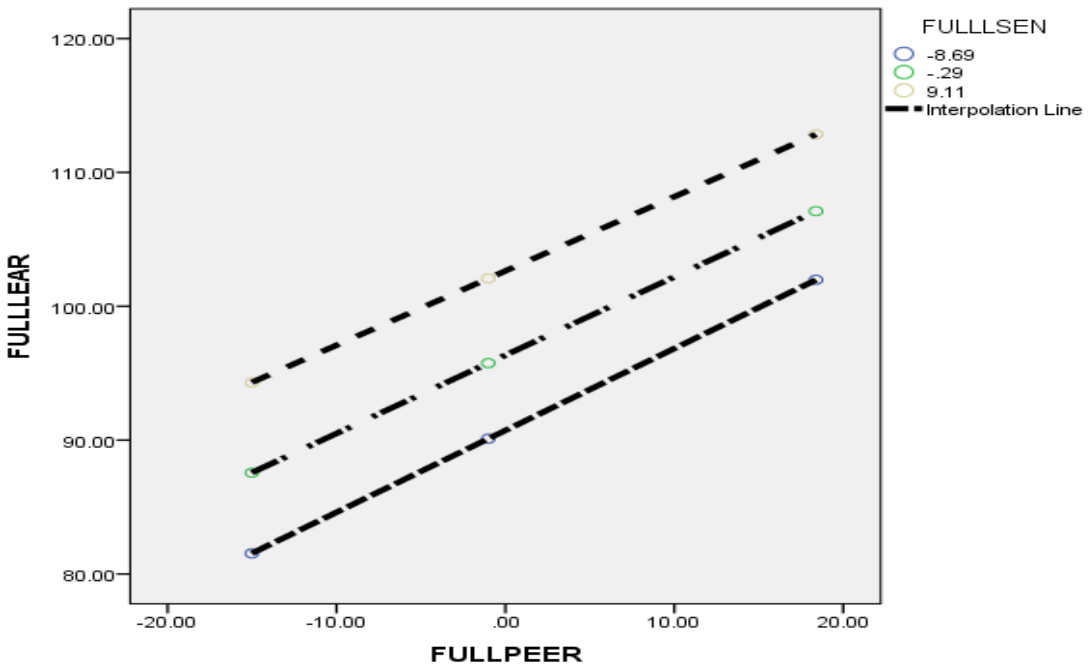

Fig 1. Graphical Representation of the Moderation Result

Figure 1 indicated that no significant moderation effects were evident for a sense of belonging in peer attachment and learning styles. It can be deduced that the graph is linear, indicating no moderation effect. With this, sense of belonging did not enhance, neither did it serve as a buffer or an antagonist to peer attachment as it predicts learning styles among students during the period of COVID-19.

Hypothesis 3: Gender Differences exist in Peer Attachment (secure, anxious and avoidant), Learning Styles ((individual, cooperative and competitive) and Sense of Belonging (belonging, accepting and rejection)

The hypothesis sought to determine gender differences in peer attachment (secure, anxious and avoidant attachments), learning styles (individual, cooperative and competitive) and sense of belonging (belonging, accepting and rejection). Relying on the variable combination, MANOVA was deemed appropriate for the analysis because the dependent variables were measured in nine levels against male and female (gender). Before running the MANOVA test, homogeneity of variance-covariance assumptions was met using the Box's M Sig. value of .136, which was greater than .05. Again, Levene's Test was checked for violations of equality of variance for all nine dependent variables. The results showed that none of the variables violated the equality of variance assumptions as secure attachment (.580), anxious attachment (.372), avoidant attachment (.851), individual learning style (.051), cooperative learning style (.901), competitive learning style (.770), belonging sense of belonging (.652), accepting sense of of belonging (.730), and rejection sense of belonging (.940), which was all produced sig. values greater than .05. Table 5 presents the results on the descriptive statistics:

Table 5.

Descriptive Statistics

Variables	Gender	Mean	Std. D	N
Individual Learning Style	Male	32.43	8.97	136
	Female	30.94	7.75	148
	Total	31.65	8.37	284
Cooperative Learning Style	Male	35.12	10.85	136
	Female	35.84	10.49	148

	Total	35.49	10.65	284
Competitive Learning Style	Male	29.44	9.43	136
	Female	28.86	9.13	148
	Total	29.14	9.26	284
Sense of Belonging	Male	15.63	3.65	136
	Female	14.75	3.60	148
	Total	15.17	3.65	284
Acceptance Sense of Belonging	Male	16.04	3.50	136
	Female	15.16	3.63	148
	Total	15.58	3.59	284
Rejection Sense of Belonging	Male	16.80	3.74	136
	Female	16.28	3.71	148
	Total	16.53	3.72	284
Secure Attachment	Male	34.00	7.90	136
	Female	33.11	8.21	148
	Total	33.54	8.06	284
Anxious Attachment	Male	27.13	6.80	136
	Female	25.82	6.38	148
	Total	26.45	6.60	284
Avoidant Attachment	Male	20.74	5.45	136
	Female	19.37	5.43	148
	Total	20.03	5.48	284

Source: Field Data

Table 5 shows that descriptive results of the study variables indicated that there were no significant differences in mean scores of male and female students during the COVID-19 pandemic in terms of individual learning style (male: M=32.43, SD=8.97; female: M=30.94, SD=7.75), cooperative learning style (male: M=35.12, SD=10.85; female: M=35.84, SD=10.49), competitive learning style (male: M=29.44, SD=9.43; female: M=28.86, SD=9.13), belonging sense of university community (male: M=15.63, SD=3.65; female: M=14.75, SD=3.60), acceptance sense of university community (male: M=16.04, SD=3.50; female: M=15.16, SD=3.63), rejection sense of university community (male: M=16.80, SD=3.74; female: M=16.28, SD=3.71), secure attachment (male: M=34.00, SD=7.90; female: M=33.11, SD=8321), anxious attachment (male: M=27.13, SD=6.80; female: M=25.82, SD=6.38) and avoidant attachment (male: M=20.74, SD=5.45; female: M=19.37, SD=5.43) at .05 level of significance. It implied that, descriptively, male students were not different from female students in their peer attachment, learning styles and sense of belonging as most schools are fraught with problems of COVID-19 pandemic. However, the descriptive results were not enough to confirm the non-significant differences in mean scores of the respondents, hence the need to examine the MANOVA Multivariate Tests in Table 6:

Table 6.

Multivariate Tests

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.973	1088.508	9.000	274.000	.000	.973
	Wilkes Lambda	.027	1088.508	9.000	274.000	.000	.973
	Hotelling's Trace	35.754	1088.508	9.000	274.000	.000	.973

	Roy's Largest Root	35.754	1088.508	9.000	274.000	.000	.973
Gender	Pillai's Trace	.052	1.664	9.000	274.000	.097	.052
	Wilks Lambda	.948	1.664	9.000	274.000	.097	.052
	Hotelling's Trace	.055	1.664	9.000	274.000	.097	.052
	Roy's Largest Root	.055	1.664	9.000	274.000	.097	.052

Source: Field Data

Table 6 presents the results of the multivariate test (MAVOVA) which checked for statistical differences between male and female students in terms of peer attachment, learning styles and sense of belonging. Table 6 showed that no differences existed between male and female students as the Wilks' Lambda results showed a statistically insignificant differences in gender, F (9, 274) =1.664, p>.097; Wilks' Lambda=.948, partial eta squared =.052. Based on the non-significant differences detected, there was no need for further examination of the test. Deductively, it was revealed that male students did not significantly differ from female students in peer attachment, learning styles and sense of belonging amidst the COVID-19 global pandemic. The findings disconfirmed several studies that found differences between male and female students in peer attachment, learning styles and sense of belonging. For instance, Gorrese and Ruggieri (2012) and Ma and Huebner (2008) in their studies found female students attaching to their peers more than their male counterparts but such was not the case in the current study. Also, Henrich et al. (2001), Nelis and Rae (2009), and Richards et al. (2010) found female students are more attached to their peers than their male counterparts because they display higher trust in their friends and a deep communication with them (Gullone & Robinson, 2005; Ruijten et al., 2011; Song et al., 2009). In terms of learning styles, Baneshi et al. (2014) found female students cooperative learning styles than their male counterparts who fronted for independent learning styles. This was in line with Amir et al. (2011) and Hamidah, Sarina, and Jusoff (2009) female students' preference for cooperative learning styles over competitive learning styles against their male counterparts. Inversely, Azarkhordad, and Mehdinezhad (2016) male students' dominant style was cooperative, while female students' dominant style was competitive style, where such behaviours were not evident in the current study. In terms of sense of belonging, Good et al. (2012) found female students to feel less belonging than their male counterparts and Murphy et al. (2007) also found female students reporting a low sense of belonging. Furthermore, Hughes et al. (2015) found a lower sense of belonging among female students than their male counterparts.

4. Conclusion and Suggestions

It is evident from the results that the presence of COVID-19 has distracted students to the extent that most of them has low peer attachement and exhibited low belongingness. The results again demonstrated that most of them exhibit individuality in their academic work. It is equally important to note that the experience of low peer attachment predicted students learning styles. Again, some students indicated that the effects of the pandemic made them develop the cooperative style of learning. Other students who had the opportunity to collaborate with their colleagues exhibited some competitiveness in their learning.

With the warning of a third wave, there is no doubt that the COVID-19 pandemic will take a longer time to be defeated by local and global health professionals stakeholders. As such, it is important that students continue to practice individual learning styles most often but could collaborate with some few colleagues in some other academic situations so that they could maintain their bond. In this process, universities and schools in general should be mindful of the fact that students could contract the virus irrespective of their current practices of academic engagement. Furthermore, as students keep isolating themselves from colleagues, it is important that they feel being part of their mother institutions as the fight to eradicate COVID-19 continued unabated. It is advised that school psychologists and counsellors should constantly

be in touch with students as they keep observing protocols of COVID-19 so that they may not lose their attachment abilities and sense of belonging.

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What do secondary school students think about experimental practices in science lessons taught in distance education?

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Abstract

Following the COVID-19 pandemic, which took the world under its influence, many countries, including our country, switched to distance education. During this period, students did not go to schools and lessons continued to be taught online remotely. In this study, it was aimed to investigate secondary school students' opinions about conducting experiments in science lessons in the distance education process. The study group consisted of 587 secondary school students receiving education in 24 schools located in different regions of Turkey. The form consisting of five open-ended questions used as the data collection tool was developed by the researchers. The descriptive content analysis method was used to analyse the data obtained. In the first question, in which the opinions of students about experiment practices in science lesson were investigated during the distance education process, the answers included in the theme of positive opinion were encountered the most. The greatest difficulty faced by students in conducting experiments in distance education was found to be related to the physical conditions they had. Among the expectations of the students, the most common response was related to increasing experimental practices in distance education. The students stated that they found conducting experiments face to face to be more effective and advantageous compared to conducting experiments in distance education. They also made various suggestions regarding the features of the experimental practices. In line with the results of this study, since it was determined that students found it more effective to do face-to-face experiments, it is thought that it would be appropriate to include experimental practices more, especially in lessons conducted face-to-face, at least in the classrooms where hybrid education is applied.

1. Introduction

Throughout history, people have always tried to find alternative solutions to the extraordinary situations they encountered. While the COVID-19 pandemic period caused great repercussions around the world in 2020-2021, it also created difficult conditions for many people. Especially education carried out in schools has been affected a lot in this respect. In the report published by OECD (2020), it has been stated that around 1.2 billion students worldwide have stayed away from schools, and many countries have interrupted face-to-face education and switched to distance education or continued hybrid education in a controlled manner (OECD.org, 2020). In hybrid education, students continue to face-to-face education activities along

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with distance education (OECD.org, 2020) and many countries adopt the hybrid model in the education system during the pandemic process.

The effects of changing activities in education, which are transformed in line with the needs of people, on the continuity and deficiencies of education, are being investigated by many researchers. (Basilaia & Kvavadze, 2020; Tria, 2020; Toquero, 2021). It has been stated that decisions should be made by considering the moral, ethical and controversial nature of the society during the resolution of COVID-19 related problems, which have been a global socioscientific issue (Evren-Yapıcıoğlu, 2020). Although there is a belief that the society's attitude towards distance education is lower than face-to-face education, studies conducted show that, on the contrary, attitudes towards distance education are actually more positive with appropriate materials and flexible studies (Odabaşı et al., 2020; Hodges, Moore, Lockee, Trust, & Bond, 2020). In their studies, in which they investigated students' views about distance education, Kahraman (2020) and Çiçek, Tanhan, & Tanrıverdi (2020) determined that students had both positive and negative thoughts, and that they experienced difficulties especially in laboratory and applied lessons, which shows that more studies should be carried out in secondary school groups.

Since the materials to be used in distance education lessons should have a positive effect on students' learning, they should be planned in advance. With the pandemic period, while schools in many countries left the implementation and improvement of the curriculum in the hands of teachers during this crisis, some of them created open education resources (Daniel, 2020). Many teachers have been caught unprepared for this process. Unlike face-to-face education, the use of materials has also changed in the distance education process. For teachers, it has become difficult to increase the participation and motivation of the students, and to support and follow them (Sari & Nayır, 2020). It has been observed that teachers have experienced problems in controlling students and classroom management in virtual classrooms (Alea, Fabrea, Roldan, & Farooqi, 2020; Arslan & Şumuer, 2020). The problems experienced by the teachers have also affected the interests and attitudes of the students and changed their interactions in the lessons. Students' interest in lessons has decreased, and as a result, their participation in distance education classes has decreased. Of course, it is not correct to associate this decline only with interest in the lesson. It has also been stated that among the reasons for students not to participate in lessons, there are many reasons such as physical conditions, that is, lack of Internet connection and technological equipment (Adnan & Anwar, 2020; ElSaheli-Elhage, 2021; Henaku, 2020). Distance education period has been realized with the participation of the learners through technological tools such as the Internet network, smart phone, computer, tablet, etc. However, lack of equality of opportunity was observed in many regions (Ramos-Morcillo et al., 2020). Keskin & Özer Kaya (2020), in their research on the evaluation of distance education, reported that students experienced shortcomings in terms of communicating, and that there were technical problems during education.

In our country, the continuity of education has been ensured with the Education Information Network (EBA) in distance education (Can, 2020; Kaçan & Gelen, 2020; Karakuş & Yanpar Yelken, 2020). In the distance education process, as in face-to-face education, it is aimed to provide students with the cognitive structures and skills determined in the curricula (MoNE, 2018). Especially in science lessons, it is aimed for students to learn by experimenting and discovering. Pınar & Dönel Akgül (2020) stated in their studies on the distance education of science lessons that students found distance education useful due to the pandemic process, and that the lessons held allowed them to repeat and reinforce science subjects, and they also expressed that not being able to conduct experiments in distance education was a major deficiency. The student found experimenting more motivating and fun and social in terms of learning the concepts better, and they claimed that not being able to experiment was the biggest deficiency. Babinčáková & Bernard (2020) determined in their study on online chemistry experiments with students that students found these activities instructive. On the other hand, another point that students criticize in distance education is that teaching is carried out with teacher-centered questions and answers and traditional approaches are

mostly used (Koçoğlu & Tekdal, 2020). Tanık-Önal & Önal (2020) stated in their study that parents thought that using EBA in science lessons was beneficial for students.

However, researching what students think about experiments that are an integral part of science lessons during distance education and how they conduct experiments in this process are important in terms of identifying and solving existing problems. In this study, it was aimed to determine students' views on the continuity of laboratory experiments in science classes.

1.1. Research Questions

In this study, answers to the following research questions were sought:

1. What are the opinions of the students about conducting the experiments in the science lesson in distance education?
2. What are the difficulties that students are faced with while performing the experiments in the science lesson in distance education?
3. What are the expectations of the students about the experiment practices in the science lesson in distance education?
4. What are the opinions of the students in distance education in terms of comparing the experimental practices in the science lesson with the experiment practices in the real laboratory environment?
5. What are the students' suggestions for conducting experiments in the science lesson in distance education?

2. Methodology

In this part of the research, information is given about the research model, study group, data collection process and data analysis.

2.1. Research Model

Based on the research problem, this research was carried out with the singular screening model, which is one of the screening model types. In studies using singular screening model, the studied event, item, individual, group, subject, etc., it is aimed to describe the variables belonging to the unit and the situation separately (Karasar, 2009).

2.2. Study Group

The study group consisted of 587 students studying in 24 different secondary schools in four cities located in different regions of Turkey. These schools were selected among schools with different socio-economic levels and different achievements in LGS (High School Entrance Exam). While the participants of the study were determined, maximum variation sampling method, one of the purposeful sampling methods, was used. With the maximum variation sampling, it is aimed to find out whether there is a common point between the situations that display diversity, and to reveal the different dimensions of the problem according to this diversity (Yıldırım & Şimsek, 2008). The distribution of the students included in the study group by grades is given in Table 1 below.

Table 1.

Demographic characteristics of the participants in the study group

Variables		N	%
Grade Level	5th Grade	185	31.52
	6th Grade	195	33.22
	7th Grade	117	19.93
	8th Grade	90	15.33
Gender	Female	289	49.23
	Male	298	50.77

2.3. Data Collection Tool

A form consisting of six open-ended questions was prepared by three researchers to examine the opinions of secondary school students about conducting experiments in distance education. Experimental practices in science lessons in distance education are among the expectations of students to gain their own scientific process skills in a way that they can gain their own experiences and contribute to their lives. With these questions, the ideas of students regarding distance education and hybrid education processes in periods when the number of cases are low during the pandemic process were investigated. Starting from March 2020, when the pandemic began, all classes continued distance education until the end of the term. At the beginning of the 2020-2021 academic year, hybrid education was initiated first in the 8th grades prepared for the exam, followed by the 5th grade, and the distance education was continued at other grade levels. However, after a short time, 5th graders moved to distance education again. Currently, all classes continue distance education. During this time, the students did not have the opportunity to do any experiments face to face. Students individually need a computer, tablet or smart phone, computer access, etc. technological devices and applications in the distance education process. These needs are supplied by the families of the students, and tablets and free internet connections were distributed gradually by the MoNE to the students in need of. Computer and internet access points have been established at some points for students in need by the MoNE. In fact, a virtual laboratory environment was created in schools for students in need of, and students were enabled to continue distance education in this way.

With the questions in this form, it was aimed to determine the students' opinions about conducting experiments in science lessons in the distance education process, the difficulties they encountered while doing experiments, the expectations of the students, the comparison of the real experiment practices and the distance education experiment practices, and the suggestions of the students. This form was then examined in terms of structure, content and scope by two experts who had doctorate degree in the field of science education and two science teachers. In order to determine the compliance and consistency between the experts' opinions, inter-expert compliance was calculated with the reliability formula suggested by Miles & Huberman (1994). This calculation was made as follows:

$$Reliability = Agreement / (Agreement + Disagreement).$$

As a result of this calculation, the consensus among experts was calculated as .82. The rate above .70 obtained as result of the reliability calculations an acceptable rate (Miles & Huberman, 1994). Three researchers worked again to ensure consensus on the questions in line with expert opinions; as a result, one of the six open-ended questions in the form was removed, and the remaining five questions were finalized. The questions in this form were sent to the secondary school students in the sample via form sharing practices in electronic environment, and the students answered the questions in the form and sent them back through the practice. Thus, the data were collected from the students online.

2.4. Data Analysis

The categorical analysis method, which is one of the descriptive content analysis methods, was used in the analysis of the data obtained from the data collection tool. Descriptive content analysis is a systematic review that aims to identify and explain general trends and research results in a particular research (Çalık & Sözbilir, 2014). The stages of descriptive content analysis are given below.

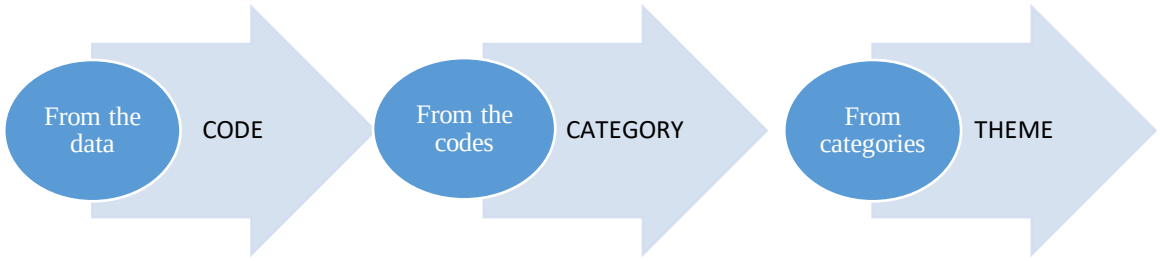

Fig. 1. The stages of descriptive content analysis (Mcmillan & Schumacher, 2010)

In the data analysis process, firstly, the answers given by the students for each question were examined one by one independently by the researchers. After coding was done according to the concepts extracted from the data, it was tried to find common aspects between the codes. Categories were created by combining the codes. In the study, by combining the categories under more general headings, themes were formed. In order to ensure the reliability of the data analysis, the data were analyzed independently by three researchers. The kappa statistic was used to determine the inter-rater reliability for data analysis. In kappa statistic, inter-rater reliability is calculated as follows (Sim & Wright, 2005):

$$k = \frac{\text{Observed rate of compliance} - \text{Incidental compatibility rate}}{1 - \text{Incidental compatibility rate}}$$

The inter-rater kappa statistic value was determined as.87, which quite a high value. Then, the findings obtained as a result of the analysis of the data were converted into percentages and frequencies and presented in charts and tables. While presenting the student answers, the students were coded according to the grade level. 5th grade students were coded as A, 6th grade students as B, 7th grade students as C, and 8th grade students as D, and by writing the student numbers next to these letters, it was shown which grade students gave the relevant answers. For example, code B22 denotes the student numbered 22 at sixth grade level.

3. Findings

In this section, the findings regarding the students' views on experimental practices in the science lesson in the distance education process are included.

3.1. Findings Regarding the First Question of the Study

In this section, the findings obtained from the analysis of the answers of the students regarding the practices of the experiments in the science lesson in the distance education process are included. The themes obtained from the students' answers are shown in Chart 1 below.

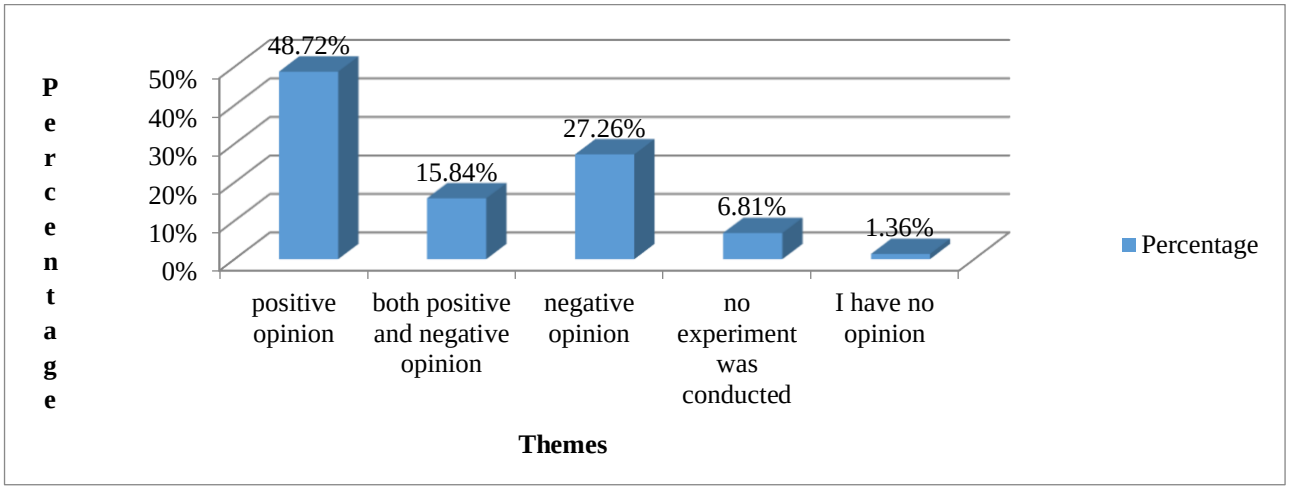

Chart 1. Students' views on the practices of the experiments in the science lesson in the distance education process

When Chart 1 was examined, it was determined that 48.72% of the answers given by students regarding experimental practices in the science lesson in the distance education process were under the theme of positive opinions, 27.26% under the theme of negative opinions, and 15.84% under both the positive and negative opinions themes. 6.81% of the students stated that they did not conduct experiments in the science lesson, and 1.36% stated that they did not have opinions about experimental practices in the distance education process.

According to the grade level, the frequencies of students' views on the implementation of experiments in the distance education process are given in Table 2 below.

Table 2.

Distribution of students' views on the practice of experiments in distance education by grade levels

Themes	5th Grade	6th Grade	7th Grade	8th Grade	Frequency
positive opinion	110	88	43	45	286
both positive and negative opinion	28	35	16	14	93
negative opinion	36	57	46	21	160
no experiment was conducted	9	12	12	7	40
I have no opinion	2	3	2	1	8

When Table 2 was examined, it was found that 5th grade students had more positive opinions about the experimental practices in the distance education process than the students in other grade levels. It was determined that the students in the 6th grade were the most involved in the negative opinion theme. Opinions were obtained from secondary school students that the experiments were not conducted in different grade levels. It was also found that a small number of students from each grade level did not have opinions about experimental practices in the distance education process.

Among the students' views on experimental practices in the distance education process, some of the students' opinions in the positive opinion theme are as follows:

"Practices were explanatory and instructive. We learned by trying ourselves" (A169)

"Thanks to the experiments conducted in distance education, it is easier for us to learn and we learn better*"* (B93)

"I've done experiments on my own, my self-confidence has increased, I learned new things" (C33)

"I can say that the lesson is useful and efficient" (D22)

When the expressions of the students in the theme of positive opinion were examined, it was encountered with the answers regarding students' increased motivation for the lesson, their ability to practice individually, facilitation of their learning, and the lesson being more instructive, efficient and permanent with experimental practices in the distance education process.

Among the students' views on experimental practices in the distance education process, some students' responses regarding the negative opinion theme are as follows:

"It is not efficient because we cannot use the materials that we would use in the school environment" (A78)

"In the distance education process, the opportunity to do experiments has been very limited" (B91)

"Because there was no support from the teacher, I had difficulty in getting detailed knowledge about the experiments I did" (C31)

"I don't think it is necessary to conduct experiments in distance education. After all, we do not understand much. Conditions are bad" (D18)

Examining the students' responses in the theme of negative opinion, it was found that the students had individual difficulties in the experimental practices during the distance education process and they needed teacher support. The students stated that the physical conditions of the environment in distance education were insufficient and the experimental practices could not be carried out efficiently. In this process, it was even found that the experimental practices had to be suspended for a while.

3.2. Findings Regarding the Second Question of the Study

In this section, students' views on the difficulties they encountered while conducting the experiments in the science lesson in the distance education process are included. Students' answers are shown in Chart 2 below.

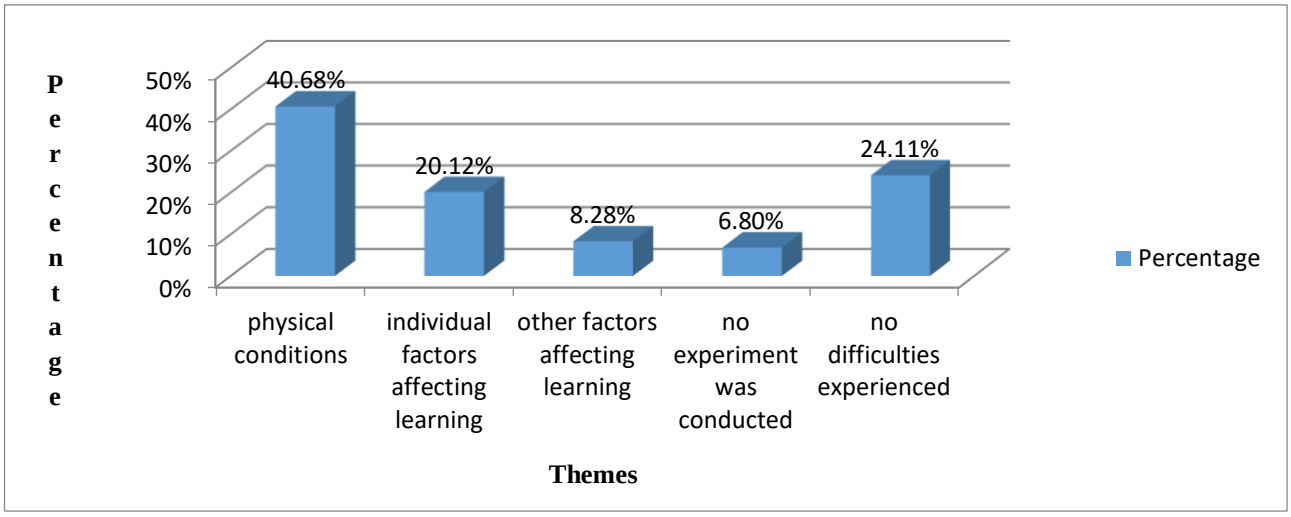

Chart 2. Students' views on the difficulties encountered in the practice of the experiments in the science lesson in the distance education process

When Chart 2 is examined, it is seen that 40.68% of the students stated that they had problems related to physical conditions, 20.12% experienced individual problems, and 8.28% had problems in other factors such as the lack of teacher support in the distance education process which affected their learning. It was determined that 24.11% of the students did not have any difficulties in conducting experiments in the distance education process. 6.80% of the students stated that they did not conduct experiments in the science lesson.

The frequencies of the students' views on the difficulties encountered in the practice of the experiments in the distance education process in the themes according to the grade level are shown in Table 3 below.

Table 3.

Distribution of the students' views on the difficulties encountered in the practice of experiments by grade levels

Themes	5th Grade	6th Grade	7th Grade	8th Grade	Frequency
physical conditions	75	97	53	50	275
individual factors affecting learning	42	40	30	24	136
other factors affecting learning	22	11	15	8	56
no experiment was conducted	10	17	16	3	46
no difficulties experienced	61	57	21	24	163

When Table 3 was examined, it was determined that students of all grade levels had the most difficulty in physical conditions regarding the difficulties encountered in experimental practices during the distance education process. It was found that 6th grade students experienced more difficulties related to physical conditions than the students in other grade levels. It was found that 5th grade students had more difficulty individually and were more affected by other factors affecting learning, such as the lack of teachers. There were statements of the students in different grade levels expressing that no experiments were conducted in the lessons. There were also students' opinions in different grade levels stating that they did not have any difficulties in the practice of experiments in the distance education process.

Among the opinions of the students about the difficulties encountered in experimental practices in the distance education process, some of the students' views on the physical conditions theme are as follows:

"Lack of experiment materials and environment" (A54)

"Some experiments requiring strength, conditions" (B118)

"I had a hard time choosing the materials, lack of equipment, home environment" (C31)

"The materials used in experiments are not available at home, a dark environment is required or even a bright environment is required to find them, find materials and gather them, they used to be all readily available in the school lab" (D48)

Examining the statements of the students in the physical conditions theme, it was concluded that the home conditions of the students in the distance education process were not suitable for providing the necessary environment and material conditions for their experimental practice. It was observed that there were statements of the students expressing that they experienced technological device problems in the distance education process.

Among the opinions of the students about the difficulties encountered in experimental practices in the distance education process, some of the students' views on the themes of individual and other factors affecting learning are as follows:

"I have a little difficulty because I am not with my teacher and cannot fully understand how to do it." (A46)

"While conducting experiments in the science lesson in the distance education process, I can sometimes have difficulties. For example, when we are doing experiments, because we are remotely participating, I am having trouble how to do them, but when the lesson is face-to-face, I understand it more clearly" (B108)

"The size of the devices we use to attend the lessons may create some difficulties. I believe we make a lot of effort to see when we attend the lessons through the mobile phone, but when we attend through large screen devices such as computers and tablets, this situation becomes easier" (C89)

"Teacher support" (D22)

Examining the responses of the students in the themes of individual and other factors affecting their learning, it was found that the students had individual difficulties in the experimental practice in the distance education process. In the category of other factors affecting students' learning, the answers such as lack of teacher support, inability to establish eye contact, communication problems and connection problems were found. In addition, it was concluded that the students had difficulty understanding the subject because the learning process was not face-to-face.

Among the opinions of the students about the difficulties they encountered in experimental practices in the distance education process, some of the students' views on the theme of not having any difficulties are as follows:

"I did not encounter any difficulties" (A79)

"No difficulty" (C116)

"Usually we do not experience difficulties" (D32)

When the expressions of the students in the category of not having difficulties were examined, it was found that the students in different grade levels did not encounter any difficulties individually or environmentally in the experimental practice during the distance education process.

3.3. Findings Regarding the Third Question of the Study

This section includes the expectations of the students about the experiments in the science lesson in the distance education process. Students' answers are shown in Chart 3 below.

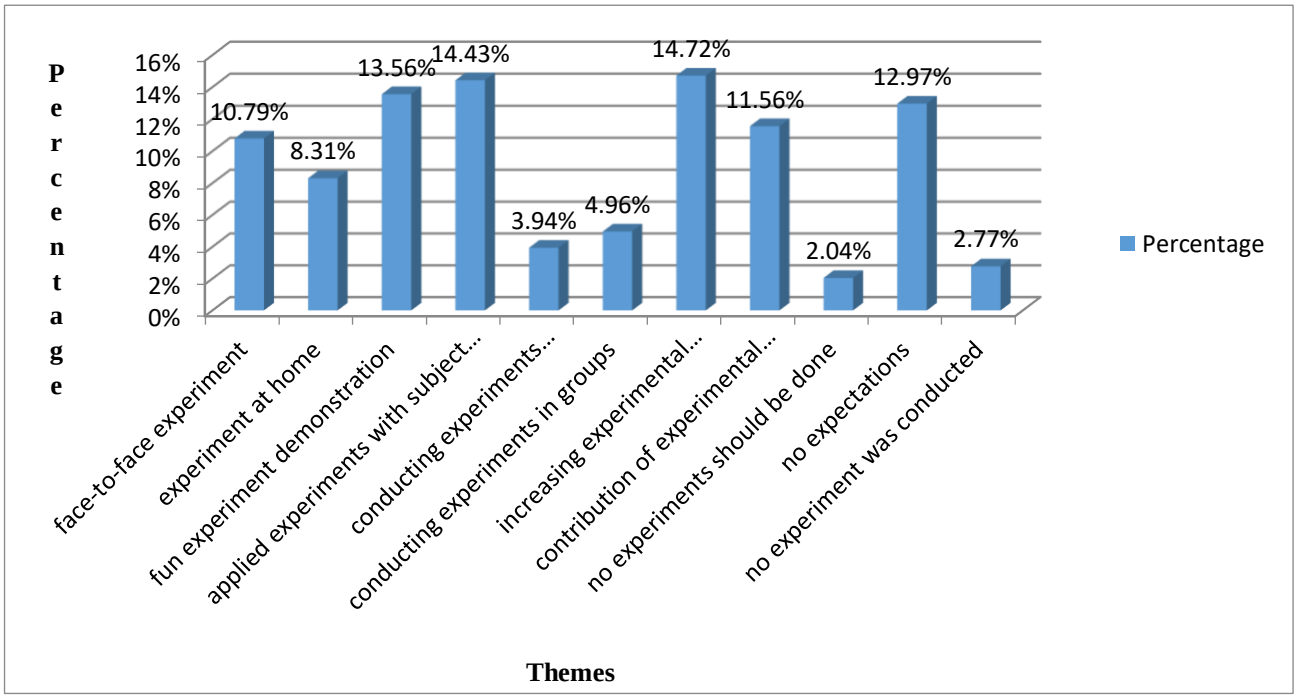

Chart 3. Opinions of students regarding the expectations from experimentation in science lesson during the distance education

When Chart 3 is examined, the expectations of the students in the experiments in the science lesson during the distance education process are as follows: 10.79% of the students expected to be able to do face-to-face experiments, 28.31% to do experiments at home, 13.56% to conduct fun experiments, 14.43% to do subject-content hands-on experiments, 3.94% to do experiments individually, 4.96% to do experiments in groups, while 11.52% wanted experimental practices to contribute to learning, and 14.72% expected the number of experimental practices to be increased. 12.97% of the students stated that they had no expectations, and

2.04% stated that they did not want any experiments to be conducted. 2.77% of the students stated that no experiments were done in the process.

The frequencies of the opinions of students regarding the expectations from the practice of experiments in the distance education process in the themes according to the grade levels are given in Table 4 below.

Table 4.

Distribution of the students' expectations of about the practices of experiments in the distance education by grade levels

Themes	5th grade	6th grade	7th grade	8th grade	Frequency
face-to-face experiment	23	16	23	12	74
experiment at home	13	25	10	9	57
fun experiment demonstration	31	35	19	8	93
applied experiments with subject content	28	40	22	9	99
conducting experiments individually	11	10	4	2	27
conducting experiments in groups	12	15	5	2	34
increasing experimental practices	41	30	21	9	101
contribution of experimental practices to learning	27	20	18	14	79
no experiments should be done	4	5	2	3	14
no expectations	20	28	19	22	89
no experiment was conducted	3	8	3	5	19

In Table 4, the themes related to the expectations of students regarding experimental practices in the distance education process are included. When the frequency table was examined according to the themes, it was determined that the expectations of the students about the experimental practices in the distance education process were more towards being able to experiment face-to-face rather than being able to do experiments at home. While the 5th, 7th and 8th grade students expressed their expectations about conducting experiments face-to-face, it was determined that the 6th grade students had more expectations of being able to do experiments at home. As for the types of experiments, it was found that the 5th grade students had more expectations for fun demonstration experiments, and that the students in other grade levels had expectations for applied experiments with subject content. The students stated that they expected experimental practices to be increased, and that they expected experimental practices to contribute to learning. Some of the students in different grade levels stated that no experiments were conducted in the lessons, while some stated that the experiments should not be done. It was also found that students in different grade levels did not have any expectations from the experimental practices in the distance education process.

Among the opinions of the students about their expectations from experimental practices in the distance education process, some of the students' views on the theme of experimenting are as follows:

"By experimenting, we can perceive what we have learned better" (A84)

"To be able to do experiments with my teachers and friends" (B74)

"I think experiments can also be conducted in distance education experimental. For example, the teacher can get the experimental material and show the experiment to us practically in the live lesson (conducting the experiment on his/her own)" (C108)

"In my opinion, we have to do at least two experiments on each subject because we personally witness the subject we deal with in the experiments and understand the subject better" (D28)

When the statements of the students in the theme of being able to conduct experiments were examined, it was concluded that the students learned the subject better with the experimental practices and the experimental practices should be increased. Some of the students stated that in the distance education

process, they wanted the teachers to apply the experiments and present them as a demonstration, while some of them wanted to be able to do experiments with their teachers. Students stated that their technological problems should be solved in order to be able to perform experimental practices in the distance education process. In the distance education process, it was found that the experiments should be presented with video and slide, or simpler and easier experiments should be applied at home.

Among the opinions of the students regarding their expectations of experimental practices in the distance education process, some of the students' views on the themes that no experiments should be done and no experiments were conducted are as follows:

"Experiments should not be done" (B163)

"I advocate that experiments should not be conducted in great numbers, because after listening to the lecture, reading the textbook and learning the subject thoroughly, solving related problems is much better than conducting experiments" (D25)

When the statements of the students on the theme that no experiments should be done were examined, they expressed that the experiments applied in the process were not appropriate. The students stated that they preferred problem solutions to reinforce the subject rather than experimental practices. Students stated that their technological problems should be solved in order to be able to perform experimental practices in the distance education process. It was found that in the distance education process, the experiments should be presented with video and slide, or simpler and easier experiments should be conducted at home.

3.4. Findings Regarding the Fourth Question of the Study

In this section, when the experimental practices in the science lesson in the distance education process were compared with the experimental practices in the real laboratory environment, the students stated that they found these two practices different from each other. The themes obtained from the students' answers are shown in Chart 4 below.

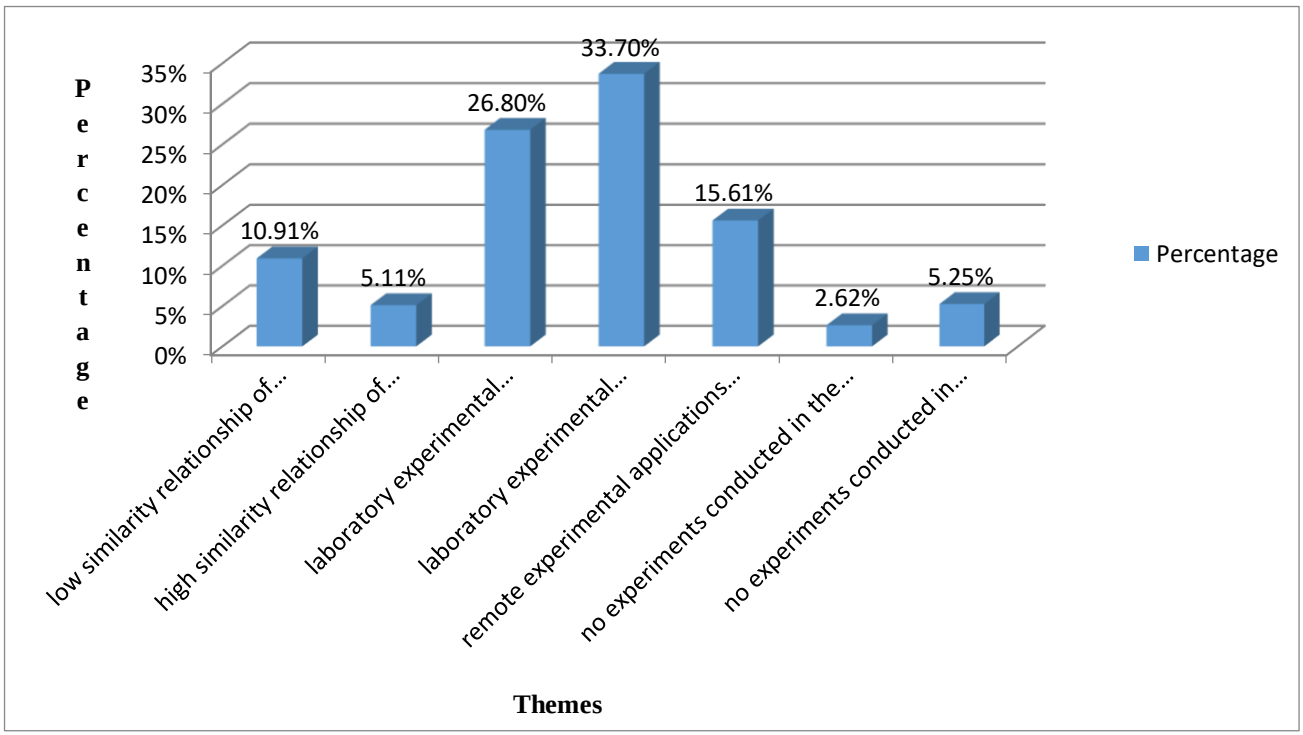

Chart 4. The opinions of the students regarding the differences between the experimental practices in distance education and the experimental practices in the real laboratory environment

When Chart 4 is examined, it is seen that regarding the differences between the experimental practices in the science lesson in the distance education process and the experimental practices in the real laboratory environment, 10.91% of the students stated that the similarity relationship of the experimental practices was low, 5.11% found the experimental practices had a high similarity relationship, 26.80% of the students stated that the experimental practices were effective in the laboratory, 33.70% expressed that the experimental practices in the laboratory were advantageous, 15.61% stated that remote test practices were disadvantageous, 2.62% stated that there were no experiments conducted in the laboratory, and 5.25% stated that there were no experiments conducted in the distance education process. Most of the students stated that the experimental practices in the distance education process and the experimental practices in the real laboratory environment were different, and that the experimental practices in the laboratory were effective and advantageous.

Regarding the comparison of the experimental practices in the science lesson during the distance education process and the experimental practices in the real laboratory environment according to grade levels, the frequency table presenting the differences is given in Table 5 below.

Table 5.

Distribution of the students' views on the differences between experimental practices in the science lesson in the distance education process and real experimental practices by grade levels

Themes	5th grade	6th grade	7th grade	8th grade	Frequency
low similarity relationship of experimental practices	34	34	5	6	79
high similarity relationship of experimental practices	13	8	5	11	37
laboratory experimental practices are effective	58	76	34	26	194
laboratory experimental practices are advantageous	54	72	61	57	244
remote experimental practices are disadvantageous	33	36	26	18	113
no experiments conducted in the laboratory	5	6	6	2	19
no experiments conducted in distance education	12	9	13	4	38

Table 5 shows the themes related to the comparison of experimental practices in the distance education process with the experimental practices in the real laboratory. When the frequency table according to the themes was examined, it was seen that the 5th and 6th grade students stated that the experimental practices in the distance education process and the experimental practices in the laboratory environment were very different from each other, while the 7th and 8th grade students stated that this difference was not very high. Students at all grade levels stated that experimental practices in the laboratory were effective and advantageous, while experimental practices in distance education were disadvantageous. It was found that some of the 5th, 6th, 7th and 8th grade students did not do any experimental practices either in the laboratory environment or and in the distance education process.

Among the students' views on the comparison of experimental practices in the distance education process with experimental practices in real laboratory environment, some of the students' opinions about the theme of low similarity relationship between experimental practices are as follows:

"It would be a big difference. Because the time is limited in distance education, but if we were at our school, our teacher would better explain the points we do not understand" (A49)

"There is a lot of difference, of lesson; first of all, we do not have the experiment materials and the experiment environment with us; we do the experiments without the supervision of the teacher" (D29)

"In the laboratory, we can perceive with our five senses, but in distance education we only see and hear" (D47)

When the statements of the students regarding the low similarity relationship between the experimental practices were examined, the students stated that there was a big difference between the laboratory environment experiment practices and the experimental practices in the distance education process in terms of environment, material, number of experiments, time, teacher support and practice. Students stated that they learned better by perceiving with five sensory organs in the laboratory. In this theme, students stated that they learned only visually in the distance education process.

Among the students' views on the comparison of experimental practices in the distance education process with experimental practices in real laboratory environment, some of the students' opinions about the theme of high similarity relationship between experimental practices are as follows:

"*Our teacher is teaching very well. I cannot see a difference if you listen to him/her very well. There is no difference in terms of place; we should just understand each other" (A178)*

"Since we do not conduct experiments at school either, it did not make much difference" (B35)

"It was not so different; it was just the way it was done in the laboratory" (C107)

"In real life, we could make eye contact or show where we got stuck, but in distance education, not much changed for me, we did the same experiments again; even if we were in real life, nothing would change" (D30)

When the statements of the students about the high similarity relationship between the experimental practices were examined, the students stated that there was not much difference between the experimental practices in the distance education process and the experimental practices in the laboratory environment in terms of the effect of the experiments on learning. The minimum difference between experimental practices in the distance and laboratory environment showed that the learning paths, learning environments, opportunities of the students, the method used in teaching and the instructional effect were different. It was found that students' opportunities in the distance education process, their opportunities at school and their technological capabilities were effective on experimental practices.

Among the students' views on the comparison of experimental practices in the distance education process with experimental practices in real laboratory environment, some of the students' opinions about the theme that experimental practices in the laboratory environment are advantageous are as follows:

"In the laboratory, there are more appropriate tools and we as a whole class ask questions to our teacher and learn better. In distance education, on the other hand, sometimes there is a connection problem. We either do not understand the subject or learn it partially" (A136)

"In the real lab, I can get ideas from my friends, I can do my experiments there with my friends, I show my experiment there to my teacher, I can ask my teacher whatever I am curious about. But, in distance education, experiments are usually given as homework, I do the experiment myself at home, sometimes I can get ideas from my family, my family helps in dangerous experiments. Also, in the real laboratory. It is more fun and I feel like a scientist" (B148)

"In a laboratory environment, there are more tools such as microscope, etc. But in our homes, there is no microscope, we could not even examine a cell closely. I think it will be more difficult as the tools and equipment required for every experiment cannot be found in the home environment. With the opportunities of distance education, we can reach less information and more superficial results" (C18)

When the statements of the students in the theme of advantages of experimental practices in the laboratory setting were examined, the students stated that they learned with more fun by exchanging ideas with their friends and teachers in the laboratory environment. The students stated that they did not experience any material shortage in the real laboratory environment, and that they ensured more meaningful learning by

touching the materials. It was found that experimental practices in real laboratory environment were advantageous in terms of students' motivation for the lesson and permanent learning by doing and experiencing.

Among the students' views on the comparison of experimental practices in the distance education process with experimental practices in real laboratory environment, some of the students' opinions about the theme that experimental practices in distance education are disadvantageous are as follows.

"In home environment, a limited number of experiments can be done due to lack of material" (A130)

"There are motivating items in the lab that catch the child's attention; home is insufficient in this regard" (B192)

"Distance education is difficult and there is no teacher support. The experiments in the laboratory environment are meticulously designed with more care, and there is the teacher support, which makes sense" (C43)

When the statements of the students regarding the theme of the disadvantages of experimental practices in the distance education process were examined, it was found that the students were not motivated for the lesson in the home environment, had difficulties in terms of the system, could not understand enough with virtual practices, and that the materials and environment were inadequate. The students stated that they could not do enough experiments due to the environment and lack of materials. The experimental practices in distance education were found to be disadvantageous in terms of students' physical conditions, motivation for the lesson and permanent learning.

Among the students' views on the comparison of experimental practices in the distance education process with experimental practices in real laboratory environment, some students' views on the theme that no experiments were made in distance education and no experiments were conducted in a laboratory environment are as follows:

"I did not do any experiments in a laboratory environment. I have no idea" (A119)

"We did not do any experiments during the distance education process" (B45)

"We did not do any experiments in the laboratory, neither did we do any experiments in distance education. So, I do not know if there is a difference" (C87)

When the statements of the students in the theme that no experiments were conducted in the laboratory environment were examined, it was found that these students did not meet the laboratory environment until the grade level they were in. When the statements regarding the theme that no experiments were done in the distance education process were examined, it was observed that the students did not do any experiments only in the distance education process. It was found that some students were not familiar with experimental practices.

3.5. Findings Regarding the Fifth Question of the Study

In this section, students' suggestions about experimental practices in the science lesson in the distance education process are included. The themes obtained from the students' answers are shown in Chart 5 below.

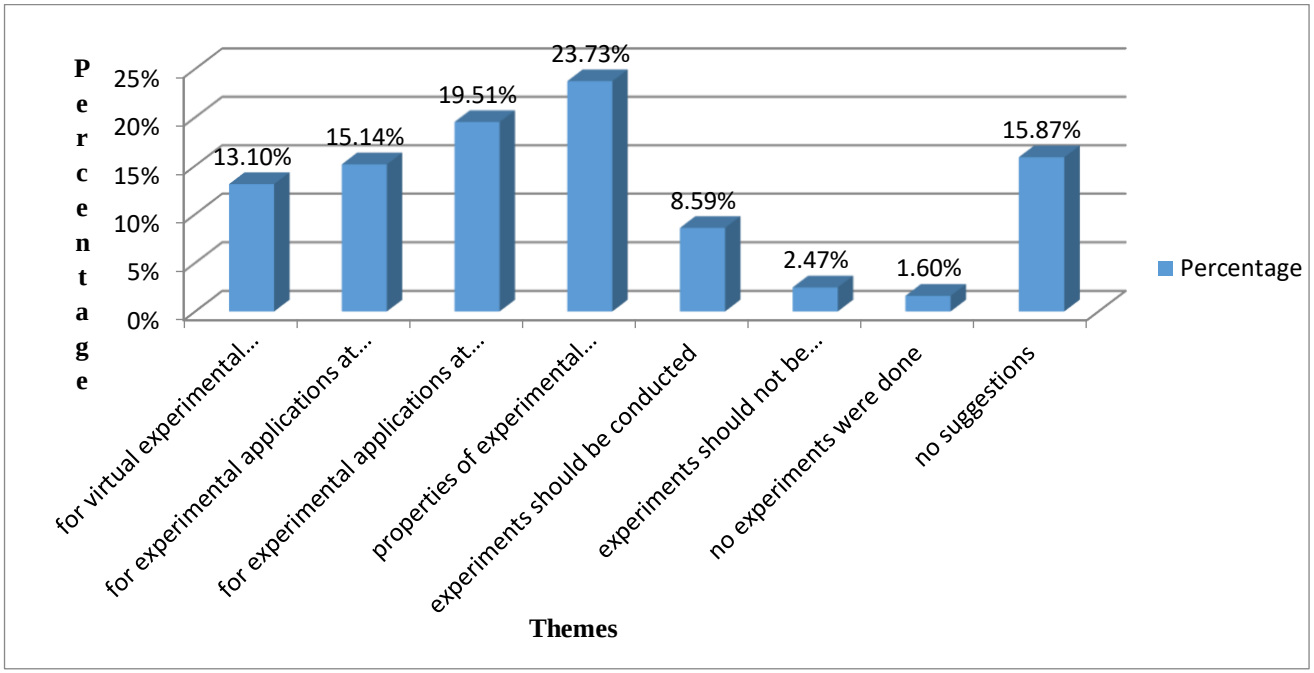

Chart 5. Students' views on suggestions for experimental practices in science lessons in the distance education process

When Chart 5 is examined, it is seen that regarding the experimental practices in the science lesson in the distance education process, 13.10% of the students made suggestions about virtual experiment practices, 15.14% about conducting experiments at home, 19.51% about experiments at school, 28% about the properties of the experimental practices, and that 8.59% of them suggested that experiments should be conducted, while 2.47% of them suggested that experiments should not be conducted. 15.87% of the students stated that they had no suggestions, and 1.60% of them stated that no experiments were conducted.

The frequency table regarding the suggestions for conducting experiments in the science lesson in the distance education process according to the grade level is given in Table 6 below.

Table 6.

Distribution of the students' suggestions regarding experimental practices in science lessons in the distance education process by grade levels

Themes	5th grade	6th grade	7th grade	8th grade	Frequency
for virtual experimental practices	17	35	22	16	90
for experimental practices at home	43	47	8	6	104
for experimental practices at school	28	57	25	24	134
properties of experimental practices	79	40	21	23	163
experiments should be conducted	11	22	18	8	59
experiments should not be conducted	0	2	9	6	17
no experiments were done	2	5	3	1	11
no suggestions	31	39	24	15	109

In Table 6, the themes related to the suggestions for experimental practices in the distance education process are included. When the frequency table was examined according to the themes, it was determined that the suggestions of the students regarding the experimental practices in the distance education process were related to the virtual experiment, the experiment at home, the experiment at the school, the features of the experiment practices, and the conducting or lack of experimental practices. It was noticed that the students mostly made suggestions for the features of the experimental practices. Some of the students in different

grade levels suggested that experiments should be conducted, while others stated that experiments were not conducted.

Among the opinions of the students about the suggestions for experimental practices in the distance education process, some of the students' views on the themes of virtual experiments, experiments at home, and experiments at school are as follows:

"After the video presentation, the same experiment was performed live by the teacher under laboratory conditions and shown through video conference" (A158)

"Experiments must definitely be done at school in reduced classroom environment. Simple experiments can be done in the home environment" (B91)

"I think a program could be developed to do these experiments. In fact, there are already such programs in the networks such as Morpa campus and EBA" (C89)

"There can be Interactive digital experiments or experiment videos" (D18)

When the suggestions of the students in the theme of virtual experiment practices in the distance education process were examined, it was found that the experiments that the students had difficulty in should be performed and watched in the digital environment in the form of visual examples with different practices. Some students stated that they wanted to do the experiments and prepare their own videos. When the statements of the students regarding the theme of experimental practices at home in the distance education process were examined, it was determined that the suggestions of the students for the conducting experiments at home were to improve the physical conditions in the house, and to conduct simple experiments that can be done with the materials at home. When the suggestions of the students on the theme of experimental practices in the laboratory during the distance education process were examined, it was found that the students wanted the experiments to be carried out face-to-face with their teachers and friends with reduced number of students in the laboratory without any shortage of tools and equipment.

Among the student views regarding the suggestions of experimental practices in the distance education process, some of the students' views on the theme of experiment features are as follows:

"I would like experimental practices to be emphasized. So, it becomes better and more fun" (A2)

"I would recommend doing the experiments with materials that will not be difficult to obtain for the experiments" (B19)

"I think contents could be more fun and more realistic. I am not saying it because they are unrealistic), but for example, there can be more activities and practices in which we can match and observe the results ourselves, I believe" (D35)

When the suggestions of the students regarding the features of experimental practices in the distance education process were examined, it was found that the students suggested that experiments should be simple, instructive, permanent, entertaining, enjoyable, different and more in number.

Among the opinions of the students regarding their suggestions about experimental practices in the distance education process, some of the students' views on the themes that no experiments should be conducted and no experiments were conducted are as follows:

"Let the teacher go to school and do the experiment in a live lesson, there must be experiments" (C83)

"It may be difficult to conduct experiments in the lessons in the distance education process, and students may not be able to comprehend. Instead, rather than doing real experiments the students can be made to understand the subject through solving new generation skill-based experiment problems. We do not do experimental studies in our lessons, but we solve experiment-based problems" (D23)

When the suggestions of the students in the theme that experiments should be conducted in the distance education process were examined, it was found that students wanted the experiments to be conducted in

order for them to comprehend the subject. When the suggestions of the students in the theme that experiments should not be conducted in the distance education process were examined, it was found that the physical conditions of the students were not equal, that conducting experiments was difficult in distance education, and that they did not contribute much to learning. For these reasons, students stated that it was not appropriate to conduct experiments in the distance education process.

4. Discussion and Conclusion

In this study, secondary school students' opinions about conducting experiments in science lessons in distance education were investigated. For this purpose, a form including five open-ended questions was applied to the students. In the first question in which the opinions of the students about the practice of the experiments in the distance education science lesson were investigated, the answers in the theme of positive opinion were found to be the most frequent. It was seen that especially the 5th grade students had more positive views on this issue. The students whose answers were in this theme mentioned that doing experiments in this process facilitated their learning that the lesson was more efficient and useful, and that learning was permanent. They stated that it was beneficial not only to teach science lessons theoretically but also to conduct experiments. The second most common theme for this question emerges as the negative opinion theme. It is seen that 6th and 7th grade students expressed more negative opinions than other grade levels. The students mentioned that they could not access the materials while conducting experiments remotely, and that this process was difficult. Some student responses, though not many, were encountered at every grade level stating that no experiments were conducted in this process.

In the question in which the difficulties students encountered while conducting experiments in distance education were investigated, the students stated that they mostly experienced difficulties related to physical conditions. The students in this theme stated that they could not access the experimental materials and they could not obtain the experimental materials in the home environment. The most answers in this theme were provided by the 6th grade students, while the least answers in this regard were given by the 8th grade students. This result shows that the biggest problem faced by students in doing experiments was to reach the experimental materials. Similarly, in different studies, it was found that the lack of equipment in distance education had negative effects on students' learning (Hebebci, Bertiz & Alan, 2020; Suri, 2021). On the other hand, students' answers stating that they did not experience any difficulties while performing experiments were also encountered.

When asked about the differences between experimental practices in distance education and experimental practices in face-to-face education, students stated that doing experiments in the laboratory environment was more effective and more advantageous. They stated that the rate of similarity between experimental practices in these two environments was low. Based on this result, it can be said that the students found the experimental practices in face-to-face teaching more effective. Similarly, Pınar and Dönel Akgül (2020) stated that doing face-to-face experiments in secondary school students' science lessons was effective in terms of their understanding the subjects. Unlike this result, it was found that the technology-based method used in distance education in high school science lessons was more effective than the traditional method (Sofi & Laafou, 2020). Both the physical constraints and low motivation experienced by the students during the distance education process may have influenced this result. There are also studies which concluded that distance education caused a decrease in students' motivation (Niemi & Kousa, 2020; Turner, Hughes & Presland, 2020). The students stated that while experimenting in face-to-face education, they discussed their ideas with their friends and carried out the experiments with their friends. The students stated that they asked questions based on the ideas of their classmates in face-to-face education and that they were influenced by each other's ideas. Moreover, they mentioned that this learning environment did not occur in distance education and that an active learning environment was not created during the experiment. Science teachers stated that there are various difficulties in online collaboration among students in the distance education process (Rannastu-Avalos & Siiman, 2020). Studies show that collaborative learning

environments where students discuss their ideas with their peers are more effective on learning (Okumuş & Doymuş, 2018; Unal & Cakır, 2021). However, even if students do experiments in distance education, they think it is less fun because they cannot actively communicate with their peers and teacher. As a result, it can be said that the experiments conducted in the laboratory environment are more effective for the students.

When asked about the expectations of the students about conducting experiments in science lessons in distance education, it was determined that the students gave answers in a wide variety of themes. It is seen that the answers in these themes and the frequency of encountering them are close to each other. It is seen that the expectations of the students are mostly to increase experimental practices and to do applied experiments with subject content. Tüysüz and Çümen (2016) found in their study that secondary school students thought that more subject content should be added to the EBA. It is seen that students' expectations are to make the experiments fun and to conduct the experiments face-to-face. Bostan Sarıoğlan (2015) obtained the result that secondary school students thought that science experiments should be made more fun in face-to-face education. Considering that experiments are an integral part of science lessons, it is not surprising to get these results. Students stated that they would like to continue conducting experiments in science lessons, even from a distance. Tarık-Önal and Önal (2020) determined that parents thought that more experiments should be conducted in science lessons in distance education.

Finally, when the students were asked for suggestions about experimental practices in distance education, they emphasized the importance of doing experiments at school. However, in cases where this was not possible, they suggested using some software that can compensate for experimental practices. Ray and Srivastava (2020) stated that virtual classes and online resources were seen as a possible alternative way of learning science from home in science classes. It was found that students who used virtual laboratory activities in science lessons achieved higher success than students in traditional lessons (Ambusaidi, Al Musawi, Al-Balushi & Al-Balushi, 2018; Rowe, Koban, Davidoff & Thompson, 2017). Studies conducted show that the use of virtual laboratories in science education has a positive effect on the achievements and attitudes of students at all educational levels (Kaba, 2012; Karamustafaoğlu, Aydın & Özmen, 2005; Tüysüz, 2010). It is also among the suggestions that the existing infrastructures should be improved, the content of experimental practices should be enriched, and these practices should be expanded.

In all the questions asked to the students, some of the students answered that no experiments were conducted in distance education as well as in face-to-face education. Conducting experiments, which is an integral part of science lessons, seems to have been neglected in some cases during distance education. The students mentioned that they had difficulties with conducting experiments in distance education among the reasons for these. Students who responded in this manner stated that they did not conduct experiments in science classes during face-to-face education. Studies show that teachers do not experiment in science lessons for various reasons (Güneş et al., 2013; Yıldız et al., 2006). For these reasons, some students have adopted not experimenting in the distance education process as a normal situation and stated that also they do not experiment in face-to-face education. As a result, experimentation, which is an important part of science lessons, is overlooked by some teachers both in face-to-face education and in distance education. This result is a situation that will negatively affect the students' opinions about experimenting in distance education, and the students have offered various suggestions for experimenting in distance education and offered solutions to this situation. In fact, it seems that most of the students were willing to do experiments and had ideas to compensate them even if they experienced physical difficulties. Students stated that it would be useful if teachers to make experiments using experimental materials in distance education. The fact that teachers can practice more in science lessons by using different techniques in distance education is effective in increasing students' interest in the lesson (Bostan Sarıoğlan & Şentürk Özkaya, 2021; Sarwoto, Jatmiko & Sudibyo, 2020). Students consider experiments in science lessons as entertaining, instructive and effective in terms of permanent learning.

5. Suggestions

In the light of these results obtained from the study, the following recommendations have been made:

Students stated that they had problems in accessing experimental materials at home during the distance education process. For this reason, it would be appropriate to design the experiments with simple and inexpensive materials that are available at homes. At the same time, practices should be developed to enable students to access technological tools so that they do not have problems in accessing technological tools.

It was determined that the students had positive opinions about conducting experiments in science lessons, but they had some difficulties in this regard. There were answers that the students could not make experiments in distance education. It is thought that it would be appropriate for teachers to do more experiments in distance education and also in face-to-face education in science lessons. It would be appropriate to make virtual laboratory practices widespread and open to students' use in order to enable students to have access to more experiments. In this way, students' curiosity will be supported.

Students stated that doing experiments in face-to-face education is more beneficial than in distance education. It will be especially beneficial for students to conduct experiments in classes where face-to-face education is conducted in classrooms where hybrid education is applied. In future studies, it would be appropriate to investigate the effects of not being able to do face-to-face experiments for a long time at science lessons on students' achievements, motivations and cognitive factors etc.

6. Limitations of the Study

In this study, it was attempted to have access to secondary school students receiving education in schools located in cities in different regions of Turkey with different socio-economic characteristics and LGS (High School Entrance Exam) achievements. However, it was not possible to increase the diversity and reach a sample that can represent all of Turkey within the scope of this study. This problem can be eliminated with studies with larger samples. Thus, it can be determined what students think about conducting experiments in the distance education process in every school type. At the same time, since face-to-face education was not continuing, the data collection form was sent to the students online and the students filled these forms online. It was assumed that the data obtained from students were sincere and reliable. However, the themes obtained from the students 'answers suggest that the students' answers to the questions reflect their views on doing experiments.

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A valid and reliable scale development study to determine the problems encountered by teachers in the distance education process

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Abstract

The aim of study is to develop a valid and reliable scale in order to determine problems encountered by teachers in distance education process. Survey research method was used in the study. The sample of research consists of 411 teachers working in different branches and recitation with distance education at the 2019-2020 academic years. In this study, it was used teachers' problems determination scale consist of 47 items as a data collection tool. In order to validity of the scale, content, construct and face validity was examined. Besides, the cronbach alpha coefficient was calculated for the reliability study. Expert opinion was taken for the content and face validity, and exploratory and confirmatory factor analysis was applied for construct validity. As a result of the exploratory factor analysis, thirteen items were removed and the scale consists of five-factor was confirmed by confirmatory factor analysis. As a result of confirmatory factor analysis, it was calculated values of RMSEA 0.046, GFI 0.83, CFI 0.93 and IFI 0.92. Besides Cronbach alpha internal consistency reliability coefficient of the scale was found 0.892. As a result, a valid and reliable scale consisting of 34-items was developed to determine problems encountered by teachers in distance education process.

1. Introduction

Rapidly developing technology enables the creation of environments that will affect all segments of life. Depending on the rapidly development of technology, it is seen that different applications have emerged in the field of education. In this context, applications such as computer-aided education, computer-based education, web-based education, education using web 2.0 technologies, and distance education can be evaluated as the effects of technology on education (Korkman, 2018)

Among these developments, distance education applications, which have been widely used recently, draw attention in this area. In fact, it is seen that distance education applications are not a new application and have been used before. Distance education was first mentioned in the 1892 Catalog of the University of Wisconsin and was used in an article written in 1906 by William Lighty, the director of the same university. Since the 1960s, the term has had an expanding user base in the light of technological developments (Adıyaman, 2002).

In this historical process, researchers have attributed different meanings to the concept of distance education and made different definitions. According to the definition made by the University of

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Wisconsin Continuing Education Group, Distance education; prepared in a way to create student interaction and learning opportunities; It is the practice of creating and experiencing designed learning environments that use technological developments in order to bring together participants in different environments (Adıyaman, 2002). According to another definition, distance education is educational practices where students and teachers are located in different places, and learning materials are performed synchronously or asynchronously by using technological infrastructure (Akkoyunlu & Bardakcı, 2021). However, Bozkurt & Shamer (2020) describe education as distance education in cases where there is no space and time limit between the students.

Although there are different definitions of distance education, many researchers agree on the contribution of distance education to education. In the literature, it is stated that the concepts of time and space in distance education allow an education style independent of time and space (Akkoyunlu & Bardakcı, 2021). In addition, it is emphasized that with distance education, students can gain multidimensionality in both communication and research stages during education activities by having multiple interaction environments in the field of education with devices such as computers, tablets and smart phones (Haşlaman et al., 2008) In addition, distance education is claimed to give students an awareness of learning by placing them at the center of education (Kaya, 2002). In addition, it is stated that thanks to the asynchronous applications of distance education, students find opportunities to repeat the lessons as much as necessary, to follow the lessons whenever they want, and to learn according to their own progress (Aslan, 2006). In addition, it is emphasized that students can complete their incomplete educational achievements by interacting with other students or educated people that they do not fully understand during distance education activities (Aslan, 2006; Çelen, Çelik, & Seferoğlu, 2011). Students and researchers who conduct research with the distance education method can obtain information from people in different places and obtain the resources they want by spending a little time (Birişçi & Metin, 2009). In addition, distance education eliminates time and space limitations, enabling the student to learn in a less costly and comfortable environment. As a result, learning becomes more enjoyable (Aydın, 2002; Duyar, 2016). Changing conditions with distance education can be quickly adapted to the new situation and continuity in learning activities can be ensured. Besides, the student has the opportunity to test what they have learned by conducting assessment activities with distance education (Kaya, 2002). In addition, if there is incomplete learning, it can be overcome with the unlimited repetition opportunity offered by distance education (Aslan, 2006).

In addition to the advantages of distance education, there were some limitations (Korkman, 2018). One of these limitations is that very few teachers have sufficient knowledge, skills and experience skills for the development, design and implementation of distance education course materials (Kaya, 2002). In addition, teachers and students should have technological devices such as computers, tablets or smart phones required for distance education applications and have the skills to use these devices adequately (Aslan, 2006; Çelen et al., 2011; Duyar, 2016). In addition, the fact that the preparation and digitization of existing face-to-face training materials for distance education is difficult requires expertise and is a long time-consuming process can be expressed as another limitation of distance education (Demir, 2014). However, in distance education; since the evaluation cannot be done face to face, it causes problems in the evaluation process (Aslan, 2006; Duyar, 2016). In addition, teachers are required to gain expertise in providing individual feedback to students and evaluating student performance online (Demir, 2014).

2. Literature

Despite the advantages and limitations of distance education, it can be said that it is a preferred education application today. In this context, when the studies in the field of distance education / online education are examined in the literature, it is seen that there are different studies and research results. There are studies examining in literature; the effect of distance education on academic achievement (Başarmak, 2013; Gündüz 2005; Polat Çevik, 2010; Olpak 2010; Yılmaz, 2015; Korkman & Metin, 2021), its effect on teacher and student attitudes (Bodur 2010; Gümüş, 2007; Yılmaz, 2015), its effect on students' motivation

(Başarmak, 2013). In addition, with the pandemic process, it is seen that there is an increase in distance education applications.

In addition, in the process of the Covid-19 pandemic, Studies were carried out primary school students, (Bozkurt, 2020; Sirem & Baş, 2020) university students, (Aktaş, et al., 2020; Altuntaş Yılmaz, 2020; Çetin, 2020; Eroğlu & Kalaycı, 2020; Genç & Gümrükçüoğlu, 2020; Karadağ & Yücel, 2020; Karakuş & Yanpar Yelken, 2020; Karakuş et al., 2020; Karatepe, Küçükgençay & Peker, 2020; Keskin & Özer Kaya, 2020; Yolcu, 2020), teachers, (Bakioğlu & Çevik, 2020; Doğan & Koçak, 2020; Kocayiğit & Uşun, 2020; Özdoğan & Berkant 2020; Tekin, 2020) higher education institutions (Dikmen & Bahçeci, 2020) and review studies for distance education (Akyürek, 2020; Sarı, 2020; Telli Yamamoto & Altun, 2020).

When the studies conducted with teachers in the literature are examined, it is seen that teachers' opinions, attitudes, knowledge levels, thoughts about the education process are determined and examined the problems they encounter in distance education with a qualitative research. It is seen that there are a limited number of studies that identify or examine the problems encountered in the distance education process. Accordingly, teachers, who are the implementers of distance education, which has become compulsory with the Covid19 pandemic process, have recently started to use distance education applications, making it inevitable that they will have difficulties in this area. In order to determine the problems encountered by teachers in the distance education process and to propose solutions to these problems, it is necessary to conduct a generalizable study with a large sample. For this, there is a need for a valid and reliable scale that will determine the problems teachers encounter in the distance education process.

When the scale development studies related to distance education are examined in the literature, it was seen that the scale on distance education such as satisfaction scale (Parlak, 2007), social presence scale (Çakmak, Çebi, & Kan 2014;), community feeling scale (Aşkar & Ilgaz 2009;), perception scale (Eygü & Karman, 2013), attitude scale (Ağır, Gür & Okçu 2008; Arslan & Bircan, 2019; Demir & Akpınar 2016; Kışla 2016; Usta, Uysal & Okur, 2016), opinion determination scale (Yıldırım, et al., 2014; Özkul, et al., 2020). However, although there are a limited number of studies aimed at determining the problems encountered in distance education (Bakioğlu & Çevik, 2020; Özdoğan & Berkant, 2020), there are not studies on scale development.

In this context, it is desired to develop a valid and reliable scale to determine the problems teachers encounter in the distance education process. It is thought that the developed scale will play an active role in determining the problems caused by the teachers in the distance education process, which is increasing in importance with today's technological and social developments. Besides, it is assumed that training plans will be made to eliminate the deficiencies identified, and it is assumed that teachers' professional skills required for distance education will be increased. In addition to these, it is a fact that researchers who will carry out study in the field of distance education will contribute to the literature by using this scale as a data collection tool with the scale to be prepared with this study.

3. Methodology

The survey method, one of the quantitative research approaches, was used in this study. Quantitative research is a research approach in which variables can be determined with precise limits, the relationship between them can be measured, and aims to reach generalizations (Yıldırım & Şimşek, 2016). Survey research method includes studies aiming to collect data to determine certain characteristics of a group. The reason for using the survey method in this study is that the survey studies can provide us with information that can be obtained from a sample that can consist of a large number of individuals in order to determine the validity and reliability of the developed opinion scale (Büyüköztürk et al., 2015).

3.1. Research Sample

The universe of this study consists of teachers who work in different provinces and teach lessons to their students through distance education in Turkey. Since reaching all of these teachers is very costly and time consuming, the sample was selected in the study. The sample of the study consists of 411 teachers from different branches who are selected by using random sampling method among teachers who teach students with distance education and want to participate voluntarily in the research. While determining the sample number, the rule of at least ten times the number of questions in the test was applied. The demographic characteristics of the teachers who participated in the study are given in Table 1.

Table 1.

Demographic Characteristics of Teachers Participating in the Study

Sex	**f**	**%**	**Branch**	**f**	**%**
Female	222	%54	Turkish	52	%12.65
Male	189	%46	Maths	55	%13.38
Age	**f**	**%**	Science	65	%15.82
20-25	41	%10	Social Science	45	%10.95
26-30	90	%21.9	English	42	%10.22
31-35	106	%25.8	Class Teacher	53	%12.90
36-40	66	%16.1	Other branches	99	%24.09
41-45	66	%16.1	**Profess Expert.**	**f**	**%**
46-50	24	%5.8	Less than 5 year	129	%31.4
51-55	13	%3.2	6-10 years	109	%26.5
56-60	5	%1.2	11-15 years	59	%14.4
Place of Duty	**f**	**%**	16-20 years	55	%13.5
City Center	185	%45.0	21-25 years	34	%8.3
District	160	%38.9	26-30 years	14	%3.4
Town/Village	66	%16.1	Over the 30 year	11	%2.7

According to Table 1, when the teachers participating in the study are examined it was seen that in terms of gender, 54% are women and 46% are men, besides It is seen that in terms of ages; 10% of them are between 20-25, 21.9% of them 26-30, 25.8% of them 31-35, 16.1% of them 36-40, 16.1% of them 41-45, 5.8% of them 46-50, 3.2% of them 51-55 and 1.2% of them between the ages of 56-60. In addition, when the teachers were examined in terms of their place of duty, 45% were working in the city center, 38.9% in the district and 16.1% in the village / town. It was seen that in the term of branches; 12.65% of them Turkish, 13.38% of them maths, 15.82% of them sciences, 10.95% of them social studies, 10.22% of them English, 12.90% of them classroom and 24.09% other branch teachers. In addition, when teachers are examined according to professional experience, 31.4% of them less than 5 years, 26.5% of them 6-10 years, 14.4% of them 11-15 years, 13.5% of them 16-20 years, 8.3% of them 21-25 years, 3.4% of them 26-30 years and 2.7% of them over 30 years have professional experience

The sample in the CFA application, which was conducted to verify the factor structures of the scale obtained as a result of the exploratory factor analysis in the study, consists of 230 teachers who were outside the sample that was previously applied to the scale. While choosing these teachers, it was taken into consideration that the teachers lectured by distance education, were in different branches and voluntarily participated in the research. The sample required for CFA application was determined by randomly choosing among the teachers who had these characteristics.

Considering the characteristics of the teachers participating in the confirmatory factor analysis, when the teachers are examined in terms of gender, 52% are women and 48% are men, besides It is seen that in terms of ages; 5.6 % of them are between 20-25, 16.8% of them 26-30, 22.8% of them 31-35, 29.4% of

them 36-40, 17 % of them 41-45, 4.38% of them 46-50, 3.4% of them 51-55 and 0.62 % of them between the ages of 56-60. In addition, when the teachers were examined in terms of their place of duty, 58% were working in the city center, 29.4% in the district and 11.8% in the village / town. It was seen that in the term of branches; 15.2% of them Turkish, 18.4% of them maths, 24.6% of them sciences, 10.2% of them social studies, 11.6 % of them English, 10.20% of them classroom and 9.8% other branch teachers. In addition, when teachers are examined according to professional experience, 13.4% of them less than 5 years, 24.3% of them 6-10 years, 27.6% of them 11-15 years, 17.6% of them 16-20 years, 11.6 % of them 21-25 years, 3.6% of them 26-30 years and 1.9 % of them over 30 years have professional experience

3.2. Development of the Measurement Tool

Within the scope of the research, a five-stage process was followed while developing the scale for determining the problems encountered by teachers in the distance education process. While determining this five-stage process, the scale development steps of many researchers in the literature were taken into consideration (Aksu, Metin & Konyalıoğlu, 2014; Büyüköztürk et al. 2015; Balcı, 2007; Metin, 2010; Metin, 2014; Metin, Birişçi, Coşkun ve Kolomuç, 2012; Metin, Kaleli Yılmaz, Coşkun ve Birişçi, 2012; Tavşancı, 2002; Tezbaşaran, 2002). Five stages such as item pooling, consulting expert opinions, pre-trial, factor analysis and reliability analysis are explained in detail below.

3.2.1. The Stage of Establishing the Item Pool: At this stage, a literature review was conducted regarding the need to write items to determine teachers' encountered problems on distance education. In this literature review Altun-Ekiz (2020), Aktaş, et al., (2020), Alam (2020), Almaghaslah & Alsayari (2020), Alpaslan (2020), Andoh, Appiah & Agyei (2020), Edelhauser & Lupu-Dima (2020), Eroğlu & Kalaycı (2020), Fidan (2020), Kaden (2020), Keskin & Özer Kaya (2020), Koçyiğit & Uşun (2020), Kürtüncü & Kurt (2020), Kurnaz & Serçemeli (2020), Ramos-Morcillo et al., (2020), Serçemeli & Kurnaz (2020) and Yolcu (2020), researches on the issues of views on distance education have been examined. In line with these investigated sources, scale items were determined to determine the opinions of teachers, who are directly related or related to distance education, towards distance education. In addition, face-to-face interviews were held with 10 teachers. In the interviews to the teachers; “What are the negative effects of distance education on students and teachers” and “what are the problems encountered in distance education practices (infrastructure, communication, use of the program and pedagogical evaluation) were asked. As a result of the literature review and the interviews with the teachers, a five-point Likert-type draft scale with 47 items of "Strongly Disagree", "Disagree", "Undecided", “Agree" and "Strongly Agree" was developed

3.2.2. The Stage of Consulting Expert Opinion: The reason for consulting experts is to ensure the Content and face validity of the scale. Content validity is an indicator of whether the items of the scale adequately reflect the behavior desired to be measured (Büyüköztürk et al., 2015). Second, face validity was provided. Face validity shows what the measuring tool appears to measure rather than what it measures. The face validity of a scale is that it seems to measure the characteristics that it actually wants to measure (Öncü, 1994).

The draft scale, which has 47 items developed within the study, was sent to two academicians who had studies in the field of distance education in order to evaluate the content validity. Academicians were asked to review the items in the scale on whether they fully measure the problems teachers encounter in the distance education process. As a result of the academicians' examination, five items were removed from the scale and four items were rearranged. In addition, in line with the suggestions of the academicians, two items were added to the scale and the items of the scale were divided into categories. After making the necessary arrangements, the scale consisting of 41 items was sent to an academic who is a measurement and assessment expert. The measurement and assessment expert was asked to evaluate the content validity of the scale, the face validity, and whether the items were suitable for the desired characteristics to be measured. As a result of the arrangement made in line with the opinions of the

measurement and assessment expert, a five-point Likert-type scale consisting of 46 items was obtained. In addition, this scale was examined by a Turkish language expert in terms of spelling, understandability and suitability, and the scale was finalized.

3.2.3. Pre-Trial Phase: In the pre-trial phase, the developed draft scale was applied to a group of 20 teachers. The teachers were informed about the response time of the scale, the comprehensibility of the items and whether it was suitable for the teacher group. From the opinions of the teachers; it was concluded that the scale with 41 items is understandable, the number of items in the scale and the expressions in the item are suitable for teachers, and the scale can be completed in 20 minutes.

3.2.4. Factor Analysis Phase: The scale, which was prepared after taking expert opinions and performing the pre-trial procedures, was applied to a group of 490 teachers. It is concerned with the normal distribution of the data obtained from the teachers' responses to the scale. For this, Skewness and Kurtosis value, histogram graph, Q-Q plot test, Kolmogorov-Smirnov values were examined. As a result of this application, exploratory and confirmatory factor analysis was applied to the scale data, which was determined whether it exhibits normal distribution or not.

Principal Component Analysis (PCA) was used in the exploratory factor analysis. In this study, It was take an account that the KMO (Kaiser-Meyer-Olkin) value which gives an idea about whether the factor analysis is good or not and the Bartlett Test (Bartlett Test of Sphericity) which gives an idea about whether correlation between the variables. (Field, 2005; Kline. 2005; Pallant, 2020). In addition, it was considered the information that the number of factors included in the model is equal to the number of factors with an eigenvalue greater than one and that the conditions should be accepted such that the factor loadings are at least 0.30 (Turgut & Baykul, 1992; Seçer, 2015). For the determination of the ideal factor structure, the necessary rotation operations were performed and the "oblimin" rotation method was preferred. As a result of the rotation, it was considered that the load value is less than 0.30 and not overlapping in the distribution of the data to the factors. In addition, the factors were named by considering the factors in which the scale items were collected. However, the suitability of the factor structure obtained by EFA analysis was tested with Structural Equation Models.

In this context, the appropriateness of the model obtained in the Confirmatory Factor Analysis method and Exploratory Factor Analysis was examined. In the Confirmatory Factor Analysis, RMSEA (Root Mean Square Error of Approximation), CFI (Comparative Fit Index), GFI (Goodness of Fit Index) and X^2 criteria were used as criteria. While Exploratory Factor Analysis for the scale was tested with SPSS 13.0 package program, Lisrel 8.5.1 package program was used for Confirmatory Factor Analysis.

3.2.5. Reliability Calculation Stage: After the factor analysis was done, the reliability coefficients of the Cronbach alpha internal consistency coefficient and sub-factors of the scale (UZEÖD) were calculated. This value is required to be above 0.7. Low values are generally reached in scales with few items. Therefore, the cronbach alpha value is closely related to the number of items in the scale (Büyüköztürk et al., 2015).

4. Finding

The findings of the study were obtained from a valid and reliable scale to determining the problems encountered by teachers in the distance education process, applied to 411 teachers working in distance education in the 2019-2020 academic years.

This section is presented four headings in order to present the results obtained in line with the analysis in a more systematic structure:

- Findings Regarding the Distribution of Scale Data
- Findings Regarding the Validity of the Scale

• Findings Regarding the CFA Results of the Scale

• Findings Regarding the Reliability of the Scale

Detailed explanations of these topics are given in the following sections.

4.1. Findings Regarding the Distribution of the Scale Data:

Before performing the factor analysis of the applied scale, it is important to determine whether the scale data exhibit a normal distribution or not. Skewness and Kurtosis value, histogram graph, Q-Q plot test, Kolmogorov-Smirnov value are examined to determine the distribution of the data obtaining the scale applied to 411 teacher (Field, 2005).Skewness and Kurtosis value is between +1 and -1, the histogram plot clustered is in the middle, the QQ plot test is being collected on the line, and the Kolmogorov-Smirnov value p> 0.05 are indicators of the symmetrical data distribution (Field, 2005; Kline 2005; Pallant 2020). The values related to the distribution of the data from obtained scale applied are given below.

Table 2.

Descriptive statistic of scale item

	Mean	Median	Variance	Std. Deviation	Skewness	Kurtosis
Statistic	158.608	158.000	334.385	18.286	.144	.064
Std. Error	.902				.120	.240

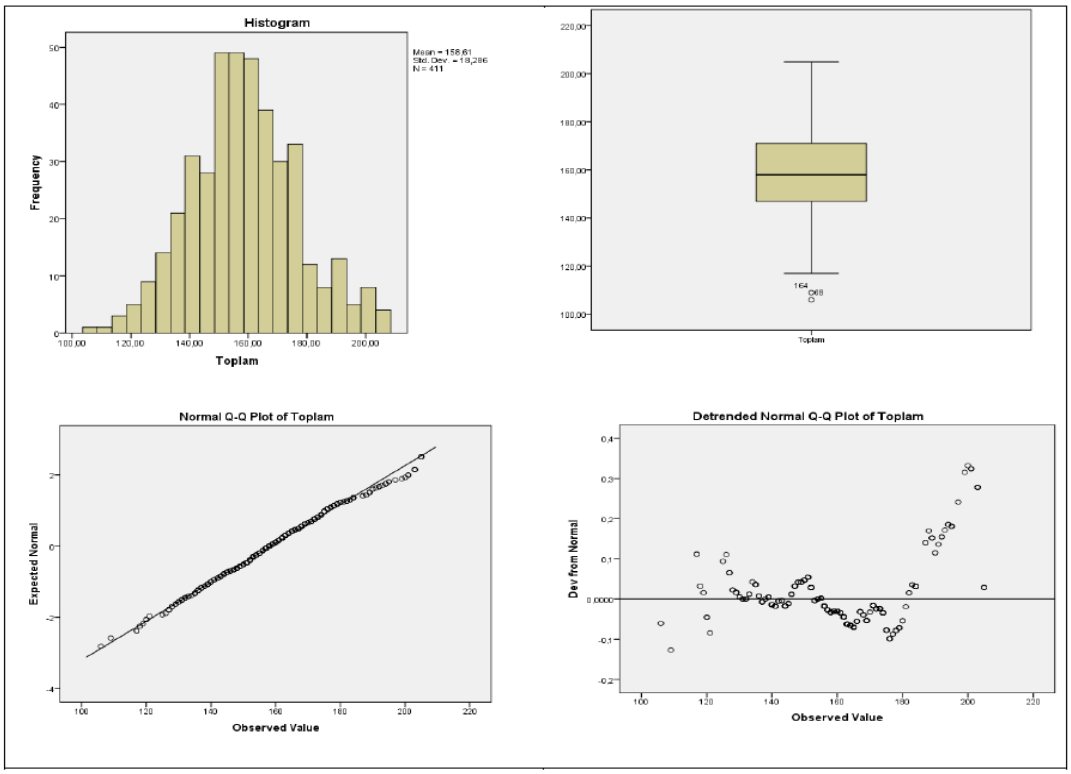

Figure1. *Normal Distribution Plots of Scale Items*

Table 3.

Tests of Normality

	Kolmogorov-Smirnov			**Shapiro-Wilk**		
	Statistic	df	Sig.	Statistic	df	Sig.
Total	.037	411	.186	.994	411	.084

When the tables and graphs are examined, it is observed that the Skewness and Kurtosis value is between -1 and +1 value, the data set in the histogram graph is mostly clustered in the middle, the data is collected on the line in the Q-Q plot test and the Kolmogorov-Smirnov value is higher than 0.05. According to these values, it can be stated that the data from obtaining the scale applied to 411 people show a normal distribution.

4.2. Findings Regarding the Validity of the Scale:

In order to the scale developed within the scope of the research to be valid, the context, face and structure validity were provided. Within the context of the research, the context and face validity of the scale were provided by field, measurement and assessment and language experts. Before the analysis, KMO and Bartlett Test results were examined in order to determine the suitability of the data obtained from the research to the exploratory factor analysis. After that, exploratory factor analysis was applied to ensure the construct validity of the scale consisting of 41 items.

Table 4.

KMO and Bartlett Test Results of the Scale

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.876
Bartlett's Test of Sphericity	Approx. Chi-Square	4511.017
	df	561
	Sig.	.000

According to Table 4, exploratory analysis was performed because the KMO value was greater than 0.7, the Bartlett Test result was greater than 1 and statistically significant (KMO: 0.876; $\chi 2 = 4511.017$; sd = 561, $p < 0.05$). According to Tavşancıl (2002), KMO value is seen as perfect as it approaches 1 and unacceptable when it is 0.5.According to Table 4, The KMO value calculated as 0.876 indicates that the sample of research is suitable for exploratory analysis because of it is greater than 0.7.

In determining the number of factors, the eigenvalue is greater than one, when looking at the breaking point of the slope in the line graph, the explained variance ratio and the factor's contribution to the total variance ratio are taken into account (Pallant, 2020; Tabachnick & Fidell, 2007). As a result of the first exploratory factor analysis, the overlapping 3rd, 5th, 6th, 10th and 19th items were removed from the scale. As a result of the second factor analysis consisting of 36 items, the eigenvalues of the scale items and the line graph were examined to determine the number of factors.

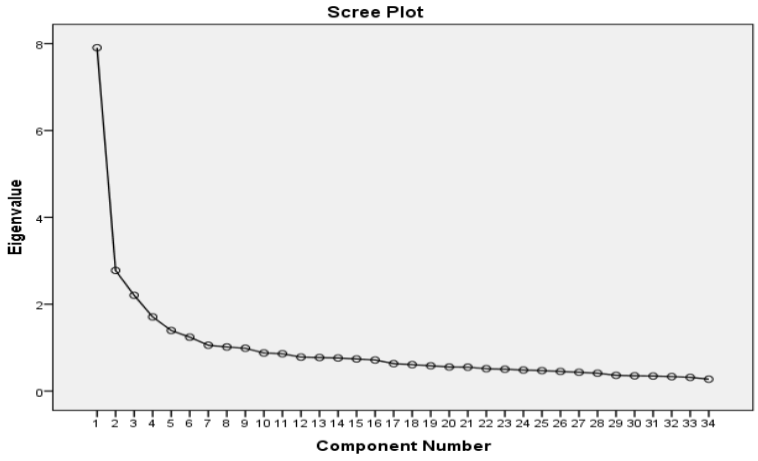

Figure 2. *Line graphic of the eigenvalues of scale items*

When figure 2 is examined, since breakage occurs after five factors, the factor number was limited to five and factor analysis was applied for the third time. Items 28th and 38th were removed from the scale, and as a result of the analysis applied to the 34 item scale for the fourth time as a result of the factor, the eigenvalues and variance values of the five-factor scale are shown in Table 5.

When Table 5 is examined, it is seen that 34 items in the scale are grouped under five factors with eigenvalues greater than 1.

Table 5.

Eigenvalue and Variance Percentages of the Items in the Scale

Factors	Eigenvalues	% of Variance	Cumulative %
Factor 1	4.142	12.182	12.182
Factor 2	3.864	11.365	23.547
Factor 3	3.439	10.115	33.663
Factor 4	2.311	6.799	40.461
Factor 5	2.237	6.578	47.040

The total variance value explained by the five factors for the scale is % 47. 040. This value is at an acceptable level according to Kline (2005), Scherer, et al., (1988). In order to determine the factor items of the scale consisting of five factors, the "Oblimin" oblique rotation method was applied to the data obtained from 411 teachers. This method is preferred when factors are interrelated (Tabachnick & Fidell, 2007). In studies conducted in the field of social sciences, it is not a very realistic situation to claim that the factors have no relationship with each other. In this respect, it is considered appropriate to prefer Oblimin 'oblique rotation method within the scope of this study.

In Table 6,

Factor items and loadings formed as a result of oblimine rotation method are given.

Item Number	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
36	.678				
32	.649				
31	.648				
29	.624				
23	.619				
40	.588				
27	.537				
34	.527				
39	.471				
18		.740			
13		.719			
17		.674			
9		.661			
21		.653			
11		.591			
7		.497			
25		.496			
14			.755		
2			.714		
26			.689		
37			.581		
12			.536		
1			.456		
20			.440		
41			.412		
22			.409		

33	.698		
30	.621		
35	.541		
15		.677	
16		.527	
24		.490	
8		.484	
4		.415	

According to Table 6, there are nine items under the first and third factors, eight items under the second factor, three items under the fourth factor and five items under the fifth factor.

Accordingly, the names of the factors; first factor: "Problems with Students in Distance Education (PSDE)", second factor: "Problems with content preparation and transferring in distance education (PCTDE)", third factor: "Problems with parents in distance education (PPDE)", fourth factor: "Problems Encountered in the Use of the Program (PEUP) and fifth factor: "Problems with the distance education application program (PDEAP).

Correlation values that determine the relationship between the factors determined in the scale are shown in Table 7.

Table 7.

Correlations between Scale Factors

	PSDE	PCTDE	PPDE	PEUP	PDEAP
PSDE	1	.394**	.516**	.427**	.391
PCTDE	.394**	1	.365	.407**	.378**
PPDE	.516**	.365**	1	.315**	.440**
PEUP	.427**	.407**	.315**	1	.293**
PDEAP	.391**	.378**	.440**	.293**	1

The Pearson's correlation coefficient between the two variables or factors is between 0.70-1.00 at a high level; it is between 0.30-0.69 at medium level; there is a low level relationship between 0-0.29; if this coefficient is negative, it indicates a negative relationship, while positive indicates a positive relationship (Büyüköztürk, 2008). In Table 7, it was shows that there is a medium-level correlation between all factors. According to these results, since the correlation between the factors is over 0.3, it can be said that it is appropriate to use "oblimin" instead of "varimax" as a rotation method.

4.3. Findings Related to CFA Results of the Scale:

Factors determined as a result of the exploratory factor analysis, Confirmatory Factor Analysis was applied with the data collected from 230 teachers who worked in different branches, had distance education experience and different from the sample group. The CFA result of the 34-item scale consisting of a five-factor structure is shown in Figure 1.

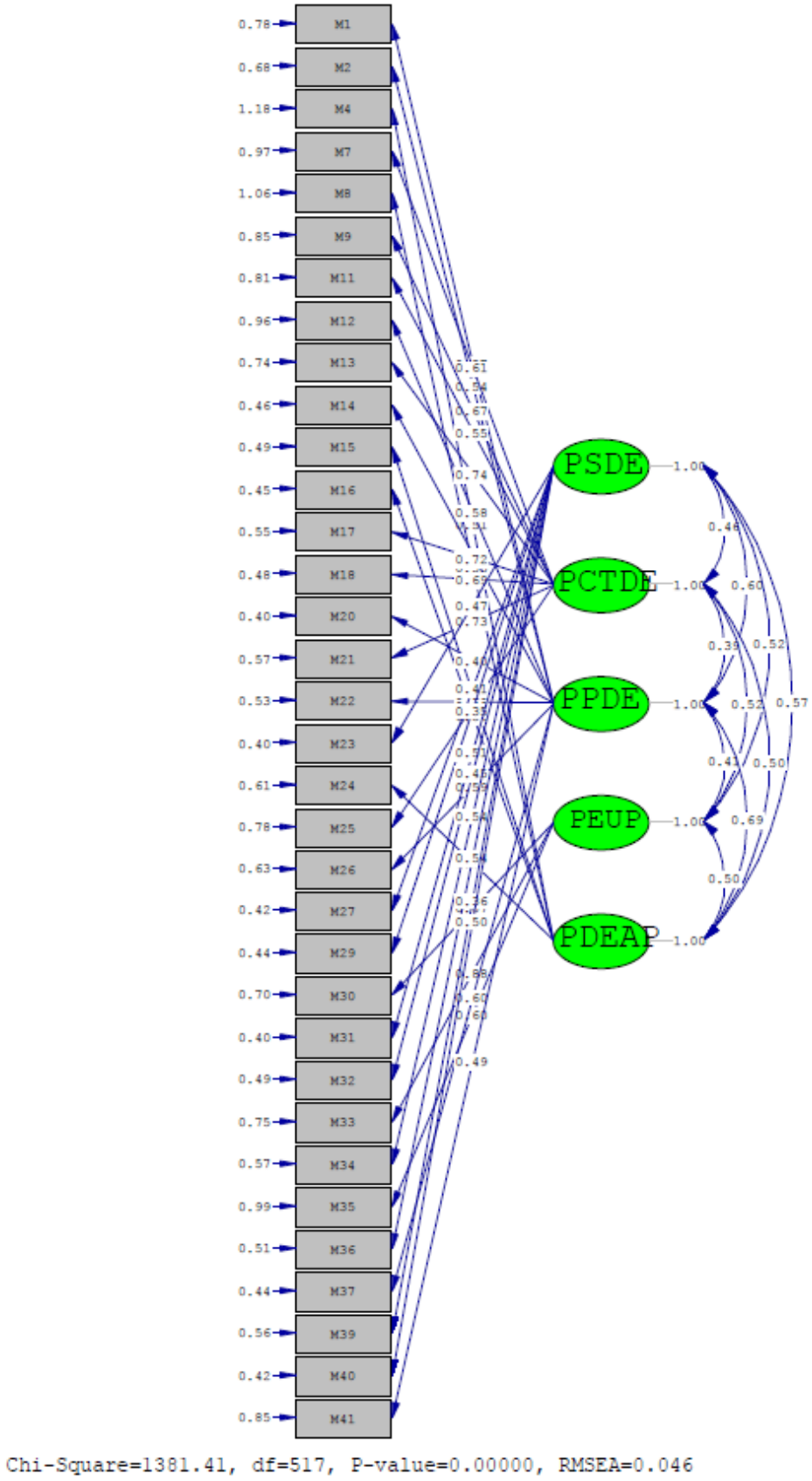

Figure 1. *Confirmatory Factor Analysis Model of Scale Items*

When Figure 1 is examined, Chi-square values and degrees of freedom as a result of CFA; It is seen that the ratio of $\chi 2 = 1381.41$ df = 517, $p < .05$ and $\chi 2$ / df = 2.67 was obtained. This ratio was obtained from the sample group in which the study was conducted and the ratio below 3 indicates perfect fit (Jöreskog & Sörbom, 1993; Sümer, 2000; Kline, 2005). In addition, according to the DFA result obtained from the research, it is seen that the RMSEA value is 0.046. An RMSEA value between 0.05 and 0.08 is an acceptable value indicating good model fit. In the confirmatory factor analysis, it is assumed that the RMSEA value is acceptable between 0.050-0.080, perfect between 0.000-0.050, and above 0.080 unacceptable (Pallant, 2020).

In addition, the calculation of the GFI (goodness of fit index) value close to 1 is an indication of the suitability of the factor model and the high level of explaining the data. The fact that the GFI value is higher than 0.70, indicates the applicability of the determined factor model (Durkan, 2017). In this study, GFI value found 0.83 as a result of DFA is within the acceptable range. If CFI and IFI values determined in DFA are 0.95 and above, it means that the fit between the data of the factor model is perfect (Bentler, 1990; Hu & Bentler, 1999; Sümer, 2000; Çokluk, Şekercioğlu, & Büyüköztürk, 2010). However, CFI and IFI values of 0.80 and above are at acceptable levels (Jöreskog & Sörbom, 1993). As a result of DFA, the CFI value is 0.93 and the IFI value is 0.92. According to these results, it can be said that the data fit of the factor model determined is acceptable. The harmony values obtained as a result of DFA are given in Table 8.

Table 8.

Fitting Values Obtained as a Result of CFA

$\chi 2$	df	$\chi 2$/sd	RMSEA	GFI	CFI	IFI
1381.41	517	2.67	0.046	0.83	0.93	0.92

As a result of the factor analysis, it was determined that the five-factor structure of the 34 item scale aimed at determining the problems encountered by teachers in the distance education process was confirmed by CFA. The reliability analysis of the 34 item scale, which was created as a result of exploratory and confirmatory factor analyzes, was examined.

4.4. Findings Related to the Reliability of the Scale:

After the construct validity was provided in the study, Cronbach Alpha reliability coefficient was found as $\alpha = 0.892$ in the calculation of the reliability analysis of the scale consisting of 34 items, and since this value was above 0.7, it was concluded that the whole scale was reliable. Reliability coefficient results of each factor in the scale are given in Table 9.

Table 9.

Reliability Coefficients of the Factors

	Factor Names	Number of Item	Cronbach Alpha Values
Factor 1	Problems with Students in Distance Education	*9*	0.818
Factor 2	Problems with content preparation and transferring in distance education	*8*	0.822
Factor 3	Problems with parents in distance education	*9*	0.794
Factor 4	Problems Encountered in the Use of the Program	*3*	0.704
Factor 5	Problems with the distance education application program	*5*	0.700
	Overall of The Scale	*34*	0.892

When Table 9 is examined, it can be said that the scale is reliable in order to the cronbach alpha value is above 0.70 as a result of the reliability calculation made for each factor of the scale

5. Conclusion

In this study, a valid and reliable scale was developed to determine the encountered problems by teachers in the distance education process. Validity and reliability study of the draft scale with 47 items; it was conducted with 410 teachers experienced in distance education. For each item in the scale; It is presented with the options of "Strongly Disagree, Disagree, Undecided, Agree, Strongly Agree". Content, face and construct validities were tried to be provided for the validity study of the draft scale.

Arrangements have been made for the content and face validity in line with the expert opinion. Exploratory and confirmatory factor analyzes were applied for the construct validity study. The KMO value for the scale was calculated as 0.876 and the suitability of the sample size for exploratory factor analysis was determined. If the KMO value is greater than 0.7, it means that the adequacy of the sample is at a good level, and if it is greater than 0.8, it means that it is very good (Çokluk et al., 2010). Exploratory factor analysis was applied after the results that were found to be meaningful according to the Bartlett Test results. As a result of the exploratory factor analysis, the total variance value of the scale with five factors, 34 items, was calculated as 47.04%. It is at an acceptable level according to this value (Scherer, et al., 1988; Kline, 2005). As a result of factor analysis, each factor should have at least 2 items that are acceptable, the more items there are in each factor, the more reliability and the factor explanation of the scale (Seçer, 2015). The scale consists of 34 items with nine items under the first and third factor, eight items under the second factor, three items under the fourth factor and five items under the fifth factor, which indicates that the factors of the scale are acceptable. Accordingly, the names of the factors are; first factor: "Problems with Students in Distance Education (PSDE)", second factor: "Problems with content preparation and transferring in distance education (PCTDE)", third factor: "Problems with parents in distance education (PPDE)", fourth factor: "Problems Encountered in the Use of the Program (PEUP) and fifth factor: "Problems with the distance education application program (PDEAP).

In order to verify the five factors determined as a result of the exploratory factor analysis, it has been determined suitability; the ratio of $\chi 2$ / df = 2.67 was obtained as a result of CFA carried out with different teachers from the EFA sample group, the RMSEA value are 0.046, the GFI value are 0.83, the CFI value are 0.93 and the IFI value are 0.92. In the confirmatory factor analysis, RMSEA value is considered to be between 0.050-0.080, it is considered perfect to be between 0.000-0.050, and unacceptable to be above 0.080 (Pallant, 2020). The fact that the GFI value is higher than 0.70, indicates the applicability of the determined factor model (Durkan, 2017). CFI and IFI values of 0.80 and above are at acceptable levels (Özdamar, 2013).

After determining the appropriateness of the CFA model, the cronbach alpha coefficient was examined to determine the reliability of the scale consisting of 34 items. This coefficient value is calculated as 0.892 for the whole scale and over 0.7 for each factor. In order for a scale to be accepted as reliable, it is suggested that the cronbach alpha reliability coefficient value of the whole scale and the sub-factors of the scale should be 0.70 and above (Anastasi, 1982; Büyüköztürk, 2007). Since the reliability coefficient value of the whole scale and its sub-factors is above 0.70, it can be said that the prepared scale is reliable. When similar scale development studies in the literature are examined,

Consequently, in this study, a valid and reliable scale consisting of 34 items and a five-factor structure was developed to determine the problems teachers encounter in the distance education process. It can be said that the developed scale can be used to determine the problems teachers encounter in the distance education process.

Since this scale was developed during the Covid-19 pandemic process, many different variables such as health problems, anxiety, priorities and attitudes may have affected the views of the participants. For this reason, it can be discussed whether the internal and external variables in the pandemic process have an effect by conducting studies that reveal the problems encountered in distance education during and after

the pandemic process. For this, this scale can be applied at different times and the problems encountered during and after the pandemic can be compared and focus on solutions.

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Appendix 1. The Scale Items about Problems Encounter by Teachers in the Distance Education Process (***English Version***)

	Strongly Disagree **(1)** Disagree **(2)** Undecided **(3)** Agre**e (4)** Strongly Agree **(5)**	**1**	**2**	**3**	**4**	**5**
	Factor 1: Problems with Students in Distance Education (PSDE)					
1	In the distance education application, the student's not attending the lessons on time affects the flow of the lesson.					
2	If the student cannot participate in the practice during the lesson, there are difficulties in repetition of lesson.					
3	The lack of technological tools required for the application of distance education makes it difficult for students to participate in the lesson.					
4	In the distance education application, in-class communication with the student remains limited.					
5	The irrelevant behavior of the student in the distance education application decreases the motivation of the teacher.					
6	In distance education practice, there is a problem in giving feedback to students regarding their learning levels.					
7	Group work with students in distance education practice would be troublesome					
8	In distance education practice, the teacher has problems in providing classroom discipline					
9	In the distance education application, it is difficult to control the behavior of the student during the lesson.					
	Factor 2: Problems with content preparation and transferring in distance education (PCTDE)					
1	Difficulty using video in distance education application					
2	There is a problem in using the content we want in the distance education application.					
3	Distance education practice limits content preparation using different teaching methods and techniques.					
4	There are difficulties in assigning courses in the distance education application.					
5	It takes a long time to determine the content for the distance education application					
6	It is difficult to find content that we can make changes to the distance education application.					
7	The content to be used in the distance education application is limited.					
8	Preparing content for distance education applications would be costly					
	Factor 3: Problems with parents in distance education (PPDE)					
1	Parents are insufficient to direction of students to the live lesson					
2	Parents' requests from students during distance education are a problem					
3	Parents' intervention to lessons with distance education has increased					
4	Parents' behavior in distance education process in a way that affects the teaching of the lesson creates difficulties					
5	When the lesson is teaching in distance education, the noise of the parents affects the teaching of the lesson.					
6	Parents experience difficulties in Internet procurement for distance education application					
7	In distance education, it would be a problem, parents to answer the questions asked in the lesson instead of the student					
8	In distance education, it is a problem for parents to communicate unnecessarily with the teacher, while lecturing					
9	Parents communicating more than expected with the distance education process overwhelms us.					
	Factor 4: Problems Encountered in the Use of the Program (PEUP)					
1	Screen freezing is a problem when making changes on the contents of the distance education application.					
2	In the distance education application, the fact that sound and image come at different times creates a problem in the lessons.					
3	It would be a problem for the distance education application to kick out student from the lesson untimely.					
	Factor 5: Problems with the distance education application program (PDEAP)					
1	The fact that the menus of the distance education application are in English makes it difficult to use the program.					
2	The use of distance education application in old technological devices (computer, tablet, phone) becomes difficult.					
3	New technological tools should be purchased to use distance education applications					
4	Difficulty of menu access in the distance education program prevents immediate intervention in unwanted situations.					
5	It becomes difficult to control the study done by the student in the distance education application.					

Appendix 2. The Scale Items about Problems Encounter by Teachers in the Distance Education Process (***Turkish Version***)

	Kesinlikle Katılmıyorum **(1)** Katılmıyorum **(2)** Karasızın **(3)** Katılıyorum **(4)** Kesinlikle Katılıyorum **(5)**	**1**	**2**	**3**	**4**	**5**
	Faktör 1: Uzaktan Eğitimde Öğrencilerle İlgili Karşılaştığı Sorunlar					
1	Uzaktan eğitim uygulamasında öğrencinin derslere zamanında katılmaması dersin akışını etkiler					
2	Öğrenci ders süresince uygulamaya katılamazsa dersi telafi etmede sıkıntı yaşanır					
3	Uzaktan eğitime uygulaması için gerekli teknolojik aletlerin öğrencilerde olmaması derse katılımı güçleştirir					
4	Uzaktan eğitim uygulamasında öğrenci ile ders içi iletişim sınırlı kalır					
5	Uzaktan eğitim uygulamasında öğrencinin ilgisiz davranışı öğretmenin motivasyonunu düşürür					
6	Uzaktan eğitim uygulamasında öğrencilere öğrenme düzeylerine yönelik geri dönüt verilmede sıkıntı yaşanır					
7	Uzaktan eğitim uygulamasında öğrencilerle grup çalışması yapmak sıkıntılı olur					
8	Uzaktan eğitim uygulamasında öğretmen sınıf disiplinini sağlamada sorun yaşar					
9	Uzaktan eğitim uygulamasında öğrencinin ders esnasında davranışlarını kontrol etmek zor olur					
	Faktör 2: İçerik Hazırlama / Programa Aktarma ile İlgili Sorunlar					
1	Uzaktan eğitim uygulamasında video kullanımında güçlük yaşanır					
2	Uzaktan eğitim uygulamasında istediğimiz içeriği kullanmada sıkıntı yaşanır					
3	Uzaktan eğitim uygulaması farklı öğretim yöntem ve teknikleri kullanarak içerik hazırlamayı sınırlandırır					
4	Uzaktan eğitim uygulamasında ders ataması yapmakta sıkıntılar yaşanır					
5	Uzaktan eğitim uygulamasına yönelik içeriği belirlemek uzun sürer					
6	Uzaktan eğitim uygulamasına üzerinde değişiklik yapabileceğimiz içerikleri bulmada zorlanılır					
7	Uzaktan eğitim uygulamasında kullanılacak içerikler sınırlı kalmaktadır					
8	Uzaktan eğitim uygulamalarına yönelik içerik hazırlamak maliyetli olur					
	Faktör 3: Velilerle ile İlgili Sorunlar					
1	Velilerin öğrencileri canlı derse yönlendirmesi yetersiz kalmaktadır					
2	Uzaktan eğitimde ders sırasında velilerin öğrenciden taleplerde bulunması sorun oluşturur					
3	Velilerin uzaktan eğitimle derse olan müdahaleleri artmıştır					
4	Uzaktan eğitimde velilerin dersin islenişini etkileyecek şekilde davranması sıkıntı oluşturur					
5	Uzaktan eğitimde ders yapılırken velilerin gürültü çıkarması dersin işlenişini etkiler					
6	Veliler Uzaktan eğitim uygulaması için internet tedarikinde sıkıntı yaşarlar					
7	Uzaktan eğitimde velilerin derste sorulan sorulara öğrenci yerine cevap vermesi sorun olur					
8	Uzaktan eğitimde velilerin ders anlatırken öğretmenle dersle ilgisiz iletişim kurması sıkıntı oluşturur					
9	Uzaktan eğitim süreciyle birlikte velilerin beklenenden fazla iletişim kurması bizleri bunaltır					
	Faktör 4: Programın Kullanımında Karşılaşılan sıkıntılar					
1	Uzaktan eğitim uygulamasında içerikler üzerinde değişiklik yaparken donmaların yaşanması sıkıntı oluşturur					
2	Uzaktan eğitim uygulamasında ses ve görüntü farklı zamanda gelmesi derslerde sıkıntı oluşturur					
3	Uzaktan eğitim uygulamasının zamansız bir şekilde dersten atması sorun oluşturur					
	Faktör 5: Uygulama Programıyla İlgili Karşılaşılan sorunlar					
1	Uzaktan eğitim uygulamasının menülerinin İngilizce olması programı kullanmayı zorlaştırır					
2	Uzaktan eğitim uygulamasının eski teknolojik (Bilgisayar, tablet, telefon) aletlerde kullanımı zor olur					
3	Uzaktan eğitim uygulamalarını kullanabilmek için yeni teknolojik araçların alınması gerekir					
4	Uzaktan eğitim programında menülerin kolay ulaşılabilir olmaması istenilmeyen durumda anında müdahaleyi engeller					
5	Uzaktan eğitim uygulamasında öğrencinin yapmış olduğu çalışmaların kontrolü zorlaşır					

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Use of take-home exam for remote assessment: A case study from Turkey

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Abstract

COVID-19 has changed the way we teach. Today, we have become far more experienced in the delivery of distance education and use of online tools. However, the quality of distance education and learning outcomes have become a matter of ongoing debate. Just as higher education aims to develop high-level skills in its students, researchers are seeking ways to perform valid and reliable assessment in distance education. Institutions and educators are also in search of assessment tools that can help prevent instances of cheating and plagiarism. However, performance-based assessment tools may also offer options to measure both high-level skills and in limiting cheating behaviors. In this study, we used the take-home exam as a formative remote assessment tool as a local case in Turkey. We surveyed the views of 43 undergraduate students about the quality of take-home exams as a remote assessment tool. The results showed that participants had a high quality perception about the use of take-home exam, especially with regards to being kept informed about evaluation and scoring, rapid assessment, the provision of feedback, and consistency of scope between assessment and course content. Whereas students highly perceived the use of take-home exams, they reported more moderate views regarding take-home exams increasing the level of interaction with their peers. The results of this study suggest that the use of take-home exams is significantly preferred by higher education students, that it is a reliable and distinctive way to measure students' academic performance, and may increase student-teacher interaction through its formative use.

1. Introduction

Measurement results produce "indicators" that can be used for different purposes in education. These indicators form the basis for crucial individual decisions such as gaining entrance to a certain school or program of academic study, measuring successful completion of a program, achieving the course objectives or obtaining a certificate, and for social decisions such as the determination of educational policies. Most of these decisions are based on summative assessment (Knight, 2002). In addition, results obtained from intermittent and continuous measurements taken throughout the education period are used formatively in order to make the education process more efficient. Determining the disruptions, deficiencies, or errors in education, and then compensating for them through both instructors and/or students can be carried out based on the indicators of formative assessment. Therefore, the importance of measurement results within education is indisputable in terms of determining the quality of education, enhancing academic output, and in making appropriate and necessary decisions.

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Higher education is considered the most powerful means available for countries to develop and grow a knowledge society. Higher education presents both the opportunity to facilitate and encourage research to be undertaken, to increase knowledge, and to boost technological innovation (Bouhajeb et al., 2018). Making valid and reliable assessments in higher education is therefore critical, since graduates of higher education must be capable of meeting the wide-reaching requirements of a productive life in the 21st century. With the onset of the COVID-19 pandemic, higher education institutions worldwide are required to utilize distance education and distance tools (Crawford et al., 2020; Salim et al., 2021). On the other hand, institutions were not prepared such an urgent shift (Agormedah et al., 2020, Durak et al., 2020). Overnight, students from applied science disciplines such as medicine, psychology, and education had to be completely educated through remote means (Al-Balas et al., 2020). It is highly arguable as to what extent institutions that had little or no distance education experience or technical competence have been able to provide the required level of qualification through distance education (Mbiydzenyuy & Silungwe, 2020; Sankar et al., 2020). At this point, it is important not only to ensure that students reach their academic goals, but also to determine to what level they have reached, and the validity and reliability of their assigned grades. More than ever, during the Covid-19 pandemic it has become critical for academic institutions to produce valid and reliable assessment results (Schweig et al., 2020; University of Guelph-Office of Teaching and Learning, 2020).

There are numerous advantages that distance education tools provide in terms of educational assessment. Submitting work, responding to students, content and artefact storage, materials reuse, ease of editing based on feedback, and the provision of statistical data are just some of the advantages that distance education tools provide in terms of assessment (Şenel, 2020). Along with these, there are also certain limitations to the use of distance tools in assessment. As with all instructional events in distance education, assessment practices are limited by the information and communication technology competencies of both faculty members and their students. In addition, the difficulty of ensuring test security is considered as the primary limitation (Boud et al.,1999; Butler-Henderson & Crawford, 2020; Dawson, 2020; Peterson, 2019; Rovai, 2000; Sullivan, 2016; Vazquez et al., 2021). Test security means taking certain measures in order to be able to accurately rely upon assessment results (Frey, 2018). The high probability of cheating and plagiarism in remote tests has made test security a more frequently discussed topic in recent literature (Butler-Henderson & Crawford, 2020; Dawson, 2020; Conference on Test Security, 2021; Senel & Senel, 2021; Vazquez et al., 2021).

The virtual classroom may limit certain critical learning components such as collaborative working, communication, and both student-student and student-teacher interaction that are more naturally afforded in the traditional classroom environment (Jung et al., 2002). Deficiency of these critical components therefore must be compensated instructionally in distance education, or through the use of additional educational technological measures that can limit the potential negative effect on learning outcomes (Abrami et al., 2011). Formative assessment emerges as a solution to enhance the social components of learning (Stödberg, 2012), especially student-teacher interaction (Black & Wiliam, 2009). Formative assessment in distance education offers powerful interaction, both amongst students and with their teachers, based on feedback options which provide an opportunity to monitor the learning process and to enhance it via formative feedback. Formative feedback on learning outcomes may also create opportunities for students to organize their learning at the same time. Along with formative assessment and feedback, students can encounter more effective interaction with their instructors as they strive to achieve their educational goals. There is, therefore, a significant need for formative assessment and feedback (Higgins et al., 2002) for both effective learning (Hricko & Howell, 2005) and to increase learner motivation.

Measurement techniques can be divided into two areas; tests and performance-based techniques. In distance education, tests are usually referred to as online synchronous tests, in which a class of students all logon to a learning management system at the same time and enter their answers within a limited time period (e.g., 45 minutes). These tests may consist of true-false, matching, or multiple-choice items that are answered

selectively, as well as open-ended items. As a group, performance-based techniques include performance tasks, assignments, and e-portfolios. Participation and reflection reports can also be added to live lectures or discussion forums in order to be considered as indicators of participation in distance education. Rubrics, rating scales, and also checklists can be used for scoring in performance-based techniques. The choice and application of appropriate measurement techniques, along with software measures, can be effective in overcoming the limitations of remote assessment in distance education. The strengths, limitations, and measures that may be taken against the limitations of online tests in distance education are summarized in Table 1.

Table 1.
Strengths, limitations and measures taken against online tests limitations

	Strengths	Limitations	Measures to be taken against limitations
Multiple-choice / Short or single-response items	• Higher content validity • Instant scoring and feedback • Motivating in-class use	• Lower test security • Inefficient for assessing higher-level skills	Varied measures can be taken with software and measurement techniques to ensure test safety. • Time limit for whole exam • Time limit for individual items • Presenting test-takers with items in a different order • Presenting test-takers with response options in a different order • Using item pool/presenting different (equal) items • Disabling option to change an answer once entered • Limiting/blocking new web page or tab opening • Requiring the test-taker's camera to be open • Other technologies (e.g., voice, retinal, face scans)
Long-response or open-ended items	• Aimed at higher-level skills	• Time consuming and heavier workload • Lower scorer reliability	• Well-prepared tests measuring higher-level skills may decrease cheating • Rubrics and control lists for scoring • Use of antiplagiarism software (e.g., Turnitin, iThenticate)

In online testing, test security emerges as an issue that requires significant emphasis. Online tests, which consist of matching, true-false and/or multiple choice items, are more suited to the measurement of low-level skills such as recall, comprehension, and application, are particularly susceptible to acts of cheating and/or plagiarism when applied in the distance education context. As can be seen in Table 1, there are many software measures that focus on test security (Dawson, 2020; Dendir & Maxwell, 2020; Harmon et al., 2010; Howell et al., 2009; Jain et al., 2006; Sullivan, 2016). Asking students an excessive number of items within a given time limit can also be added to the measures (Mohanna & Patel, 2016). The ability of online tests to provide instant feedback is also critical, especially in distance education. This is effective in fostering student motivation and engagement to the lesson (Chaiyo & Nokham, 2017). When open-ended items aimed at higher-level skills such as critical thinking and problem solving are included within online tests, the probability of interference from alternative sources is likely to decrease. In addition, originality reports for open-ended responses can be readily obtained with software support.

Table 2.
Strengths, limitations and measures to be taken against the limitations of performance-based tools

	Strengths	Limitations	Measures to be taken against limitations
Assignments, performance tasks, e-portfolios	• Aimed at higher-level skills • Fosters student engagement	• Time consuming and heavier workload • Lower scorer reliability • Difficult to measure group member contribution	• Cheating may decrease with a focus on higher-level skills • Demanding assignment-based online/ oral presentation • Demanding schedules and interim reports • Use of self/peer/group assessment • Rubrics and control lists used for scoring

			• Use of antiplagiarism software (e.g., Turnitin, iThenticate)
Participation indicators (attendance rates, post/message numbers, post/message length, other logs)	• Supports student participation and collaboration • Supports self-regulation	• Demands motivation-enhancing activities and feedback	• Initiating discussions by using in-class activities • Routing and guiding discussions (lecturer/assistants) • Clearly explaining about start/end of discussions • Instructor participation in discussions/ evaluations • Providing instant feedback to student posts

The strengths of performance-based techniques are summarized in Table 2. These techniques, which are considered suitable for the measuring of high-level skills, invite students to research, reveal new ideas, and to develop products. Faculty members should choose the technique deemed most appropriate for the intended educational goals, considering the limitations and strengths of the available tools. In terms of remote assessment, it is recommended to apply these methods in a blended way considering their strengths within the context of application (Erkuş, 2006).

Gaining high-level skills and applying these skills are considered some of the required features or competences that higher education students should possess in the 21st century (Kyllonen, 2012). Considering that skills such as critical thinking, problem-solving, collaboration, creativity, and productivity should be at the fore, it is clear that tests consisting of open-ended items and performance-based techniques should be used predominantly in the measurement of high-level skills. Considering what has been reported so far, it is recommended to focus on assessment techniques for high-level skills in remote assessment, which create detailed feedback opportunities, maintain a focus on the students' development, formulation, and support purposes, and provide opportunities for students to organize their learning. However, in addition, test security must also be taken into consideration.

The use of take-home exams in distance education, and during the COVID-19 pandemic in particular, is generally recommended, together with detailed explanations on how to appropriately use take-home exams (Institute of Education Sciences, 2020). Take-home exam is a nomenclature that relates to the conditions of measurement and evaluation, rather than to any specific assessment method (London School of Economics and Political Science, 2020). In take-home exams, with an approach similar to open-book or open-web exams, students may take the exam using a variety of different resources available to them. Due to their obvious similarities, findings related to open-book (Atılgan et al., 2009) and open-web exams were also used in reviewing the current literature. Take-home exams can be defined as a test consisting of open-ended items that provides the student with an opportunity to apply their knowledge to a specific problem or question within a limited time and by using all available resources, regardless of location (Zoller & Ben-Chaim, 1989). Since students are predominantly located "at home" to receive distance education during the pandemic, this approach can be expected to be widely preferred by higher education institutions. Based on the literature, the potential benefits of take-home exams in remote assessment are discussed as follows.

> ***Higher test security:*** In online tests, test security cannot be fully ensured, even if software-based precautionary measures are taken for test security (Dawson, 2020). Test security can be increased when open-ended items or tasks that aim to measure high-level skills are created through take-home exams (Zoller & Ben-Chaim, 1989). Exams should include items that do not have a concrete answer, and are therefore less liable to instances of cheating and plagiarism affecting the score (Butler, 1988; Mohanna & Patel, 2016). Notably, open-book exams or exams where each student is expected to provide their own unique answers are also referred to as cheating reduction methods (Dawson, 2020; Sullivan, 2016).

Measuring/enhancing higher level skills: Take-home exams emerge as the recommended method for measuring students' high-level skills. In addition, when used for formative assessment, preparation with items for high-level skills is also important for the development of high-level skills and professional development (López et al., 2011; Mohanna & Patel, 2016).

Supporting learning: Take-home exams support learning by helping students to acquire, research, and apply course-related skills within a real-time environment (Sullivan, 2016). As in the current research, take-home exams are considered to be supportive of learning outcomes by allowing students to concentrate on specific topics, and to research and access resources for a limited 12-48 hour examination period.

Collaboration: Given the relatively limited application time limit (e.g., 1-2 days), the fact that all students taking a course are working on the same task on the same day can enhance collaboration. Students are able to communicate with each other about items. Similarly, take-home exams are also open to group working practices, and may thereby create increased peer interaction and collaboration through group exams (Johnson et al., 2015).

Decreasing exam anxiety: One byproduct of take-home exams can be said to be reduced test anxiety for students. The literature has shown that open-book exams cause less exam-based anxiety than closed-book exams (Atılgan et al., 2009; Gharib et al., 2012). Considering the negative academic connotations of the pandemic on student learning, it is seen as important that take-home exams may also lower levels of exam anxiety for students (Özdin & Bayrak Özdin, 2020). Decreasing exam anxiety may be also be considered as being even more supportive for students with lower achievement levels (Zoller & Ben-Chaim, 1989).

Higher content validity: In take-home exams, students are offered longer response times than for other types of online exam, due to the generally higher content validity of take-home exams (López et al., 2011). In this way, most educational objectives within the scope of a course can be measured.

Detailed feedback: Take-home exams provide the opportunity and support for students to organize their learning through detailed feedback. It is understood that feedback also increases student motivation towards lessons (Higgins et al., 2002), and encourages them to take responsibility for their learning; both of which can help to support students' success in distance education.

Considering its potential benefits, a well-structured take-home exam can be a very effective method when applied within the distance education context. However, at this point, it is important to consider which subjects or educational targets may be appropriately assessed. Subjects such as research methods and statistics are very much suited to the take-home format of exams, since they may provide the opportunity for students to use their knowledge in well-defined problem situations and to create a research environment themselves from various sources. From a test security perspective, take-home exams offer certain advantages. As previously stated, test security has become a subject of significant discussion in the realms of distance education. Controlling and monitoring students using the latest technology such as 360° video capturing around online test-takers and the use of biometrics (e.g., fingerprint scans, optic-retinal tests, facial recognition), or analyzing keystroke patterns are some of the available high-tech solutions that can be applied in order to prevent instances of cheating or plagiarism (Harmon et al., 2010; Howell et al., 2009; Sullivan, 2016). However, the application of these types of high-tech solution are not that common, yet have the potential to be much more common in the near future. However, the use of such control mechanisms, which aim to control and monitor students technologically during online exams, may lead to additional stress on those considered as "dishonest" or a "cheater." The effect of this view on student motivation and learning may be the subject of future studies in this area. Similarly, Butler-Henderson and Crawford (2020) reported in their systematic review of online examinations that the literature focuses more on the technical aspects rather than the pedagogy of online exams. As technology evolves, new assessment tools can be developed, but it is always possible to create appropriate measurement conditions by taking

advantage of the strengths of certain measurement methods, regardless of their technological application. The use of take-home exams, which have the benefit of high test security and are considered to result in reduced anxiety, in measuring students' high-level skills, may reduce some of the aforementioned limitations. In this respect, the current research is considered significant as it emphasizes the importance of high-security assessment in distance education through well-designed assessment tools.

The purpose of the current study is to present an example of the take-home method used in higher education assessment during the COVID-19 pandemic using case study methodology, and to provide empirical evidence about how this method is perceived by students (as test-takers). Within the framework of this purpose, answers to the following research questions were sought:

- What are students' perceptions about the quality of assessment using take-home exams?
- What are the views and preferences of students regarding the effect of take-home exams on their learning?

2. Methodology

A case is actually a complex phenomenon which has a specific definition as well as combined and well-described procedures and limits that serve a specific purpose or aim (Stake, 1995). Case studies, which are mostly qualitative in nature, aim to fully describe and offer detailed analyses of a limited process or period such as a program, a classroom event, a group of people, or a unique subject or happening (Merriam, 1998). Case studies generally focus on unique cases in order to answer and explain the "how" and/or "why" academic questions (Yin, 2002).

Similarly, the current study aims to explore how a specific assessment tool, "take-home exams," can be employed as a formative assessment tool in a specific learning context (remote assessment in distance education), and how participants react to this unique case. As the pandemic continues to limit the use of conservative assessment tools, and instructors also look for reliable and valid means and methods of measurement, the researchers of the current study sought to design a specific case study in order to offer a viable solution. The current research employed case study methodology in order to explain how a local and unique practice of take-home exams in distance education is used, and how the participants perceived its effectiveness.

2.1. Study Group

The current study was conducted with students enrolled to a Basic Statistics course at Faculty of Education in Turkey. In total, there were 64 students registered to the course and all received a take-home exam for their mid-term evaluation. Of the 64 students, 43 volunteered to complete the data collection tool and to state their opinion about the evaluation method applied in the course. The 43 university students (31 female, 12 male) were attending a mid-sized state university in Turkey, and were studying in their second or third grade (37 were 2nd graders, six were 3rd graders). All of the students were aged between 20 and 23 years old. The data were collected via an electronic form, with answers given anonymously in order to ensure sincere participant views were collected, with only their gender and grade level recorded.

2.2. Procedure

The research context for the study was an introductory course in statistics. The course was offered to undergraduate students of a mid-sized state university in Turkey. All of the course content was delivered through the distance education medium, with synchronous weekly lessons and asynchronous activities used as additional studies. Microsoft Teams was the platform used for all of the instructional activities, including live lessons, assignments, the sharing of course material, announcements, and both student-student and student-instructor communication.

The exam date and start time was announced in advance to the students (participants), and the take-home exams were uploaded to Microsoft Teams prior to the set exam hour. The participants were then able to access the exam document at the predetermined exam hour, and were given 14 hours to respond. The course instructor was available online throughout the exam hours, and replied to student queries regarding the exam through instant messaging. Details about the procedure are as follows.

2.2.1. Developing take-home exam

Exams such as take-home, open-book, or open-web, where students have the opportunity to access different resources, are key to measuring the high-level skills of students (Atılgan et al., 2009). However, the probability of test-taker cheating may increase as students can easily find answers from different sources. For this reason, such exams should include items that cannot be answered simply, but require a unique and often long answer (Butler-Henderson & Crawford, 2020; Mohanna & Patel, 2016). This basic principle has also been taken into consideration in the development of take-home exams. The literature reports that the use of take-home exams is considered more appropriate for fields/subjects such as mathematics, science, and statistics (Atılgan et al., 2009). In the current study's Basic Statistics course, the students were asked to create their own dataset and then to perform their analysis on the created dataset. In this case, 64 separate datasets were used by 64 students, enabling them to produce original and unique results through each revealing their own dataset. English language translations of some of the take-home exam items are presented in Annex 1.

2.2.2. Use of take-home exam

Since the higher education institution to which the participants were affiliated in the current study used Microsoft Teams as the main distance education platform, the MS Team's assignment tool was employed for the take-home exam. The various technical features of each learning management system can result in e-assessments being easier or more difficult (Butler-Henderson & Crawford, 2020; Seow et al., 2014). The basic features of MS Team's assignment tool in terms of take-home exams are:

1. Uploading the exam title and instructions (uploading files as necessary)
2. Setting the date and time for the exam start and finish
3. Creating a rubric for scoring

When take-home exam is sent out to the students enrolled to a course, notifications are sent direct to the user (student) accounts. When students receive the exam, they can look at the exam instructions and the developed rubric for scoring. Therefore, students can understand the assessment criteria and submit their answers within the framework of the predetermined assessment criteria. In the current study, the participant students were asked to submit their responses within a set 14-hour (08:00-22:00) window considering the active study time.

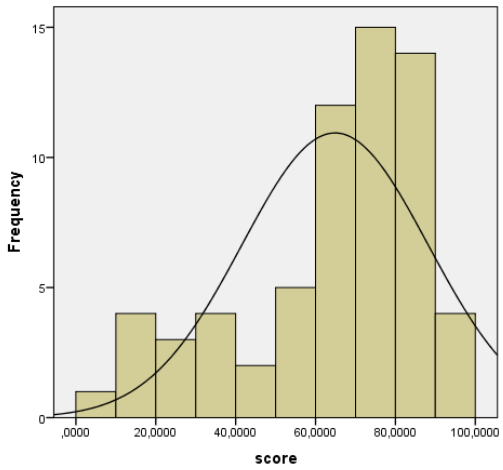
2.2.3. Scoring and Feedback

Different holistic rubrics were used for each item in scoring the take-home exam. In an analytical rubric, various dimensions of performance are scored separately (Kutlu et al., 2008). However, as separate criteria were created for each item, the use of an item-based rubric was considered to be more appropriate. A 5-point rating rubric was created for each item of take-home exam. Table 3 presents a sample rubric created in MS Teams.

Table 3.
Holistic rubric in MS teams (Sample Item-Interpretation of distribution of test scores)

Item	Achievement level / Criterion				
	1	**2**	**3**	**4**	**5**
Explain normality of distribution of test scores (10 pts)	Correct interpretation with a single statement and with no source detailed (mean-mode-median; histogram)	Distribution interpreted via histogram plot or mean-mode-median agreement	Distribution interpreted via histogram plot and mean-mode-median agreement	Distribution interpreted via histogram plot, mean-mode-median agreement, and skewness-kurtosis coefficients	Distribution interpreted via histogram plot, mean-mode-median closeness, and skewness-kurtosis coefficients. Group success evaluated according to the distribution.

As shown in the example in Table 3, each item was scored using a 5-point rating. The graded score was decided separately by the two researchers. Thus, it was possible to determine the interrater reliability for the total scores by using the Krippendorff alpha technique (Bıkmaz Bilgen & Doğan, 2017). The interrater reliability was found to be .89, which Krippendorff (1995) defined as high reliability (.80 or above). The researchers met, discussed, and rescored answers where there was no initial agreement until a consensus was reached. Histogram and descriptive statistics of the participants regarding take-home exam results are presented in Figure 1.



Mean	64.88
Std. Deviation	23.34
Variance	544.61
Skewness	-0.97
Kurtosis	0.03
Minimum	6.00
Maximum	97.00

Fig 1. Histogram and Descriptive Statistics of Take-Home Exam Results

When Figure 2 and descriptive statistics were examined, mean score shows participants' average of the achievement is above the middle score. As a supporting result, distribution of the scores is skewed to left, without distorting normality. Besides, the group is heterogeneous in terms of achievement scores regarding standard deviation (S = 23.34).

MS Teams offers a functional environment for take-home exams with the aforementioned capabilities. Students can readily access and read the instructor's feedback entered on an exam paper or feedback tool. It is also possible for students to make revisions according to the feedback they received. Where permitted by the instructor, students can revise and resubmit their answers. In Figure 2, student paper (1), instructor feedback on student paper (2), overall feedback (3) and rubric for scoring (4) were presented.

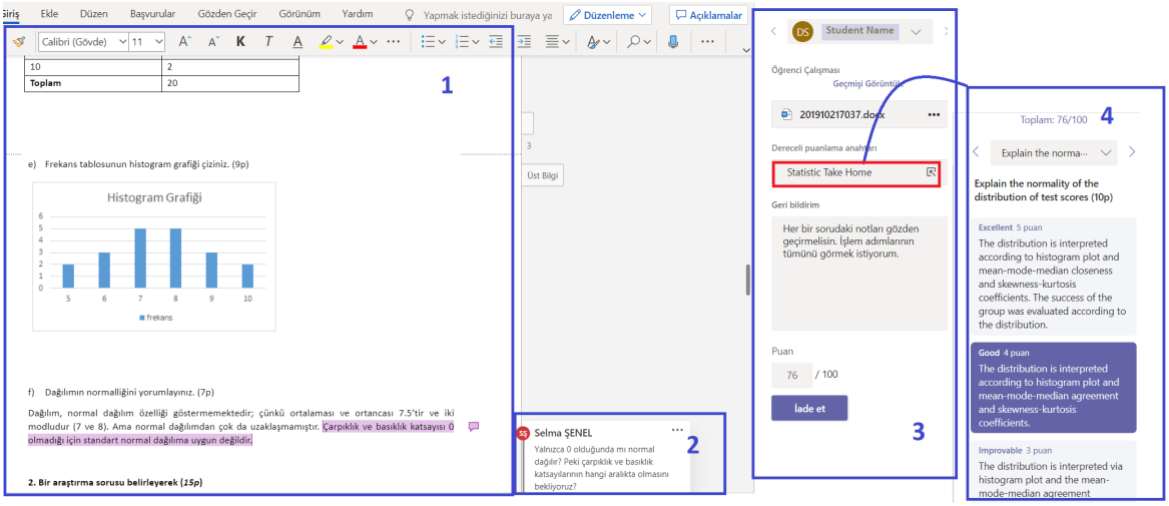


Fig 2. Scoring and feedback on MS Teams

The steps followed in scoring and feedback on MS Teams are as follows.

1.Scoring with 5-point rating without downloading the document (Fig 2-1)

2.Writing explanations (feedback) on students' paper (Fig 2-2)

3.Entering additional textual feedback for each item via MS Teams feedback tool

4.Providing overall feedback about the total of the take-home exam via MS Teams feedback tool (Fig 2-3)

5.Rubric for each item and automatic total scoring (Fig 2-4)

6.Returning results to students to review the scoring and feedback given

As can be seen in Figure 2, students can see scores they received for each item as well as their total score. In addition, students can review feedback entered for any of their responses and also read the additional or overall feedback on the exam paper. These features also afford an important level of convenience for faculty members in terms of exam scoring, feedback, and storage.

2.3. Data Collection Tools

There are two data collection tools used in this study. These tools are presented to participants in one form. This form was sent to participants electronically. Details of the data collection tools employed in the current study are as follows:

2.3.1. Students' perception about the quality of assessment with take-home exams

In order to determine the perceptions of university students regarding the quality of measurement and evaluation applied in their courses, the 11-item, single-dimension, 5-point, Likert-type instrument developed by Senel and Senel (2021) was used. While the maximum score obtainable from the scale is 55, the minimum score is 11. Senel and Senel (2021) presented validity evidence by undertaking a trial application with 486 students from various different faculties and departments. The variance explained by the instrument amounted to 55.43%. The Cronbach Alpha internal consistency coefficient of the instrument was originally calculated as .93, and .91 for the current study.

2.3.2. Views and preferences of students about take-home exams

Seven questions were prepared in order to elicit the views of the participant students regarding their use of take-home exam method. Through these questions, the aim was to collect information about how much the specific objectives targeted in the current study were achieved. For example, the limitation of only being able to answer take-home exams during daytime hours (0800-2200) was expected to increase the

cooperation of the test-takers (students). During the exam hours, it was considered that the students would be awake and focused on the exam. In addition, assessment methods aimed at evaluating high-level skills are expected to route students towards study methods appropriate for these skills. The current study's participants were asked whether or not they found the take-home exam to be an effective assessment method in distance education, and about their preferences for take-home exams. The available question responses were arranged as a 5-point, Likert-type scale, with 1 = totally disagree, 2 = disagree, 3 = partially agree, 4 = agree, and 5 = strongly agree. Additionally, an open-ended question proposed to participants for enabling them to express further views about the unique experiences.

2.4. Collecting Data

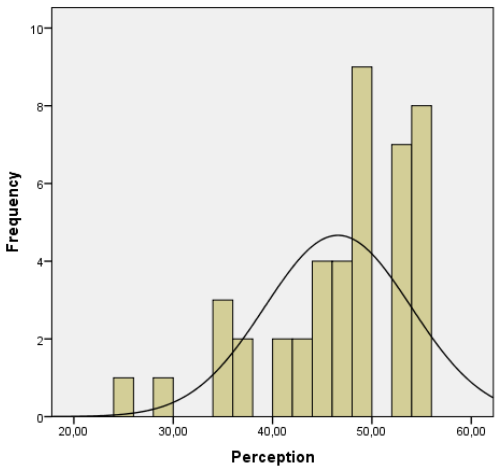
All 64 students of the course were subject to a take-home exam. They were asked to share their opinions about the quality of the assessment through take-home exam, and for their views about take-home exams. It is important for students to voluntarily participate in academic studies in order that they respond openly and honestly. In the current study, although no personal information was recorded, a total of 43 students participated using the applied data collection tool, and analyses of the students' perceptions and opinions were then conducted according to their data.

3. Results

In this section, the participants' responses were analyzed according to the research questions of the study, and were therefore presented under two headings: the students' perceptions about the quality of the assessment with take-home exams, and the students' views and preferences about take-home exams.

3.1. Students' perception about the quality of assessment with take-home exams

A histogram graph of the students' perceptions about the quality of assessment with take-home exams is presented in Figure 3, together with the descriptive statistics.



Mean	46.58
Std. Deviation	7.35
Variance	54.06
Skewness	-1.06
Kurtosis	0.80
Minimum	25.00
Maximum	55.00

Fig 3. Histogram of students' perceptions of quality of assessment of take-home exams

When the histogram graph with the normal distribution curve and descriptive statistics presented in Figure 3 are examined, it can be interpreted that the students' perception about the quality of the assessment is high ($\bar{X}$ = 46.58, S = 7.35). Considering that the maximum score that can be obtained from the scale is 55, this value can be interpreted as an indicator of the students' positive perception regarding the take-home exam method. Senel and Senel (2021) found a 35.29 mean score (S = 11,00) of students' perceptions about the quality of measurement when applying the same scale in Turkish universities during the 2019-2020 spring semester (initial COVID-19 pandemic conditions). As can be seen, the perceived quality of the take-home

exam method measured in the current study was one-unit standard deviation higher. The mean ($\bar{X}$) and standard deviation (SD) values regarding the responses given to the scale items are presented in Table 4.

Table 4.
Item statistics about the participants' perceptions about the quality of assessment using take-home exams

No	Item	$\bar{X}$	SD
i1	Instructions and explanations in assessment / assignments were understandable and clear.	4.07	0.86
i2	I was informed about the evaluation and scoring (rubric and evaluation criteria etc.).	4.44	0.77
i3	Techniques used in the assessment were appropriate to the skills aimed at being acquired in the course.	4.40	0.85
i4	Assessment was aimed at measuring high-level skills (creative thinking, critical thinking, problem-solving, etc.).	4.35	0.87
i5	Learning effectiveness was increased through rapid assessment and feedback.	4.44	0.93
i6	Assessment results and feedback were instant.	3.81	1.03
i7	Feedback was detailed and instructive.	4.00	0.98
i8	Assessment practices did not allow cheating or plagiarism.	4.23	1.00
i9	Assessment results were reliable.	4.33	0.89
i10	Distinctiveness of test results was high.	4.02	0.99
i11	Assessment scope did not exceed beyond the provided content.	4.49	0.70

According to Table 4, the mean value of the items varied between 3.81 and 4.49, and the overall mean value was found to be 4.23. This result shows that the students' views were between agree and strongly agree. In their study, Senel and Senel (2021) found the mean value of the students' perceptions about the quality of assessment to be 3.17.

It can also be observed from Table 4 that the lowest scored item was "instant feedback" (i6). The take-home exam method is somewhat time-consuming compared to online tests, which predominantly consist of multiple-choice, short-answer, true-false, and matching item types. Within the scope of the current research, since each exam paper was scored by two separate raters, the process took 14 days for all the feedback to be given in full. This may have contributed to the lower quality perception about instant feedback. The highest mean scores were that the assessment scope did not exceed the scope of the course content ($\bar{X}_{i11}$ = 4.49, SD=0.70), regarding the detailed information about how assessments would be made and the scoring ($\bar{X}_{i2}$ = 4.44, SD=0.77), about how learning effectiveness was increased through rapid assessment and feedback provision ($\bar{X}_{i5}$ = 4.44, SD=0.93), how the take-home exam was an appropriate method to assess the skills aimed to be acquired on the course ($\bar{X}_{i3}$ = 4.40, SD=0.85), that assessment was aimed at measuring high-level skills ($\bar{X}_{i4}$ = 4.35, SD=0.87), that the assessment results were deemed to be reliable ($\bar{X}_{i9}$ = 4.33), and how the assessment practices did not allow for cheating or plagiarism ($\bar{X}_{i8}$ = 4.23, SD=1.00).

3.2. Views and preferences of students regarding the effects of take-home exams on their learning

The mean and standard deviation values of the students' responses regarding the take-home exam method after the application, and the percentages for each answer category, are presented in Table 5.

Table 5.
Views and preferences of students about take-home exams

		definitely disagree	disagree	partly agree	agree	definitely agree		
	Question	% per response category					$\bar{X}$	**S**
Q1	Take-home exam assessment method supported my learning.	0.00	2.33	13.95	25.58	58.14	4.37	0.90
Q2	Take-home exam assessment method increased my motivation to the course.	0.00	11.63	4.65	46.51	37.21	4.09	0.95
Q3	I shaped my learning strategies according to the take-home exam and feedback received.	0.00	6.98	13.95	37.21	41.86	4.14	0.91
Q4	Limiting exam hours to working hours (08:00-22:00) helped me to maintain focus.	0.00	6.98	9.30	18.60	65.12	4.42	0.93
Q5	The take-home exam increased my course interaction with my peers	0.00	13.95	27.91	27.91	30.23	3.74	1.05
Q6	I think the take-home exam is an effective assessment method in distance education.	0.00	4.65	11.63	20.93	62.79	4.42	0.88
Q7	I would prefer take-home exams for other courses.	2.33	4.65	16.28	20.93	55.81	4.23	1.04

According to the student response statistics presented in Table 5, the mean score of all the items, except for the item ($\bar{X}_{Q5}$ = 3.74, SD=1.05) about take-home exams increasing peer interaction, was above 4.09. Although the take-home exam method leaves students open to using resources and to interact with each other, it is quite understandable that students may want to create their own unique answers considering the limited response timeframe. This may have contributed to the students' views about interaction and take-home exams. The most interesting finding from this part of the study is that none of the respondents choose "strongly disagree" regarding six of the seven items. The students reportedly found the take-home exam method to be an effective method for distance education ($\bar{X}_{Q6}$ = 4.42, SD=0.88), and they also indicated having a preference for take-home exams in other courses ($\bar{X}_{Q7}$ = 4.23, SD=1.04). In addition, the students replied positively that limiting exam hours to working hours enabled them to maintain their focus ($\bar{X}_{Q4}$ = 4.42, SD=0.93). Additionally, the students considered that the take-home exam method supported their learning ($\bar{X}_{Q1}$ = 4.37, SD=0.90), and shaped the learning strategies through feedback ($\bar{X}_{Q3}$ = 4.14, SD=0.91).

The students were asked an open-ended question at the end of the data collection tool regarding their views about the use of take-home exams as an assessment method in distance education. It was not an obligatory question, and seven of the students provided their views; some of which are reported in the following as direct quotations to support the quantitative data.

One of the participants talked about the COVID-19 pandemic and distance education, and having found take-home exams to be the assessment tool most appropriate for distance education. The participant mentioned issues of test security and the measuring of high-level skills when comparing take-home exams with other remote assessment methods that had been used.

> *Due to the pandemic conditions, we receive distance education and have unfortunately witnessed cheating in many online exams. Thanks to take-home exams, I both received a really challenging exam and felt that cheating had been prevented. I believe that take-home exams are the best method in distance education.*

Another participant emphasized the importance of feedback and how take-home exams helped learning through well-defined problems. Similarly, the participant compared take-home exams and online tests, and reported that in online tests they did not even remember the test items but that the take-home exam helped

them to learn through well-defined problem situations. Another issue participant stated is that exam instructions were very clear.

> *After completing a time-limited online test, I even forget the questions, but the fact that the take-home exam method is in the form of an assignment presents real scenarios, and the feedback helped to make it possible to learn in a more practical way. It was really important that the exam instructions were both clear and precise.*

One of the students drew attention to the technical benefits of take-home exams. Comparing take-home exams to other online assessment methods, the participant found take-home exams more convenient and relaxing. Time limitations and potential problems related with internet access may cause to feel high levels of exam anxiety for students. Take-home exams have potential to help students to feel more relaxed during remote assessment.

> *The take-home exam method eliminates the possibility of problems like Internet or power failure. It helps to make students feel very comfortable. Instant disruptions within online tests can pose big problems for students, i.e., when communication via the Internet was problematic. We have limited time and high exam anxiety in online tests.*

4. Discussion

The current study aimed to examine students' views about use of take-home exams in remote assessment. The COVID-19 pandemic forced educators into using distance education and remote assessment, which meant an increased need for both valid and reliable assessment methods. As a solution, the researchers opted for take-home exams as a remote assessment tool in a unique case, with the aim to provide empirical data about how students perceive the quality of assessment through take-home exams.

Results indicated that the students had a high perception about the issue of test security. As stated by Zoller and Ben-Chaim (1989), test security can be increased when well-defined open-ended items or tasks are developed to measure high-level skills. The current study's results showed that the students found the exam instructions to be both clear and helpful. Additionally, the literature suggests avoiding developing test/exam items that have concrete or definitive answers (Butler, 1988; Mohanna & Patel, 2016). In the case of the current study, each student created their own data and then performed analysis based on their unique dataset. This approach provided a significant advantage in the prevention of cheating and plagiarism. The literature reports that open-book exams, in which students have unlimited access to books, also have a higher degree of test security (Butler-Henderson & Crawford, 2020; Dawson, 2020; Sullivan, 2016). Participants of this study, similarly, reported higher perception about the security of the take-home exam as an assessment practices and they highly reported that this method did not allow cheating or plagiarism which is a common problem in online classes (Dendir & Maxwell, 2020). Additionally, participants found take-home exams reliable and distinctive as a remote assessment tool. This result is consistent with another result of this study that students would prefer take-home exams in other courses too.

One of the biggest advantages of take-home exams is its ability to measure high-level skills (Bengtsson, 2019). The results of the current study indicate that the participants perceived the take-home exam as an assessment tool that aims to measure high-level skills such as critical thinking and problem-solving. The literature also offers take-home exams as a formative assessment tool that may help to enhance and/or measure the high-skill levels of learners (López et al., 2011; Mohanna & Patel, 2016). Participants of this study showed high level of perception about the take-home assessment method was aimed at measuring high-level skills. One of the participants compared take-home exams and online tests expressing additional

views and stated that take-home exam presents real scenarios while he/she could not even remember the test items in online tests. Additionally, using problem situations in take-home exams can also help to prevent cheating, since cheating in take-home exams is considered to be a relatively minor problem as the aim is to measure higher taxonomy levels (Bengtsson, 2019).

Take-home exams provide a high level of content validity with a wider exam-hour timeframe (López et al., 2011). With no overriding time limit in take-home exams, most educational objectives can be tested through the use of well-defined items. According to the results of the current study, the participant students showed high levels of perception regarding the relationship between the scope of the assessment and the course content. Additionally, the students considered take-home exams to be an appropriate method of evaluating the skills aimed to be acquired from the Basic Statistics course. Atılgan et al. (2009) reported that subjects such as science, mathematics, and statistics are considered to be more appropriate for take-home exams.

In the current study, the take-home exam was used as a formative assessment tool, with the students able to access the feedback and comments from their instructor for each exam item. The students found the feedback they received to be both detailed and instructive; helping to enhance student-teacher interaction, which is a key indicator of effective distance education (Harper, 2018). Additionally, the students were able to see the evaluation criteria and scoring. As reported earlier, the study's results showed that the students have a high level of perception about their exam results, and found the take-home exam results to be reliable and distinctive. Actually, this result provides additional clues regarding the prevention of cheating since students (e.g., a group of close students) may feel a sense of injustice if they believed there was cheating in any part of the take-home exam.

Another promising result of this study is about the supportive role of take-home exams for learning. Take-home exams may enhance learning by presenting chance students to research, and apply gained skills within a real-time problem (Sullivan, 2016). Similar with findings of Hall (2001) participants of this case study reported highly positive views about this new assessment method supported their learning. Additionally, participants of this study reported that take-home exams increased their motivation towards course.

Online tests may cause text anxiety for test-takers (Woldeab & Brothen 2019). Potential for technical system problems such as lack of internet access or login failures, exam-related stress, use of online proctoring systems may create anxiety among test-takers (Ilgaz & Afacan Adanır, 2020). Besides, take-home exams may help students to feel more relaxed in online exams by reducing anxiety (Rich et al., 2014; Hall, 2001). Similarly, participants of this study reported that they feel more relaxed in take-home exams eliminating potential problems.

However, take-home exams are disadvantageous in terms of developing and scoring. During Covid-19 pandemic, all of the courses moved to distance education. Using take-home exams for all of the distance courses will be time consuming and may create heavy workload. Creating feedback for each item and student takes serious time. In this study, researchers scored each paper independently for inter-rater reliability and this scoring process took approximately 14 days. Students' moderate views about the instantaneity of the assessment results and feedback may be reasoned from this unintended delay.

The current research was designed as a case study, with the take-home exam designed as a remote assessment tool. Due to the COVID-19 pandemic, the participants were studying all of their courses online (Carr, 2020), and experienced various assessment methods from other faculty members on other courses. More research may be conducted on this area in order to compare remote assessment tools, with a broader framework established for the assessment of higher education students receiving instruction via distance education. The current study aimed to employ the take-home exam as a formative assessment tool.

However, the use of assignments, e-portfolios, and performance tasks are also formative assessment tools, which may also increase student-student and student-teacher interaction during the COVID-19 period of distance education. Researching the effectiveness of these various tools may help both practitioners and course/program designers to find new solutions that can offer valid and reliable forms of academic assessment.

5. Limitations

As with all studies, the current study has certain limitations. In total, 67 students were enrolled to the Basic Statistics course upon which the take-home exam was applied. However, since not all of the students volunteered to participate, the study was conducted with only 43 voluntary participants. Second, the feedback given in response to the students' exam answers were provided 14 days after the exam day. With two separate coders evaluating the students' answers and then providing the instructor feedback, there was some debate between the coders with regards to scoring and feedback, and this additional workload led to the unanticipated delay in providing finalized feedback to the students. This may be considered a limitation as the literature clearly emphasizes the importance of feedback being given instantaneously (Nutbrown et al., 2016). Researchers used MS Teams for developing and applying take-home exams. MS Teams is a powerful tool for preparing take-home exams. On the other hand, there are numerous learning management systems used in distance education and technical capabilities of these tools may vary. Researchers and practitioners must reconsider the technical capabilities of online tools developing take-home exams.

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Annex 1.
Basic Statistic Take-Home Exam Example Items

**Important Note:* Students must provide explanations for each calculation steps. Results must be entered in the spaces provided.
The table (below) is for a double-scored achievement test result, with 10 items applied in a class (n = 20); where i1-i10 = item numbers and s1-s20 = student numbers.
Create your own unique dataset by entering test data as 1 = correct and 0 = incorrect (see first cells).

a) Calculate students' total test scores and enter in "Test Score" column. Calculate the "*z*" and "*t*" scores and enter in the appropriate columns.
b) Calculate central trend statistics and standard deviation, range, variance, and quarter deviation for the test scores, and enter to the appropriate shaded cells.

	i1	**i2**	**i3**	**i4**	**i5**	**i6**	**i7**	**i8**	**i9**	**i10**	**Test score**	***z*-score**	***t*-score**
s1	0	1	.	.	.	.	.	.	.	.			
s2	.	.	.	.	.	.	.	.	.	.			
s3	.	.	.	.	.	.	.	.	.	.			
s4	.	.	.	.	.	.	.	.	.	.			
s5	.	.	.	.	.	.	.	.	.	.			
s6	.	.	.	.	.	.	.	.	.	.			
s7	.	.	.	.	.	.	.	.	.	.			
s8	.	.	.	.	.	.	.	.	.	.			
s9	.	.	.	.	.	.	.	.	.	.			
s10	.	.	.	.	.	.	.	.	.	.			
s11	.	.	.	.	.	.	.	.	.	.			
s12	.	.	.	.	.	.	.	.	.	.			
s13	.	.	.	.	.	.	.	.	.	.			
s14	.	.	.	.	.	.	.	.	.	.			
s15	.	.	.	.	.	.	.	.	.	.			
s16	.	.	.	.	.	.	.	.	.	.			
s17	.	.	.	.	.	.	.	.	.	.			
s18	.	.	.	.	.	.	.	.	.	.			
s19	.	.	.	.	.	.	.	.	.	.			
s20	.	.	.	.	.	.	.	.	.	.			

Mean		***S***	
Mod		**Variance**	
Median		**Quarter Deviation**	
Range			

c) Interpret the test results (in terms of distribution and trend) according to the statistics.
d) Create a frequency table of the data.
e) Draw a histogram graph of the frequency table.
f) Interpret the normality of the test score distribution.

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Trend of distance education research in the covid-19 period: A bibliometric and content analysis

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Abstract

The study aims to reveal the studies' profile for distance education activities in the Covid-19 period. For this purpose, bibliometric analysis and content analysis were used together in the study. Within the scope of the study, 220 studies were selected in the Web of Science database to access the articles. Within the scope of bibliometric analysis, the most used keywords, the most cited journals, the most publishing journals, the most publishing countries and the most cited authors were analyzed with the VOSViewer program. In content analysis, methodological trends (method, sample size, data collection tool, data analysis type) used in the studies were examined. As a result of the research, the most publications were made in the last quarter of 2020, 16% of the studies were single-author and the quantitative research method was the most preferred (40%), the sample was mostly university students (n=78). It was observed that it was clustered between 0-100 intervals, the most frequently used questionnaire (n=105) as the data collection tool, and the descriptive-quantitative analysis method (40%) was used as the data analysis method. Also, the most publications are made in America and China, the most used keywords are "covid-19", "online education" and "distance education", the most cited authors are Chen, Cong, Peng and Yang, and finally It has been observed that the highly cited journal has Sustainability.

1. Introduction

The virus (Covid-19), which first appeared in Wuhan, capital of China's Hubei region, in December 2019, quickly became a pandemic and affected the whole world. The virus, which affects all areas of life, especially social and economic activities, has brought life to a complete standstill except for some essential services. The adverse effects of the pandemic have manifested themselves in the field of education as well as in all areas and all countries globally; formal education has been suspended in whole or in part. Considering the data released by UNESCO (2020), as of April 2020, schools were completely closed in approximately 190 countries around the world, while schools were partially or regionally closed in four countries due to the pandemic. This situation forced approximately 91% of students at all educational levels to face the negative effects of the pandemic, which corresponds to more than 1.5 billion students. Nevertheless, the number of teachers who were adversely affected by this process was announced as 65 million (TTF 2030, 2020).

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Immediately after the first shock of the pandemic was overcome, the countries continued their education activities with alternative methods in order to minimize learning losses by continuing their educational activities and to help students cope with the negative effects of the pandemic. Distance education-based solutions come first among alternative methods. Through the synchronous-asynchronous applications used on television and radio broadcasts, internet-supported computers and mobile devices, both educational activities were continued and students were tried to be prevented from being completely detached from the education process (Aydın, 2020). In contrast to the planned distance education activities, remote educational activities carried out in the crisis periods such as war and pandemic in the crisis has revealed the concept of "emergency distance teaching" (Hodges et al., 2020; Smith, 2020). The temporary realization of the process was to be reverted to the decision as a result of the fact that the fact that it is realized under different conditions, resulting in different objectives and dynamics, resulting in different ways of remote education and online education concepts. The presence of all these differences has increased future public health and safety concerns due to natural disasters such as fires, hurricanes and polar vortex in recent years (Samson, 2020) further increased the interests of the researchers. During this period, academic studies in education generally focused on distance education activities during the pandemic process (Aristovnik et al., 2020). When the literature is examined, Covid applications in different education levels (Adom, 2020; Fiş Erümit, 2021; Nemec et al., 2020; Zamfir, 2020), teacher and student experiences (Chertakova et al., 2020; Elizabeth Noor Coutts et al., 2020; Yavuz et al., 2020; Kim, 2020), success, perception and attitude regarding the process (Gonçalves et al., 2020; Giovannella et al., 2020; Hamann et al., 2020; Wang et al., 2020) Studies for its identification (Bozkurt, 2020; Hodges et al., 2020; Samson, 2020) are encountered.

Sometimes, the excessive number of studies in the field brings along some problems. The results of studies on a subject may support each other as well as reveal conflicting results. Researchers doing research on any subject have difficulty accessing all of the studies on that subject or spend a lot of time to reach them (Göktaş et al., 2012). At this point, the results of content and meta-analysis made on studies in a certain field provide significant convenience to researchers (Selçuk et al., 2014). Bibliometric analysis is one of the methods of evaluating literature, such as the content analysis method (Falkingham & Reeves, 1998) that helps to evaluate existing literature in a field. Bibliometrics is interested in examining various elements of academic publications with the help of numerical analyses and statistics. Bibliometric analyses may be descriptive in determining the number of articles published in a given year, or they may be evaluative in terms of citation analysis to reveal how an article affects the research that follows (McBurney & Novak, 2002). Both methods are seen as necessary for guiding researchers on the issues mentioned.

2. Literature

Bibliometric analyses were carried out in various fields during the pandemic period. In this context, the study conducted by Kambhampati et al. (2020) found 6831 articles from the PubMed database using keyword searches and included 1802 publications covering human studies. In the review, it was stated that covid-19 related studies had been continuously increasing throughout the period. While it is stated that articles related to the pandemic were published in a total of 1430 journals, the most published journals among these are the British Medicine Journal (BMJ) (252 articles) and Journal of Medical Virology (186 articles). Another bibliometric review published during the pandemic period was carried out by Darsono et al. (2020). In this context, the researchers reached 1475 publications from the Scopus database. All articles were published between December 2019 and March 2020. As a result of the study, it was determined that 11 different types of publications were made, and Viruses Journal (74 articles) ranked first among the journals with the highest number of publications, followed by Lancet (50 articles) and Journal of Virology (39 articles). Besides, China took first place with 386 studies on country basis and Hong Kong University with 44 studies on institutional basis. In a similar review, Dehghanbanadaki et al. (2020) have reached 923

studies on COVID-19 indexed in Scopus. China took first place with 348 studies based on the country, while the United States took second place with 160 studies. The Lancet and BMJ Research Ed were the journals with the highest number of publications. In terms of the institution, the University of Hong Kong and Huazhong University of Science and Technology shared first place with 30 publications. In other studies, on the subject (Chahrour et al., 2020; Chen, Guo, et al., 2020; Golinelli et al., 2020; Hamidah et al., 2020; Hossain, 2020; Hugar et al., 2020; Lou et al., 2020; Zhai et al., 2020; Zhou & Chen, 2020) some variables such as authors, countries, languages, citations, institutions, sources, and publication types were examined. Most of the studies were generally carried out with a short time interval, with a concise literature or small sample. This situation may have caused contradictory results. To illustrate, Kambhampati et al. (2020) finds BMJ as the highest producing journal, while Darsono et al. (2020) found Lancet to be the most producing journal.

As a result, the bibliometric and content analysis studies that will be carried out for distance education activities in the Covid period are considered essential for determining the trend in this area. Also, it is believed that the data obtained from these studies will also make important contributions in directing subsequent research, developing publication policies, and guiding researchers in the field. In this context, 220 articles for distance education activities of the Covid-19 period in the Web of Science database were subjected to bibliometric and content analysis. In this direction, articles were examined in terms of month of publication, number of authors, number of pages, keywords, number of citations according to different variables (such as country, journal, author) and methodological trends. The current review aims to reveal the studies' profile for distance learning activities of the Covid-19 period. For this purpose, the review addressed the following research questions.

R.Q. 1. What is the distribution of distance education studies in the pandemic period by months?
R.Q. 2. What is the distribution of author numbers in distance education studies during the pandemic period?
R.Q. 3. What is the page number distribution of distance education studies in the pandemic period?
R.Q. 4. What is the distribution of studies on distance education in the pandemic period by country?
R.Q. 5. What is the distribution of the most commonly used keywords in the studies on distance education during the pandemic period?
R.Q. 6. Who are the most cited authors in the studies on distance education during the pandemic period?
R.Q. 7. What is the co-authorship relationship of the authors in the studies on distance education during the pandemic period?
R.Q. 8. Which journals have the highest number of publications and citations (citation and co-citation) in distance education studies during the pandemic period?
R.Q. 9. What are the methodological trends (method, sample, data collection tool and data analysis) of distance education studies in the pandemic period?

3. Methodology

The purpose of this review is to reveal the profile of the studies conducted for distance education activities in the Covid-19 period. To achieve this aim, bibliometric and content analysis methods were used together in the study. Content analysis can be defined as organizing, classifying, comparing textual expressions and drawing theoretical conclusions from texts (Cohen et al., 2007), or as any qualitative data reduction and interpretation effort to determine the basic consistency and meanings by taking qualitative studies in large

numbers (Patton, 2014). On the other hand, Bibliometric analysis is based on following the studies on a specific subject and revealing the findings by analyzing these studies according to various characteristics (Marti-Parreno et al., 2016). Relevant publications in the Web of Science (WoS) database were included in the study to reach high-quality articles. In the scan conducted on 14/02/2021, key phrases were searched in the title, summary, or keyword sections by selecting the "Topic" option. Among the articles obtained after the search, English and open access articles with "ESCI, SCI-E, SSCI" indexes were included in the study. "Covid-19" and "distance learning" were used as keywords and phrases that evoke them. Keywords and inclusion criteria were presented in detail in Figure 1.

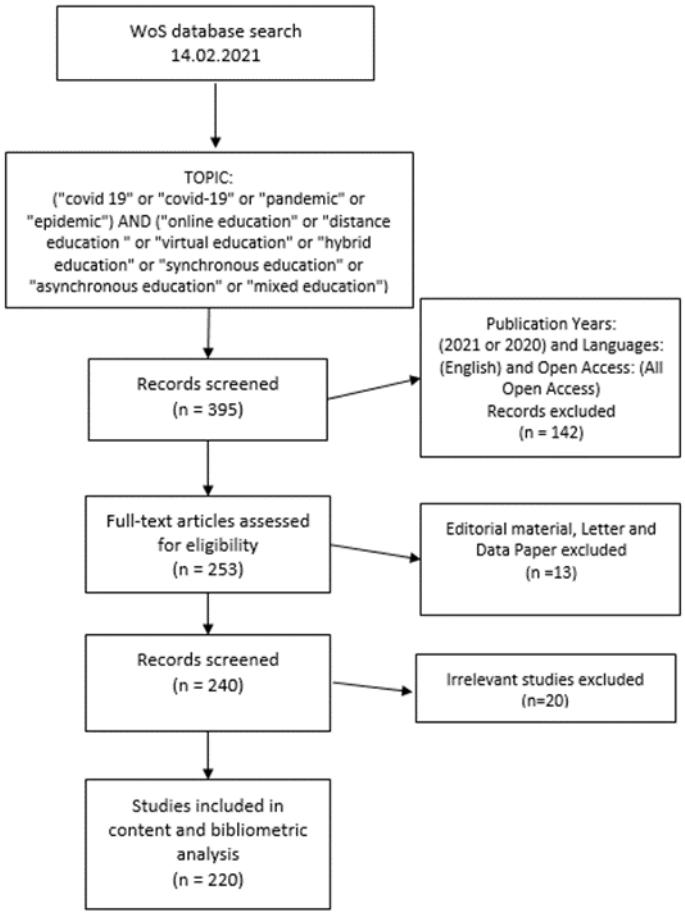

Figure 1. Article Selection: PRISMA Flow Diagram (Liberati et al., 2009)

3.1. Data Collection Tool

The researchers prepared a data collection form for data collection within the scope of the research. The data collection form has been prepared in MS Excel and consists of two parts. Titles such as the name of the study, author, page number, method used, sample group, sample number, data collection tool, data analysis method, publication year and month were included in the form. The purpose of examining the dimensions here is to reveal the methodological trends of the studies on distance education carried out in the Covid-19 period and draw a general framework by looking at them from a broad perspective. The data required for the bibliometric analysis part of the study was obtained from the WoS database. After determining all the articles to be included in the scope of the study, Export / Other File Formats / Full Record and Cited References options were checked, respectively. Then, File Format / Tab-delimited (Win) options were selected and the data was downloaded in txt file format.

3.2. Data Analysis

3.2.1. Content Analysis

In the content analysis part of the review, 220 studies were examined by the first two authors. Each author examined 110 studies and the content analysis form was filled in this context. The other author has reviewed the content analysis form. After the data entry was completed, the entire form was reviewed by two authors and errors in coding were eliminated. Thus, the coding process was carried out by providing consensus. Finally, the data entries completed in the content analysis form were examined by the third author. Therefore, any errors were tried to be prevented and the validity and reliability of the analysis were tried to be ensured. In addition, in this study, the first two authors selected ten articles and encoded them separately. The consistency between this encoding was calculated as 90%. According to Miller and Huberman (2019), the consistency between coders should be at least 80%. Since the consistency in the study is over 80%, it can be said that the consistency between coders is high.

3.2.2. Bibliometric Analysis

In addition to content analysis, the bibliometric analysis method was also used in the study. With bibliometric analysis, the most commonly used keywords, the most cited journals, the most published journals, the journals that published the most studies on the subject, the countries that did the most studies on the subject, the publication cooperation between countries, the keywords used and the relationship between them, the most cited authors, the relationship between the authors, the journals that were jointly cited and the most published areas were examined. The VOSViewer software, which is one of the widely used programs in the visualization of bibliometric networks (Artsın, 2020), was used to reveal the network visualization in the analysis.

4. Findings

The study aims to reveal the studies' profile for distance education activities in the Covid-19 period. Findings for the studies dealt with in this context were given in parallel with the research questions. Besides, descriptive information about the studies examined is presented in Table 1.

Table 1.

General information on the studies reviewed

Identification of Publications	**Sonuç**
Number of publications	220
Total number of keywords	724
Average number of keywords	3
Years	2020-2021
Total number of authors	913
Number of authors per publication	4
Total number of references	7301
Number of references per publication	33
Total number of citations	365
Number of citations per publication	2
Number of studies with a single author	35
Number of studies with multiple authors	185
Total number of pages	2584
Pages per publication	12
Number of countries where the article was published	70
Number of journals where the article was published	161
Total sample size	198681

R.Q.1. Distribution of articles by months

The first finding addressed within the context of content analysis is the publication year and month of the articles. It was seen that the articles were mainly published in the last quarter of 2020 (Figure 2).

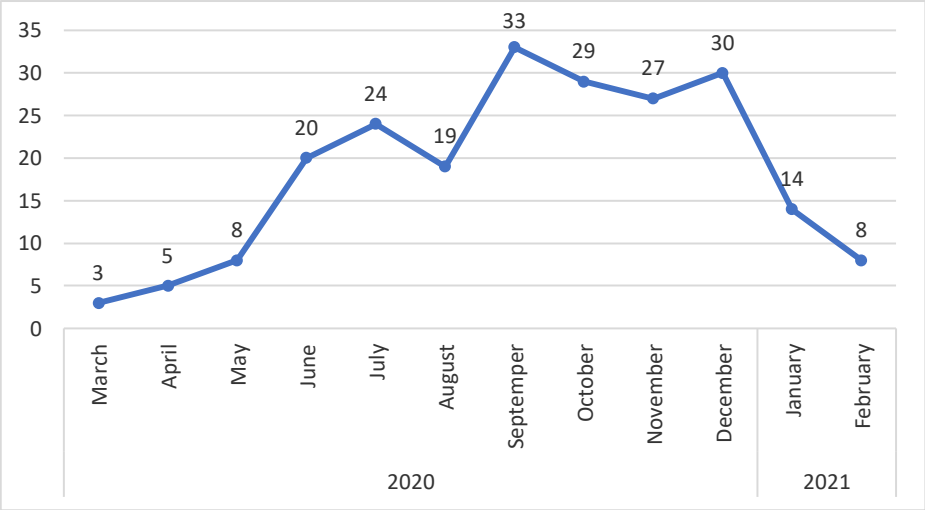

Figure 2. Distribution of articles by years and months

When Figure 2 examined it was seen that the articles were mostly published in September (n = 33), December (n = 30), October (n = 29) and November (n = 27). In other words, it can be said that the studies are stacked in the last quarter of 2020. However, at the beginning of both years, it is seen that the number of studies is in parallel and receives the lowest values.

R.Q.2. Distribution of the number of authors in the studies

The number of authors of the studies on distance education activities in the pandemic period was examined in the content analysis. In the review, it was seen that most of the studies had multiple authors. Findings about the number of authors are given in Figure 3.

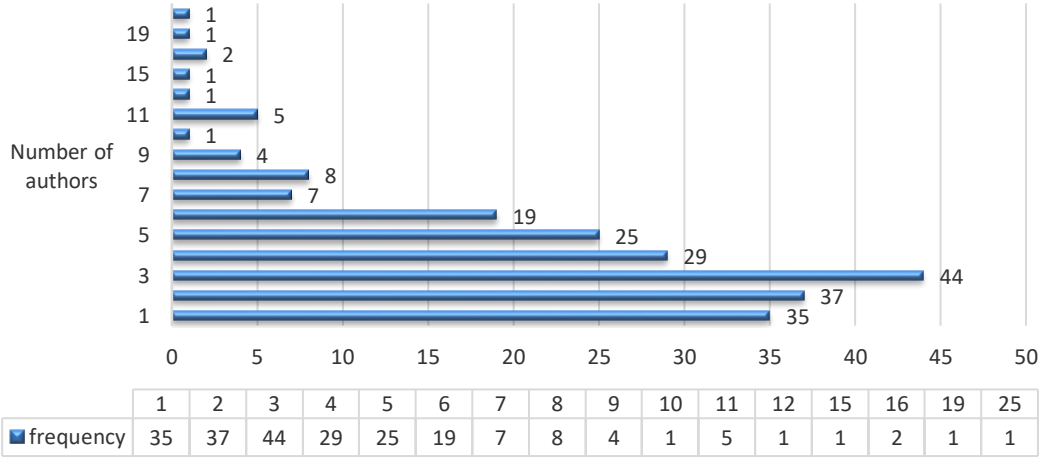

Figure 3. Number of authors scatter plot

In Figure 3, it was observed that 20% of the studies conducted for distance learning activities during the pandemic period have three authors (n=44), about 17% (n=37) have two authors, and about 16% (n=35) have single authors. In addition, it is noteworthy that approximately 5% of the studies have 10 or more authors. It is understood from the graph that the average number of authors per article is about four. This indicates that the studies were conducted largely on a collaborative basis.

R.Q.3. Distribution of articles by the number of pages

Another variable examined in the content analysis was the number of pages of the studies. According to the findings, approximately half of the studies had a page number of 10 or less. The findings of the number of pages are given in Figure 4.

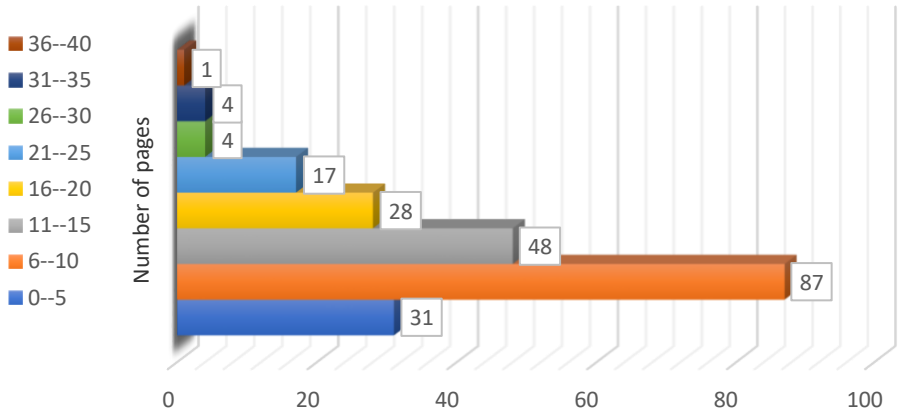

Figure 4. Number of pages scatter plot

In Figure 4, it is seen that about 14% of the studies conducted for distance learning activities during the pandemic period had 0-5 pages, about 40% had 6-10 pages, and about 22% had 11-15 pages. In addition, 12% of studies have a page number of 21 and above. Considering the entire chart, the average number of pages per work is calculated as 12. This situation can be seen as a result of the researchers focusing more on literature review studies since the subject is new.

R.Q.4. Distribution of articles by country of publication

As a result of bibliometric analysis, the distribution of articles by country was examined. When the publishing countries are examined, it shows a wide distribution on the geography of the world. The distribution of the articles by the countries in which they are published is given in Figure 5.

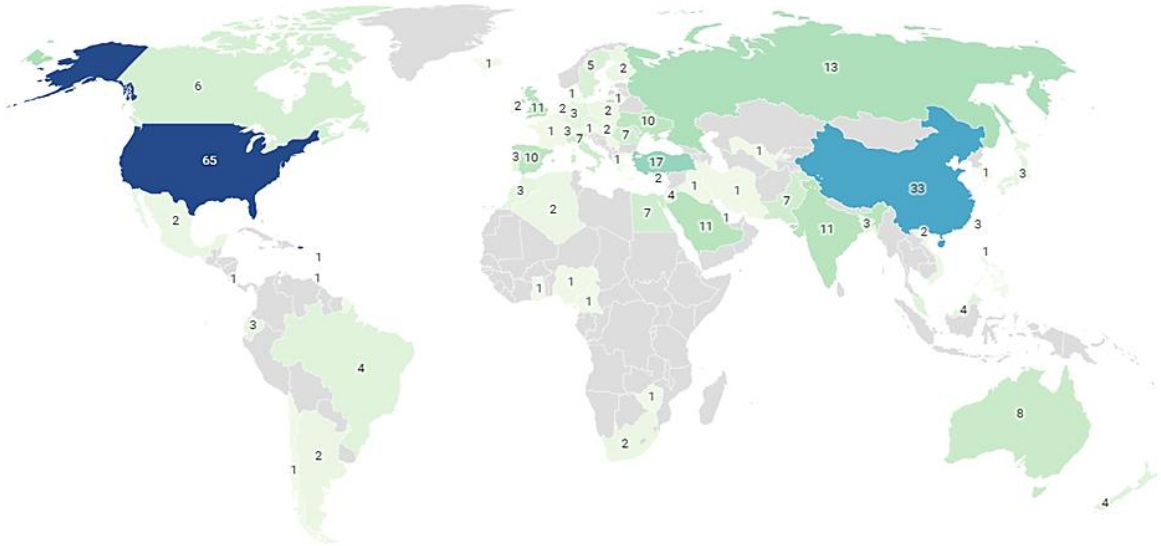

Figure 5. Distribution of articles by country of publication

As a result of the analysis, it was seen that articles were produced in 70 different countries in total. It can be said that studies have been carried out in countries where the pandemic has spread in different continents of the world. The top 10 countries with the highest number of publications are also determined and shown in Table 2.

Table 2.

Top 10 countries with the highest number of publications

Country	Documents
USA	65
China	33
Turkey	17
Russia	13
England	11
Saudi Arabia	11
India	11
Spain	10
Ukraine	10
Australia	8

When Table 2 is examined, the countries with the highest number of publications are listed as USA (n=65), China (n=33), Turkey (n=17), Russia (n = 13) and England (n = 11). It is seen that approximately 45% of the publications are published by the first two countries. In addition, the top 10 countries with the most citations are given in Table 3.

Table 3.

Top 10 countries with the most citations

Country	Citations
China	158
USA	149
England	93
Spain	72
New Zealand	69
Netherlands	64
Australia	62
Japan	54
Taiwan	54
Cyprus	54

In Table 3, the most cited countries are China (n=158), USA (n=149), England (n=93), Spain (n=72) and New Zealand (n=69), respectively. China and the United States took the top two places in the ranking of the most cited countries, as well as in the ranking of the most published countries. It is just that they have changed their position in the rankings. The total number of citations of these two countries constitutes approximately 30% of all citations. In addition, Turkey, Russia, Saudi Arabia, India and Ukraine, which are among the countries with the highest number of publications, could not be among the top 10 countries with the highest number of citations. Contrary to this situation, New Zealand, Netherlands, Japan, Taiwan and Cyprus managed to rank among the top 10 countries with the most citations.

R.Q.5. Most used keywords in studies

For the bibliometric analysis of the most used keywords, "Co-occurrence" was selected as the analysis type and "Authors keywords" was marked as the unit. In this context, a total of 685 keywords were found from the data set. Among these keywords, the minimum threshold number of 3 was selected and the bibliometric analysis (Clusters = 8, Links = 193, Total link strength "TLS" = 376), which revealed a total of 39 keywords, is given in Figure 6.

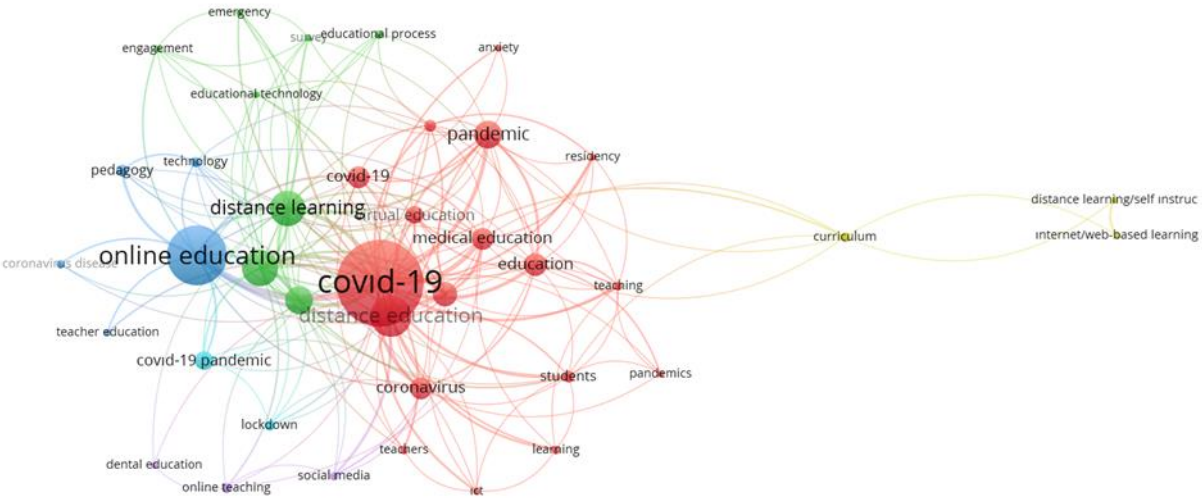

Figure 6. Analysis results of publications by keywords

When Figure 6 is examined, the keywords used in the studies listed as "covıd-19" (Occurences"Oc"=74), "online education" (Oc=46), "distance education" (Oc=29), "online learning" (Oc=25), "distance learning" (Oc=24) and "pandemic" (Oc=18). These were followed by e-learning, education, medical education, coronavirus and technology expressions. When the keywords of the publications are examined, it is seen that approximately 61% (n = 135) use words such as Covid-19 and evocative pandemic or coronavirus. In addition, it is seen that keywords such as anxiety, curriculum, telehealth and dental education are less preferred in bibliometric analysis. However, a word cloud belongs to the summary section of the articles were presented.

Figure 7. Word cloud for the summary section of the studies

As seen in Figure 7, expressions such as covid-19, pandemic, online education, distance education, learning stand out as the most used words in the summary. These keywords are in line with the keywords shown in the bibliometric analysis. In other words, the keywords in Figure 6 are similar to the word cloud of the summary section of the articles in Figure 7.

R.Q.6. Most cited authors (Citation and Co-citation analysis)

In the bibliometric analysis of the most cited authors, "Citation" was chosen as the analysis type and "Authors" was marked as the unit. The "Minimum number of documents of an author" value is set to 2 and the "Minimum number of citations of an author" value to 0. As a result of the elections, the analysis result of 35 authors is shown in Figure 8 (Items = 35, Cluster = 35; Link = 0).

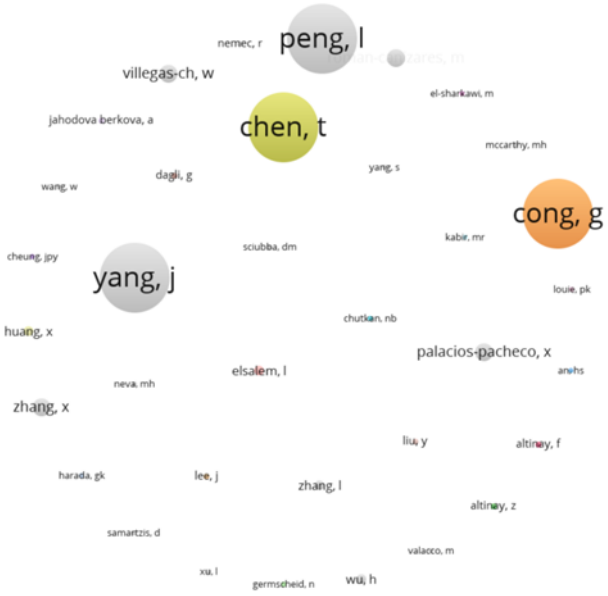

Figure 8. Most cited authors (Citation analysis).

In the above figure, the most cited authors (Citation analysis) are listed as Chen, Cong, Peng, Yang (35 citations). These are followed by Palacios, Roman, Villegas, Zhang (5 citations). However, the co-citation analysis of the most cited authors in the reviewed studies is given in Figure 9 (Items = 48, Clusters = 8, Links = 308).

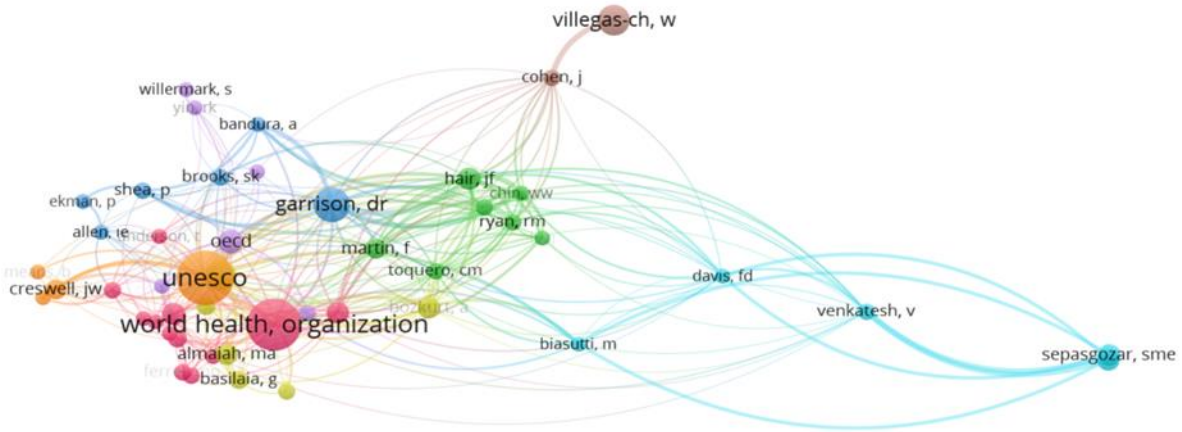

Figure 9. Most cited authors (Co-citation analysis).

Co-citation analysis aims to determine the impact of studies by counting the number of citations that occur together. Accordingly, co-citation analysis results are listed as UNESCO (39 citations), WHO (36 citations), Garrison (20 citations), Villegas (17 citations), Hodges (16 citations) and OECD (12 citations). Efforts to clarify the situation can be seen as the main reason for citing pandemic reports by organizations such as UNESCO, WHO and OECD.

R.Q.7. Co-authorship analysis

Although there is no link between the authors citing each other in the citation analysis, the co-authorship analysis is based on the direct link between the two authors. In other words, co-authorship analysis is used to evaluate collaboration between different authors (Göksu et al., 2021; Öztürk, 2020). In the bibliometric analysis carried out in this context, "Co-authorship" was chosen as the analysis type and "Authors" as the analysis unit. As a result of the co-authorship analysis in the studies, 880 authors exceeded the threshold value (threshold = 2). For each of the 880 authors, the total strength of co-authorship links with other authors was calculated. 24 authors with the highest total connection power (TLS) were selected for the visualization map. However, it has been observed that 12 of them are interconnected. As a result of the co-authorship analysis, the visualization map of the authors who are connected is given in Figure 10 (Items = 12, Cluster = 1, Link = 66, TLS = 132).

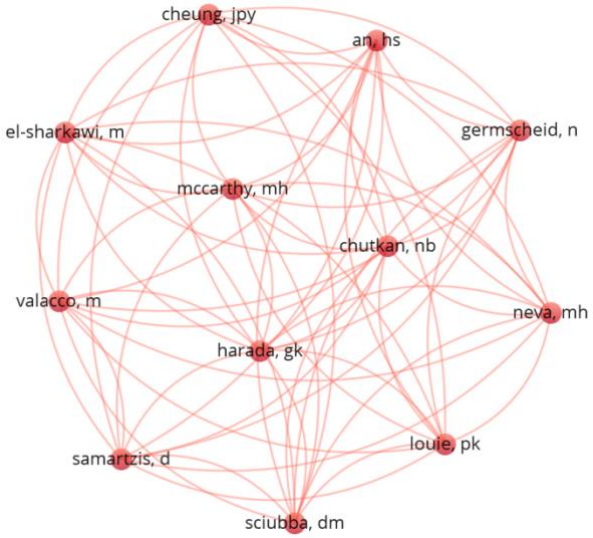

Figure 10. Co-authorship analysis for the reviewed studies

Co-authorship analysis for the studies is given in Figure 10. When this figure was examined, it was seen that only one cluster was formed about the authors who carried out the studies. It was determined that the number of studies of 12 authors in the current cluster was 2 and their TLS values were 22.

R.Q.8. Most cited journals and Most published journal (Citation and Co-Citation)

In the bibliometric analysis made for the most cited journals, "Citation" was chosen as the analysis type and "Sources" as the analysis unit. The "Minimum number of documents of an author" value was set to 2 and the "Minimum number of citations of an author" value to 0. As a result of the elections, the analysis result of 33 journals can be seen in Figure 11 (Items = 33, Cluster = 32; Link = 1).

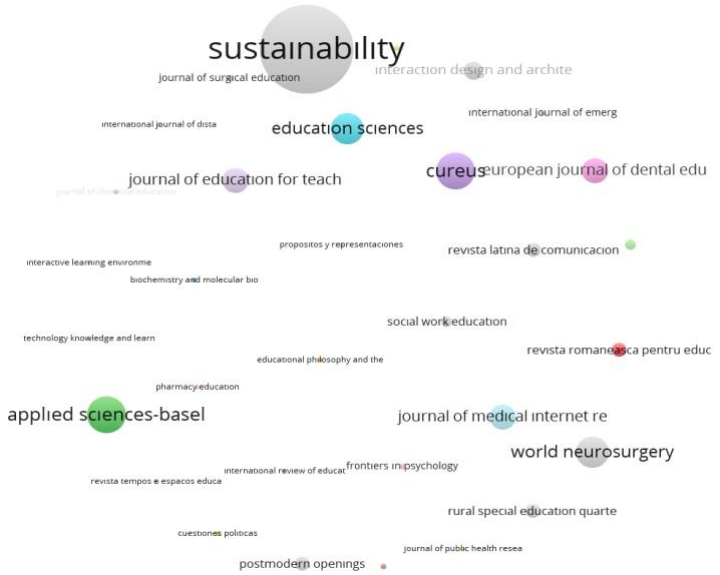

Figure 11. Most cited journals (citation)

When Figure 11 is examined, the first four journals with the most citations are listed as Sustainability (Citation=30, Document=13), Applied sciences (Citation=10, Document=3), Cureus (Citation=10, Document=2) and Education sciences (Citation=8, Document=7). In addition, "co-citation" as the analysis type and "cited sources" as the analysis unit was selected for the co-citation analysis of the most cited journals in the reviewed studies. The minimum number of citations of a source was set at 10 and the number of sources to be selected was automatically stated to be 71. The results of the Most cited journals (Co-Citation) analysis were as in Figure 12 (Items = 86, Cluster = 7, Links = 1214 and TLS = 8667).

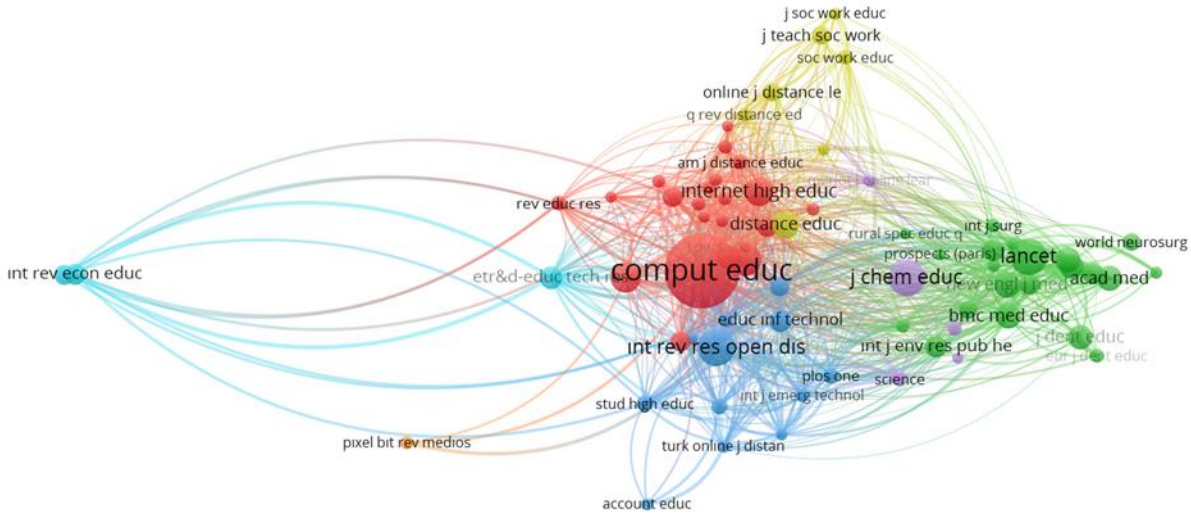

Figure 12. Most cited journals (co-citation)

When Figure 12 is examined, the co-citation numbers of journals are listed as Computers & Education (125 co-citations), International Review of Research in Open and Distributed Learning (48 co-citations), Lancet (47 co-citations), Journal of Chemical Education (47 co-citations), Sustainability (40 co-citations) and The Internet and Higher Education (34 co-citations). Another variable examined with bibliometric analysis was the journals in which the studies were published. The top 10 journals that publish the most about distance education activities during the pandemic period were given in Table 4.

Table 4.

Top 10 journals with the most articles published

Journals	**f**
Revista Romaneasca Pentru Educatie Multidimensionala	14
Sustainability	13
Education Sciences	7
Educational Technology Research and Development	5
Interaction Design and Architectures	4
Journal of Education for Teaching	4
Applied Sciences Basel	3
Cureus	3
European Journal of Dental Education	3
International Journal of Emerging Technologies in Learning	3

When Table 4 is examined, the most published journals were Revista Romaneasca Pentru Educatie Multidimensionala (n=14), Sustainability (n=13), Education Sciences (n=7) and Educational Technology Research and Development (n=5). The sum of the values in this table corresponds to approximately 50% of the articles evaluated within the scope of the study. Besides, the number of studies published in the first two journals corresponds to 45% of the total value in the table.

R.Q.9. Methodological trends of the studies

Research methods:

In terms of the methods used, the studies were subjected to content analysis. In this context, it was seen that the majority of the studies were carried out by quantitative research methods. The findings obtained regarding the method by which the studies were carried out are given in Figure 13.

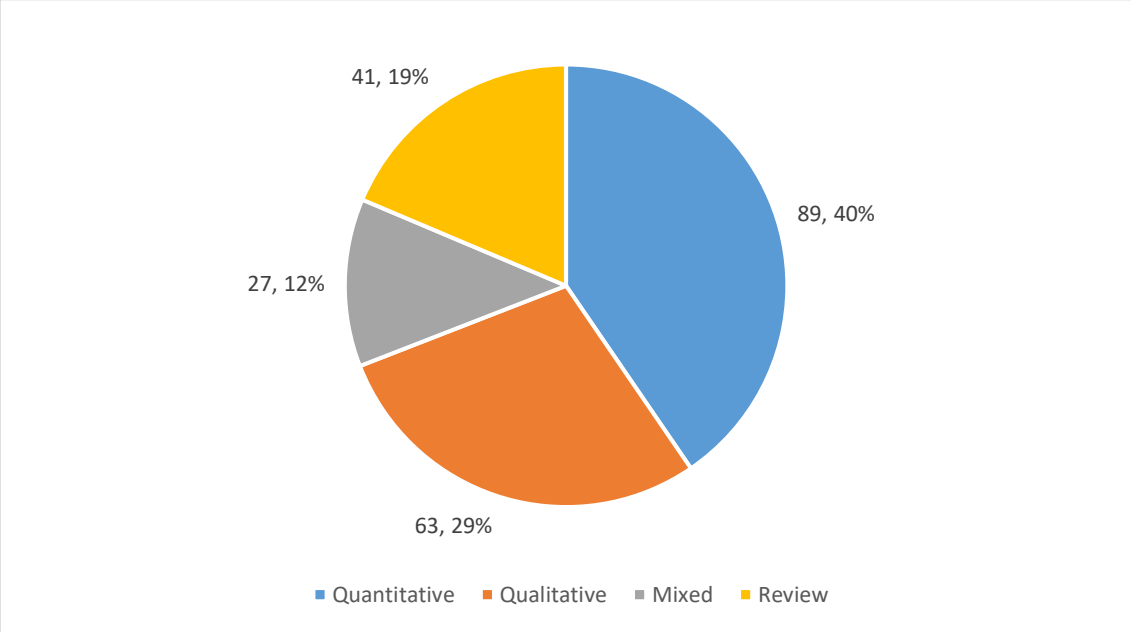

Figure 13. Research methods scatter plot

When Figure 13 is examined, it was seen that approximately 40% of the studies were quantitative, 29% were qualitative, 19% were reviews and finally, 12% were mixed studies. When the graph was examined,

it was seen that qualitative-based studies and quantitative-based studies had similar values to each other. In addition, the high rate of use of survey studies can be shown as the reason why quantitative research methods are more than other methods.

Sample distribution:

The sample numbers were examined within the scope of the content analysis carried out in the review. In this context, it was observed that samples with a sample size of less than 100 are mostly preferred. The detailed graphic of the sample sizes used in the studies is given in Figure 14.

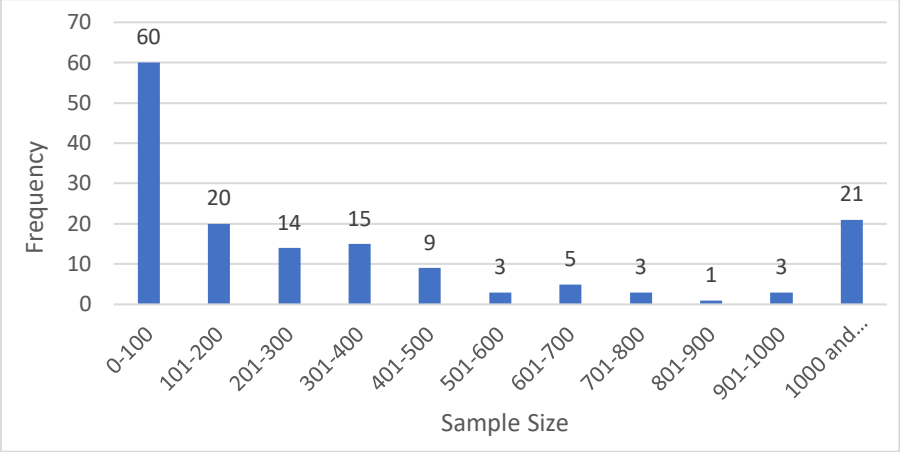

Figure 14. Distribution of publications by sample size

When Figure 14 was examined, the first three most preferred sample sizes in studies were listed as; the 0-100 range is ranked as 39% (n = 60), 1000+ 14% (n = 21), and 100-200 range 13% (n = 20). The high sample size of 101 and above (61%) indicates that the number of studies that collected data with the questionnaire is high. Another variable examined within the scope of the study is the distribution of the participants in which the sample was formed. The studies mostly focused on higher education level and it was observed that the participants were university students and lecturers. Detailed information about the sample groups used in the study is given in Table 5.

Table 5.

Distribution of the sample groups used in the studies

Sample Group	**f**
University Student	78
Instructor	25
Teacher	18
Document	13
K12 student	12
Doctor	9
Assistant	5
Parent	4
Adult	3
Child	2

Faculty	2
Out of sector	2
Others	10

When the participants in the samples are examined according to the table above, university students with 42%, lecturers with 14% and teachers with 10% take the first three places. The least number of participants were parents, adults, children, faculty and non-sector participants. By examining the overall table, it can be stated that the studies are mostly carried out for students and teachers at different education levels.

Data collection tools:

Another variable examined within the scope of content analysis is data collection tools. In this context, it is seen that surveys are generally used as data collection tools in studies. Detailed findings on data collection tools are given in Table 6.

Table 6.

Data collection tools used in studies

Data collection tool	**f**
Survey	105
Interview form	39
Document analysis form	29
Observation form	12
Scale	9
Test / Quizz / Exam	9
Internet comments	4
Document review	3
Workshop / Panel	3
Content analysis form	3
Log records	2
Video	2
Learning diaries	1

When Table 6 is examined, the top three most preferred data collection tools in studies; surveys (47%), interview forms (17%) and document analysis forms (13%). However, it has been observed that different data collection tools such as learning logs, videos, log recordings are also used. It is seen that the researchers, who cannot face the sample group due to the pandemic, prefer to collect data through online surveys intensively.

Data analysis methods:

The data analysis methods covered within the scope of content analysis were examined under three titles. While the quantitative analysis was examined in two dimensions, descriptively and predictively, qualitative

analysis was examined in one dimension. The findings obtained as a result of the analysis are given in Figure 15 in detail.

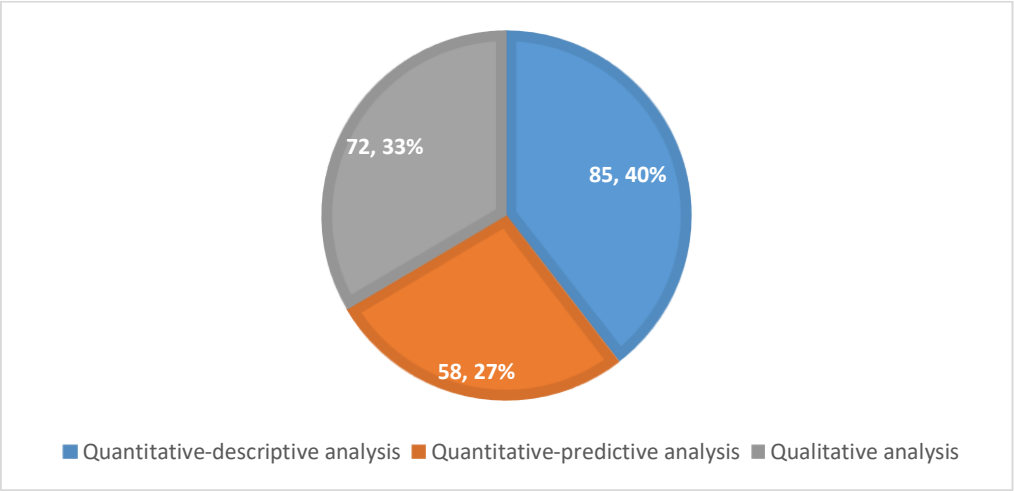

Figure 15. Data analysis methods

When Figure 15 is examined, it is seen that the quantitative-descriptive analysis method is used mostly with 40%. In the second place, qualitative analysis method was preferred with 33%. It is seen that the least preferred analysis method is the quantitative-predictive analysis method with 27%. Since the method preferred in academic studies, data collection tools and data analysis methods are determined in an interconnected way, the findings given in this graph are parallel to the method and data collection tool.

5. Discussions

The purpose of this study is to reveal the profile of the studies conducted for distance education activities in the Covid-19 period. In this context, 220 articles obtained from the WoS database were subjected to content and bibliometric analysis. In this section, the findings obtained as a result of data analysis are discussed in parallel with the research questions. When the articles on distance education during the pandemic are examined, it is seen that the studies are mainly published in the last quarter of 2020. This situation can be seen as a natural result of the writing and publishing process of the articles. Considering that the pandemic started in March and considering the average publication time of scientific articles (Umut & Şencan, 2016; Özkara, 2019), it seems normal that the number of publications will increase towards the end of the year. This finding is in parallel with the finding obtained in the study by Aristovnik et al. (2020) that "the number of publications has increased by approximately 60% after May and continues rapidly." On the other hand, it contradicts the finding obtained in the study conducted by Homolak et al., (2020) that "there were too many publications at the beginning of the pandemic period." Yet, according to the findings obtained within the scope of the study, it is seen that the number of studies conducted in the first months of the pandemic period is less than the other months. When the number of authors of the studies conducted within the scope of distance education activities during the epidemic period is examined, it is seen that they are generally written by more than one author. In addition, it can be stated that they were prepared in cooperation with multiple authors in order to compare the practices in different countries. Bozkurt et al. (2020), with 39 authors representing 31 countries from six continents in total, Elsayes et al. (2021), in which 25 authors from different countries worked together, can be cited as an example of this situation. In addition, the findings of the study conducted by Akl et al. (2020) are similar to the findings of the present study.

Considering the countries where the analyzed studies were published, it is seen that the countries with the highest number of publications and citations are the USA and China. This is in line with the number of academic activities carried out by these countries throughout the year. When the report published by World

Bank (2018) and the results of the article published by Ortas (2018) are examined, it is seen that the top two countries with the most academic publications are the USA and China. In particular, a period of about 20 years between 1996 and 2017 was evaluated in the study carried out by Ortaş (2018). The fact that the number of publications in other countries is lower than the number of publications in China may be due to the virus's origin (Chahrour et al., 2020). This can also be seen as an indication that Chinese scientists are doing their work in the fight against the virus in order to share their publications with scientists all over the world and to inform them about the conditions. Similar findings were also found in studies conducted by Akl et al. (2020), Al-Zaman (2020) and Dehghanbanadaki et al. (2020).

One of the variables examined within the scope of the review is key words. As a result of bibliometric analysis, covid-19, online education, distance education, online learning, distance learning, pandemic, medical education keywords were most commonly used in the articles. Findings obtained within the study, Aristovnik et al., (2020), Chen, Huang, et al. (2020), Fan et al. (2020) With the findings obtained in the studies carried out by Kaya and Erbay (2020), the pandemic shows similarities in terms of identifying keywords. Nevertheless Rodrigues et al. (2020) similar to the majority of the findings obtained in the study. The most cited author order examined within the scope of bibliometric analysis is Chen, Cong, Peng, Yang, Palacios, Roman, Villegas, Zhang. It is seen that these authors have done their work together and have the same number of citations. This situation coincides with the thought that most of the studies carried out during the process were co-authored (Al-Zaman, 2020; Dehghanbanadaki et al., 2020; Kaya & Erbay, 2020). A co-citation analysis was conducted to find the number of citations that occurred together alongside the most cited authors. Here, it is seen that the common citations of organizations such as UNESCO, WHO and OECD are higher than others. In the co-authorship analysis based on cooperation between different authors, it was seen in the findings that only a cluster of 12 authors was formed.

Another one of the findings obtained in the study is the most common list of journals and 33 journals were analyzed in this context. These journals are listed as Sustainability, Applied Sciences, Cureus and Education Sciences. While Sweileh (2021) listed the journal "Nurse Education in Practice" in the top 10, in the findings of this review, it was not included in the top 10. However, the journals with the most common citations are listed as Computers & Education, International Review of Research in Open and Distributed Learning, Lancet, Journal of Chemical Education and Sustainability. Darsono et al. (2020) and Kaya & Erbay (2020) found that Lancet journal is among the top 10 in the common citation list, similar to this review. In addition, the journals that publish the most articles on the subject are listed as Revista Romaneasca Pentru Educatie Multidimensionala, Sustainability, Education Sciences and Educational Technology Research and Development. Al-Zaman (2020) included Cureus magazine among the top 10 journals with the highest number of publications, as in the findings obtained in this review.

As a result of the content analysis carried out within the scope of the study, it was seen that 40% of the studies were carried out by quantitative methods, 12% by mixed and 58% by qualitative methods. Qualitative studies aimed at defining the new process that started with the pandemic and quantitative survey studies conducted to determine the views of stakeholders on the process may have caused the distribution of the methods in this way. In contrast to the current study, Maulana (2020) concluded that the number of quantitative studies is higher than the number of qualitative studies.

In the sample distribution, which is another variable examined, it was observed that studies were conducted mainly with university students, lecturers and teachers, while the most preferred sample size was found to be between 0-100. This situation may have been caused by the researchers' preference for convenient sampling. Studies in which sample numbers greater than 100 are used constitute 61% of all studies, and online survey studies can be shown as the biggest reason for this situation. As a matter of fact, when the results of the content analysis performed for the data collection tools are examined, it is seen that the most preferred data collection tool in the studies is the questionnaire, in line with the above statement. The questionnaire was followed by the interview form and the document analysis form, respectively. As a result of the content analysis performed within the scope of the review, it is seen that the most preferred data

analysis method in the studies is quantitative-descriptive analysis and quantitative-predictive analysis. With the adverse conditions of the pandemic, researchers generally preferred online studies rather than face-to-face studies. In scientific research, the research method suitable for the purpose of the study and the sample, data collection tool and data analysis methods ideal for this method are determined. In this case, it influenced the preferred research method, sample size, data collection tools and data analysis methods in a chain manner (Karasar, 2017). In line with the method used in the study conducted by Maulana (2020), data collection tools and data analysis methods continued in an interrelated way.

6. Conclusion and Suggestions

Findings obtained in this study are limited to the publications in the WoS database. In the review of the studies on distance education during the pandemic period, the following results were obtained:

- The most commonly used keywords in distance education studies during the pandemic process are Covid-19, Pandemic, Online education, Distance education, Learning.
- According to the other result obtained within the scope of the study, the USA and China are the countries that publish the most articles and receive the most citations for distance education in the pandemic period.
- It has been concluded that the studies conducted for distance education during the pandemic period are mainly co-authored studies.
- Within the scope of the study, it was concluded that the most cited authors were Chen, Cong, Peng, Yang, and in the co-citation analysis, UNESCO, WHO and Garrison.
- The most cited journals within the scope of the study are listed as Sustainability, Applied sciences, Cureus and Education sciences, and according to the co-citation analysis of the journals, Computers & Education, International Review of Research in Open and Distributed Learning, Lancet and Journal of Chemical Education.
- According to another result obtained within the scope of the study, it has been observed that qualitative and quantitative-based studies take close values. In addition, it was concluded that university students were generally used as samples, questionnaires as data collection tools, and quantitative-descriptive analysis method as the data analysis method.

In the light of the findings obtained in this study, the following suggestions can be made to future researchers;

- Increase the sample size by including studies in different databases
- Increase the number of such bibliometric studies in other fields.
- Increase the number of studies in other educational levels besides higher education
- Comparative studies were found to be insufficient in the scope of the review. Increasing the number of studies in different countries or different fields on this subject,
- After the pandemic is over, it is recommended to carry out studies that will photograph the entire Covid-19 period.

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The effectiveness of emotional motivational feedback messages via online assignments in information technologies and software course academic achievement

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Abstract

The aim of this study was to determine the effect of emotional motivational feedback messages given for online homework of secondary school sixth grade students within the scope of Information Technologies and Software course on academic success. The research was quantitatively designed based on quasi-experimental design with pretest-posttest control group. Participants of the study were 57 sixth grade students studying at a state secondary school. During the research, emotional motivational feedback messages were given the students in the experimental group and only motivational feedback was given the students in the control group. The data were collected through the academic achievement test developed by Öztürk (2015) within the scope of Information Technologies Course. The data obtained from the pretests and posttests applied were analyzed by paired group t-test and independent groups t-test, and comparisons were made. In the light of the findings obtained, it was seen that the increase in the posttest scores of both groups was significant, but that the increase in the scores between the groups did not differ significantly.

1. Introduction

Students interact with each other in cognitive, social and emotional ways in the learning environments (Spanoudis and Kyza, 2009). The interaction are realted to motivation in education process (Şener, Ertem & Meç, 2020; Meşe & Sevilen, 2021). It is known that many variables affect education, and that the education process is a multi-dimensional process. Feedback is one of the leading variables among these and has become the center of many approaches in education in the process. The importance of feedback is also emphasized in instructional designs based on different educational philosophies (Mory, 2004). Through feedback, teachers realize how their students have understood the concepts and how much they have learned (Connellan, 2002). Giving feedback, which is accepted as responses to students' behavior, tasks, and homework, is a very important technique for learning (Sprenger, 2005). Although feedback can be effective on students in many aspects such as learning, motivation and emotion, it is known that students' reactions to feedback are generally emotional (Burke and Pieterick, 2010). Emotions are very important factors in

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learning that affect students' success and motivation (Schutz and Pekrun, 2007). Emotions also provide clues to educators about what happens during the lesson in the classroom (Meyer and Turner, 2006).

ARCS Motivation Model is a motivational design model based on an expectation-value theory that suggests that an individual is motivated when personal needs and positive outcome expectations arising from tasks are met (Chyung, 2008). This model has specific strategies that must be followed when designing an instruction, and progresses step by step (Visser and Keller, 1990). It is important to include the categories of this model dating back to 1979 in an efficient motivational message design (Visser and Keller, 1990). The ARCS Motivation Model is a model consisting of the initials of Attention, Relevance, Confidence and Satisfaction, and in these categories, the conditions necessary for the motivation of the individual are included (Keller, 2000). Successfully tested in terms of reliability and validity in more than twenty countries and in a variety of contexts, including traditional teaching, this model is used by many researchers for its ease of application and effectiveness (Gabrielle, 2003). According to this model, learners are motivated if they believe that they will be successful and if they see the learning process as valuable (Balantekin and Bilgin, 2017). Motivational feedback in the research were given based on this model.

Motivational feedback is based on informing the students on how well they are doing their task and encouraging them, and it should enable students to learn not only cognitively and socially, but also emotionally (Kulhavy and Wager, 1993; Sarsar, 2014). Emotional motivational feedback was developed by Sarsar (2014) as a result of the difficulties experienced in giving emotional and motivational feedback in text-based environments. The emotional motivational feedback message is to give a feedback message which includes both motivational strategies and emotional content for increasing the students' motivation and encoruging them them to learn more about a specific topic. The main difference that distinguishes emotional motivational feedback messages from other feedback messages is that they include strategies such as using different font styles and formatting, emojis, and semantic values of words to increase the effects of emotion (Sarsar, 2014). There are various methods such as using the semantic value of words in order to apply emotional content, underlining capital letters, providing effects for scripts, using expressions and punctuation marks (Great!) (Sarsar, 2008; Sarsar and Kışla, 2013). Although the word "so" and the word "soooooo" seem to have the same meaning, the word "soooooo" creates quite a different emotional impact on the student (Sarsar and Ceylan, 2018). It is stated that font styles and writing words in bold, italic or color contribute to emotional content (Sarsar, 2014). Although emojis do not have the same effect on every student, it is emphasized that the use of the most frequently used emojis such as happy, very happy, sad, pleasant, angry, confused is important in adding emotional content to the feedback (Sarsar, 2008).

Giving feedback in online environment is quite different from giving feedback in face-to-face environment. Feedback given in face-to-face environment can be written or oral. The gestures and mimics of the people who give feedback in the oral feedback given in this environment are also important elements in feedback. The importance of adding emotion to feedback is once again evident at this point. All of these directly affect motivation. The need to add emotion to the feedback given to students in online environment has emerged at this point, and the ARCS model developed by Keller has been used for years as the best motivational teaching design model. Based on this model, Sarsar (2014) enabled emotions and feedback to come together in online environment by adding emotional content to messages. The emotional motivational feedback (EMF) type was first developed by Sarsar (2014). EMF, developed by Sarsar (2014), is a type of motivational feedback message that adds emotional content that involving the semantic value of words, formatting techniques and expressions. Emotional motivational feedback messages are based on using the ARCS Model and emotional content strategies.

Sarsar (2014) found that the EMF messages he used in his study both increased students' attitudes towards the lesson in a positive way, and the students stated that they liked these messages. Sarsar and Ceylan

(2017) carried out a qualitative study in Turkey with the participation of university students on emotional motivational feedback type, and they concluded EMF messages were more effective than motivational feedback (MF) messages. The important point in emotional motivational feedback is the provision of motivation that can rendered more effective by using positive feedback and verbal praise, as stated by Deci (1971). Another important point in emotional motivational feedback is the emotion that affects motivation by using feedback (Burke and Pieterick, 2010). In this research, two powerful variables called emotion and motivation in feedback were investigated, and the focus was placed on the combination of three factors: feedback, emotion, and motivation.

When the studies conducted on feedback are examined, the importance of feedback in increasing student achievement is encountered frequently (Burnett, 2002; Büyükbay, 2007; Çetin, 2015; Demirci, 2010; DiGennaro et al., 2007; Dökmen, 1982; Eraz, 2014; Oğuz, 1994). It was observed that students and teachers had similar views on the use of feedback, and that teachers' opinions about feedback did not differ according to their gender, professional seniority, class size and socio-economic status. It was concluded that the most effective type was seen as video in the study in which feedback types covering different multimedia were used (Ayar, 2009). In the study comparing the effectiveness of peer and teacher feedback types, it was observed that students preferred teacher feedback. In another study, the effectiveness of peer feedback was the subject of research, and it was observed that it significantly increased student achievement (Can, 2019; Kılıç, 2019).

The type of feedback given by the teacher might change the success goals and motivations of the students. It is also important that teachers should know the different types of feedback for giving them in a right way. In the literature review, it was seen that the most used feedback type by classroom teachers was reinforcing, and the least type used was motivational feedback. (Demir, 2013; Demirci, 2010; Dökmen, 1982; Erturan, 2014) .

Another study shows that students who receive positive feedback get higher scores in learning-oriented environments compared to students who receive negative feedback, and lower scores in performance-oriented learning environments (Dökmen, 1982; Viciana and Cervelló, 2007). In studies conducted on university students, it is emphasized that task feedback is the most effective type (Demir, 2013; Erturan, 2014; Viciana and Cervelló, 2007; Voerman et al., 2012; Wilbert et al., 2010).

When the literature is examined, it is seen that there is a lot of research on feedback, but that the number of studies conducted on the effect of emotional motivational feedback messages is limited. In the studies examining the efficiency of the systems designed on the basis of the ARCS Motivation Model, it was found that the attractiveness of teaching was high, the needs of the students were met, a desire for success was created, and these systems helped learners to be satisfied with teaching teaching (Eraz, 2014; Pirker, Riffnaller-Schiefer & Gült, 2014; Sarsar, 2014).

1.1. The Purpose of the study

The aim of this study was to examine the effect of emotional motivational feedback messages given to the online assignments of the 6th grade students taking the Information Technology and Software course on the academic achievement of the students. In this study, different components were used, including Visser and Keller's (1990) motivational message design, ARCS Model, and emotional content strategies (Sarsar, 2014) in order to understand the effectiveness of emotional motivational messages based on feedback strategies. In the research, the emotional motivational feedback message was operationally defined as a feedback message that includes motivational strategies and emotional content to encourage and motivate students to learn more and focus on a particular topic, while the motivational feedback message was defined

as a feedback message that includes motivational strategies to encourage and motivate students to learn more and focus on a specific subject. The research focused separately on the use of emotion in motivational feedback and motivation independent of emotional content, because the subject of the research was to determine how students would be more successful when their motivation for completing a task was increased in what way.

1.2.Research questions

Within the scope of the research, answers to the following questions were sought:

Do the pretest and posttest scores of the groups that received motivational feedback differ significantly?

Do the pretest and posttest scores of the groups receiving emotional motivational feedback differ significantly?

Does the increase in the posttest scores of the groups that received emotional motivational feedback and the groups that only received motivational feedback differ significantly?

2. Methodology

This study, which examined the effect of emotional motivational feedback given to sixth grade students on their academic achievement, is a quantitative study designed on the basis of quasi-experimental design with pretest-posttest control groups. An experimental group and a control group were included in the study. The dependent variable of the study was the academic success of the groups determined in the teaching of "Microsoft Office PowerPoint" software in the Information Technologies course curriculum. The types of motivational and emotional motivational feedback given for online environment assignments were considered as the independent variable in the study.

2.1. Participants

The study group consisted of 57 sixth grade students studying at a state secondary school in the one of districts of Izmir, Turkey. The demographic information about the study group is given in Table 1.

Table 1.

Students' Distribution by Class, Grade Level and Gender.

	Experimental Group		**Control Group**		
	Female	Male	Female	Male	**Total**
Number of Students	13	15	15	14	57

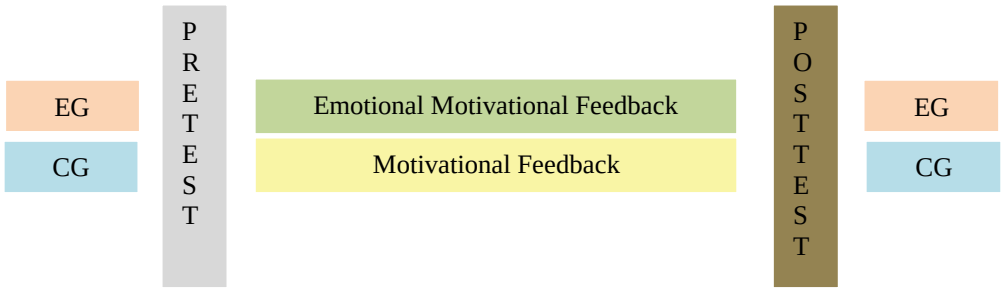
As it can be seen in Table 1, while two randomly selected sixth grade classes (6A/B) out of the existing sixth grade classes constituted the experimental group of 28 students, the other two classes (6C/D) constituted the control group of 29 students. While the experimental group provided with EMF consisted of 13 female students and 15 male students, the control group given MF consisted of 15 female and 14 male students.

2.2. Data Collecting Tools

The research data were collected through the academic achievement test developed by Öztürk (2015) within the scope of Information Technologies course. Pretest and posttest consisting of 10 questions were administered to the students at the beginning and end of the study. It was determined that the validity and reliability studies of both tests were performed.

2.3. Application Process

The study duration was six weeks. After the pretest was administered to both groups, the teaching phase was started. Following the face-to-face lessons in the classroom environment, online homework was given to all groups via e-mail. Emotional motivational feedback was given during the research about the experimental group's homework in the online environment, and only motivational feedback was given to the homework of the control group.



EG: Experimental Group and CG: Control Group

Fig. 1. Application Process.

As seen in Figure I, pretest was applied in the first week and posttest was applied in the sixth week of the application process. During the weeks when the outcomes were taught, homework was given to the students via e-mail, and their assignments were evaluated by sending motivational feedback to the students in the control group and emotional/ motivational feedback to the students in the experimental group. A schedule was prepared for the feedback to be given to students, and the scoring was determined in advance. While preparing the scoring table, the opinion of Sarsar (2014), who had previously worked on this subject, was taken, and it was decided that it would be appropriate to have a certain standard in scoring. All feedback on students' homework was given online.

2.4. Data Analysis

In the study, the missing pre-post tests' results of 3 subjects were excluded. The inclusive students who got zero in the pretest and the posttest were also tested so that they would not feel bad while their friends were doing the test, but these students were not included in the study. Also, one student participated in the pretest and did not show up for the posttest.

After the data were checked for usability, they were transferred to the computer, and all necessary calculations for the analysis were made using a statistics package program. Paired groups t-test and independent groups t-test techniques were used to analyze the data. The level of significance in the interpretation of statistical results was taken as.01.

2.5. Validity and Reliability

When the difficulty and discrimination levels of the academic pretest were examined, it was seen that the average difficulty was 0.56, and the average discrimination was 0.66. It was observed that the average difficulty of the academic achievement posttest was 0.54, and the average discrimination was 0.7. When these values are examined, it is seen that the average difficulty and discrimination values of both tests are appropriate.

2.6. Research Procedures

The researcher carried out a 6-week study with students at a state-owned secondary school after obtaining the necessary permissions

3. Findings and Discussions

3.1. The Effect of Motivational Feedback on Academic Achievement

Paired groups t-test was used in order to find the answer to the question "Do the pretest and posttest scores of the groups that received motivational feedback differ significantly?" In order to perform this test, the normal distribution assumption was tested first. Findings regarding the obtained results are given in Table 2.

Table 2.

Kurtosis and Skewness Values Belonging to the Group Provided Motivational Feedback.

	Skewness		**Kurtosis**	
	Statistic	Standart Error	Statistic	Standart Error
Pretest	.93	.44	.82	.86
PostTest	.72	.44	1.69	.86

As seen in Table 2, the assumption of normal distribution was not provided. The skewness / standard error and kurtosis / standard error values between +1.96 and -1.96 indicate that the normal distribution assumption is achieved (Field, 2005). In order to provide this assumption, square root transformation was applied. The findings obtained as a result of the square root transformation are presented in Table 3.

Table 3.

Kurtosis and Skewness Values Belonging to the Group Given Motivational Feedback After the Square Root Transformation.

	Skewness		**Kurtosis**	
	Statistic	Standart Error	Statistic	Standart Error
Pretest	.30	.44	.02	.86
PostTest	.11	.44	1.56	.86

When Table 3 was examined, it was seen that the data after square root transformation provided the normal distribution assumption. After this stage, paired groups t-test was performed in order to determine the findings for the first sub-problem.

Table 4.

Paired Groups T-Test Results of the Group Provided with Motivational Feedback.

	N	$\overline{X}$	S	sd	t	P
Pretest	28	5.54	1.36	27	-5.24	.00
PostTest	28	6.70	.89			

When Table 4 is examined, it is seen that the pretest and posttest scores of the students in the control group differed significantly in terms of the answer to the first problem of the study (t = -5.24, p <.01). It was observed that while pretest mean score of the students was $\overline{X}$= 5.54, after the motivational feedback was provided, the mean score went up to $\overline{X}$= 6.70. All scores given here are the findings obtained after the square root transformation.

3.7.2. The Effect of Emotional motivational Feedback on Academic Achievement

In order to find an answer to the question "Do the pretest and posttest scores of the groups receiving emotional motivational feedback differ significantly?", which is the second problem of the study, it was first examined whether the academic achievement pretest and posttest scores of the study group showed a normal distribution.

Table 5.

Descriptive Statistics Results Regarding the Control Group Students.

	Skewness		Kurtosis	
	Statistic	Standart Error	Statistic	Standart Error
Pretest	-.24	.43	-.74	.84
PostTest	.08	.43	-1.07	.84

As seen in Table 5, it was observed that the normal distribution assumption was achieved as a result of the analysis performed. The skewness / standard error and kurtosis / standard error values between +1.96 and -1.96 indicate that the normal distribution assumption is achieved (Field, 2005).

Table 6.

Paired Groups T-Test Results of the Group Provided with Emotional Motivational Feedback.

	N	$\overline{X}$	S	Sd	t	P
Pretest	29	41.72	17.44	28	-5.46	.00
PostTest	29	54.48	12.35			

When Table 6 is examined, it is seen that the pretest and posttest scores of the students in the experimental group differ significantly in terms of the answer to the second problem of the study (t = -5.46, p <.01). It was observed that while the pretest mean score of the students was $\overline{X}$= 41.72, after the emotional motivational feedback was given, the score increased to $\overline{X}$=54.48.

3.7.3. The Effect of Motivational Feedback and Emotional motivational Feedback on Academic Achievement

In order to find the answer to the question "Does the increase in the posttest scores of the groups that received emotional motivational feedback and the groups that only received motivational feedback differ significantly?", which is the third problem of the research, it was examined whether the increase in the

posttest mean scores of these two different groups displayed a normal distribution or not. For this, first of all, improvement score was obtained for each student. This score was obtained by subtracting the pretest score from the posttest score of each student. In the first analyses, a normal distribution was not observed, and square root transformation was performed.

Table 7.

Kurtosis and Skewness Values Related to the Improvement Score.

	Skewness		Kurtosis	
Improvement Score	Statistic	Standart Error	Statistic	Standart Error
	1.26	.32	3.84	.62

As seen in Table 7, the assumption of normal distribution was not provided. In order to provide this assumption, square root transformation has been made. Findings obtained as a result of square root transformation are presented in Table 8.

Table 8.

Kurtosis and Skewness Values Regarding Improvement Score After Square Root Transformation.

	Skewness		Kurtosis	
Improvement Score	Statistic	Standart Error	Statistic	Standart Error
	.72	.32	1.00	.63

As seen in Table 8, it was observed that the normal distribution number was achieved after the square root transformation. The skewness / standard error and Kurtosis / standard error values between +1.96 and -1.96 indicate that the normal distribution number is achieved.

Table 9.

MF and EMF Independent Groups T-Test Results of the Two Groups.

	N	$\bar{X}$	**S**	**Sd**	**t**	**P**
Control Group	28	3.50	1.57	54	.63	.53
Experimental Group	29	3.24	1.53			

According to the independent groups t-test results indicated in Table 9, it was observed that there was a difference between the posttest score increases of the groups, but this difference was not significant. All scores given here are the findings obtained after the square root transformation. As can be seen from the results in the table, it was concluded that there was no significant difference in terms of academic achievement between the use of two different types of feedback.

4. Conclusion and Suggestions

In the study, it was concluded that there was a significant difference between the academic achievement pretest and posttest scores of the control group, who were given motivational feedback messages for the Information Technologies course online homework. According to this result, it can be said that motivational feedback messages are effective in increasing academic achievement levels. Therefore, motivational feedback messages should be emphasized for a more effective Information Technology education.

Another result obtained from the study was that there was a significant difference between the academic achievement pretest and posttest scores of the experimental group to whom emotional motivational feedback messages were given for the Information Technologies course online homework. According to these results, it can be said that emotional motivational feedback messages have an important effect in increasing academic achievement levels, and that emotional motivational feedback messages should be taken into consideration for a more effective Information Technology education.

In this current study, in which the effects of motivational and emotional motivational feedback messages on students' academic achievement were compared. It was concluded that the effect of two different types of feedback on achievement was significant, but there was no significant difference between the groups in terms of academic achievement. In many studies, it has frequently been proven that the effect of feedback on learning is significant (Ezzat et al., 2017). In this study, in which the effect of feedback on success was revealed once again, it was seen that adding emotional content to messages did not yield a different result in achievement score. This also shows that it can be concluded that motivational and emotional/ motivational feedback messages create the same effect on students.

As noted earlier, giving feedback in online environment is quite different from giving feedback in face-to-face environment. Feedback given in a face-to-face environment can be written or oral, and the gestures and mimics of the people who give oral feedback can also affect the feedback. Thus, the importance of adding emotions to feedback is once again understood at this point. It is also known that all these directly affect motivation. The need to add emotion to the feedback given to students in online environment has emerged at this point, and the ARCS model developed by Keller has been used for years as the best motivational teaching design model. With the addition of emotional content to the messages by Sarsar (2014) based on this model, emotions and feedback were brought together in online environment. As seen in the research results, when motivational or emotional motivational feedback was given to students, students' achievement increased no matter what type of feedback was provided. It is thought that when this study, which covered 6th grade students in the 12-14 age group, is carried out on different age groups, emotional content may be more effective depending on the age.

In the literature review conducted, it was seen that the emotional motivational feedback type was developed by Sarsar (2014) for the first time, and Sarsar found that this type of message used in his research increased both the attitude of the students to the lesson positively, and the students expressed that they liked these messages with emotional content. In the qualitative research they conducted on emotional motivational feedback type in Turkey with the participation of university students, Sarsar and Ceylan (2017) concluded emotional motivational messages were more effective than motivational messages. When the research results are evaluated in this direction, it is seen that there is no study in the literature comparing the effects of these two types of feedback on achievement, and that in this study, the two types of feedback had the same effect on learning. In a future qualitative study on this topic with students of the same age group, it is predicted that students will find emotional motivational feedback messages more positive, as university students did. The result of a study that will measure achievement in two different types of feedback in university students is a matter of curiosity.

Feedback differs according to many variables. For this reason, how and in which environment the feedback is given is as important as when and to whom it is provided (Sarsar, 2018). Since the type of feedback given in this study was provided in a text-based environment, it would not be possible to give feedback immediately in such a learning environment. The homework sent by the students via e-mail was scored, and a feedback message was sent in the same week before the next class time came. It is thought that different results may be encountered when questions are asked in an online chat environment or in a simultaneous learning environment and motivational or emotional motivational feedback is given to

students immediately. In the study, the importance of the necessity of shaping emotional and motivational messages used in text-based learning environments on the basis of these variables was revealed.

Sixth grade students studying at state schools were selected as the study group. Research is recommended on different grade levels and in different school types. The research covered a total of six weeks, including the weeks when pretest and posttest were administered. It is thought that the effectiveness of feedback types may become more evident in a study where the research period is kept longer.

Since it is observed that students may have difficulties in using e-mail, it is thought that additional training should definitely be given on this subject one week prior to the research. This research is limited to the Information Technology course outcomes. Practitioners can develop sample applications for other outcomes using the method adopted in the research.

The research conducted within the scope of this study includes a small-scale experimental group of 57 students in a limited time. It is thought that the success graph of the obtained data may differ by applying the said research on a larger sample. The research was limited to a six-week period. If it is extended over a longer period of time and supported with more feedback, there may be differences in the increase in achievement scores between groups. In addition, the research covered sixth grade students. Similar studies can be conducted on other grade levels in new studies. The effectiveness of emotional motivational feedback according to gender was not examined in the study; therefore, new research can also be considered in this respect.

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A comparative examination of social perception, network structure, important nodes, and discourses regarding ASD awareness over online networks: A social network and content analysis

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Research Article

Abstract

The purpose of this research is to examine activities carried out on Twitter, which is a social media platform, on April 2 Autism Awareness Day; network structure in Turkey and in a global context, interaction patterns, the important nodes, user profiles, hashtag usage, and social mode within the context of the Twitter messages and discourses. In the research, mixed research method was adopted, and social network analysis and content analysis methods were used. The sample constitutes a total of 16565 people with 2790 people from Turkey and 13775 people from all over the world. According to the findings in the sample and Turkey as well as the global clustered-community group structures has been observed that the structure of the network. When compared with global examples of effective institutions related to the ASD in Turkey in the global context, the process of institutions and corporate entities has been determined to be more effective. It is seen that especially famous people who are known in the global context are involved in the process in order to reach more audiences. It is found that hashtag use in Turkey is limited, for example, on the other hand, in a global context hashtag use is more diverse to reach different target groups Comparative concept maps revealed that fewer themes were issued in Turkey while there was a wide range of themes in the global context. Social mode is positive in both samples.

1. Introduction

Autism spectrum disorder (ASD) is a heterogenous and neuro-developmental disorder characterized by repetitive and obsessive behaviors, interests, and activities limited to deficiencies in social interaction and communication (APA, 2013). ASD is encountered in all races and ethnic groups, briefly in different geographies and societies, and its prevalence is increasing every day (Elsabbagh et al., 2012; Maenner et al., 2020). According to the latest data published by the Centers for Disease Control and Prevention (CDC) (2020), one out of every 54 children is diagnosed with ASD. In addition to genetic factors such as the incidence of ASD four times higher in boys than girls and the higher risk in monozygotic twins compared to dizygotic twins (Bourgeron, 2016; Huguet et al., 2013; Ronald & Hoekstra, 2011), environmental factors such as infections during pregnancy, especially advanced father's age, and neurochemical disorders in the blood-body fluids are also thought to possibly play a role in the emergence of this disorder (Korkmaz, 2010; Lord & Bishop 2015).

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2. Literature

Since the causes of ASD are not known exactly, it is also not possible to take precautions before delivery for now. The earliest symptoms of ASD emerge with the absence of eye contact or avoiding eye contact, deficiency of social smiling, delay in language development and obsessive stereotypical behaviours in the first years of life. The severity of these symptoms may vary from slight to severe. Although it is predicted that a diagnosis can be made between the 18th and 24th months and earlier (Johnson & Myers, 2007), many children with ASD are suggested to be diagnosed at the age of 4 and later (Maenner et al., 2020; Noterdaeme & Hutzelmeyer-Nickels, 2010). There can be delays in early diagnosis due to the fact that descriptive behavioural characteristics of ASD may exhibit symptoms at the age of about 24 months or later (Guthrie et al., 2013; Ozonoff et al., 2010), families are not aware of the symptoms emerging in the early period or do not accept these symptoms/differences or difficulties are experienced during the diagnosis (Pisula, 2011). However, noticing ASD symptoms in the early period and early diagnosis is of critical importance in terms of planning the early education (Landa & Kalb, 2012). Early diagnosis and the planning of education first depend on the knowledge and awareness of parents, caregivers, and relevant people, who are the primary people responsible for taking care of the child, regarding ASD (Wang et al., 2012). However, raising the awareness of only parents and people in the immediate environment is not an adequate effort for the child to maintain these acquired skills in society as an independent individual, shortly, to integrate into society.

When the situation resulting from the lack of knowledge and perception about ASD in society is combined with the concerns, anxiety, and stress of parents whose children have been diagnosed with ASD (Bitsika & Sharpley, 2004; Kinnear et al., 2016), children with ASD and their parents face social isolation and exclusion and feel helpless (Al-Farsi et al., 2016; Bitsika & Sharpley, 2004). It is assumed that the efforts to enhance the understanding and acceptance of a child's ASD-related behaviours by society can reduce both the labelling faced by parents and the difficulties they may have in raising a child with ASD (Kinnear et al., 2016). In this respect, considering ASD as a social communication disorder concerning society, the raising of social awareness is extremely significant for early diagnosis, early intervention, and integration into society.

Due to the increase in the incidence of ASD, ASD awareness is more crucial than ever. In line with this significance, the United Nations declared April as the Autism Awareness Month and April 2 as the Autism Awareness Day worldwide to raise social awareness of ASD. In this sense, awareness activities for ASD communities have become the focal point of some large international institutions and organizations (e.g., Autism Awareness, Autism Speaks-Light It Up Blue campaign, etc.) (Dillenburger et al., 2017). In this context, the awareness activities carried out throughout April aim to support individuals with ASD and their families worldwide, raise the awareness of the other part of the society of ASD in detail, promote early diagnosis and treatment, strengthen cooperation between institutions, and encourage scientific research on ASD. To this end, a limited number of scientific studies on ASD awareness were reached when the literature was reviewed (Alsehemi et al., 2017; Biber et al., 2018; Chansa-Kabali et al., 2019; Özçelik et al., 2015; Rakap et al., 2016). For example, in the study conducted by Alsehemi et al. (2017) and aiming to determine the ASD awareness level of society, more than half of the society was found to have poor knowledge about ASD. In the same study, ASD awareness was observed to be at a higher level in women compared to men; participants above the age of 30 had more knowledge than young participants. On the other hand, it was stated that inaccurate knowledge or misunderstanding was not associated with social status, education, or profession. However, it is recommended to generalize the results of this study to different societies. In the study carried out by Biber et al. (2018), it was aimed to raise awareness in mothers who had children aged between 4-6 but had no individuals with ASD in the family or among the first-degree relatives through the ASD education received and peer chats. According to the survey data, 25% of the participant mothers stated that they had been aware of ASD before the education, whereas, due to the information acquired after the education, they asserted that their social awareness was much lower than they had assumed. The study

results indicate that the study group has inaccurate knowledge, belief, and attitude about ASD, and due to these deficiencies, society behaves discriminatorily. The study performed by Chansa-Kabali et al. (2019) aimed to examine the knowledge and awareness of 488 pre-service teachers on ASD. To this end, considering the participants' responses to the survey questions, 79% said that they had never heard of ASD before the survey. While most of the participants expressed that they first learned about "autism" or "autism spectrum disorders" on TV (41%), 61.9% said they had no relevant experience in real life when asked about their ASD experiences. In line with this result, a higher need is suggested for activities related to ASD awareness. In addition to the general social awareness, in the study in which Özçelik et al. (2015) examined the knowledge and attitudes of 270 pediatricians, it was reported that participants had difficulty making a diagnosis using the autism criteria and comprehensive evaluation techniques used to diagnose children. Another study, conducted by Rakap et al. (2016), investigated the opinions of 504 pre-service teachers, who were registered in four different teaching programs, including the special education teaching program, and studying in the final year in five universities of Turkey, regarding teacher training programs on ASD. According to the responses obtained via the survey, the participants were found to have incomplete or inaccurate knowledge about the causes and characteristics of ASD. Based on these findings, it is recommended in the research that seminars related to pre-service and in-service training programs should be held, considering that adequate information about ASD cannot be obtained from teacher training programs.

When the relevant studies are summarized, the lack of knowledge about ASD comes to the fore as the common result, and data are collected from certain segments of society, such as families, doctors, and pre-service teachers, via survey. At this point, it is assumed that there is a need for studies investigating the perspective of all segments of society with respect to ASD awareness using detailed analyses such as content/thematic analysis, discourse analysis, or social network analysis. With this perspective, it is extremely important to take into account the widespread impact, i.e., achievability of social awareness on ASD. In the activities of the 21st-century technological era, especially the use of social media such as Twitter is unquestionably powerful (Pelletier et al., 2021). However, during the review of the scientific studies in the literature, no studies investigating ASD awareness over social media/social network structure were encountered, which is remarkable (Dillenburger et al., 2017). When social media platforms such as Twitter are considered as an important source of information storage that can be used to evaluate ASD awareness worldwide, the whole world shares information and encourages each other for their tendencies regarding education, health, social rights and future assurance of these individuals on the ASD Awareness Day within the social communication network. Thus, the viewpoint of the society can be revealed by performing social network analysis on social media from a broader perspective and addressing posts, e.g., tags, discourses, and interaction patterns, in terms of ASD awareness. Based on the reasons and significance mentioned above in line with these ideas, the general purpose of this study is to examine the activities carried out on Twitter on April 2, the World Autism Awareness Day, in Turkey and globally. Within the scope of this general research purpose, answers were sought to the research questions below:

On the World Autism Awareness Day,

- What are the network structure and interaction pattern?
- Who constitutes the important nodes, and what kind of user-profiles come to the fore?
- What kind of tags are used?
- What is the content of the social mood, messages, and discourses?

3. Methodology

3.1. Research Model/Design

The convergent parallel design, one of the mixed research designs, was used in this study (Creswell, 2012). At the first stage of the study, the social network analysis method was used. In this analysis, quantitative and qualitative data are collected and analyzed together to determine the network structure and the information flow in the network. The social network analysis is an approach used to analyze and map the organizational communal structures and to determine the key nodes (shareholders) and the links (interactions) between the nodes (Hansen et al., 2010). The basic difference of the social network analysis from similar methods is its concentration on the relationships between social beings, these relationship models and practices. The social network analysis focuses on the interaction of a social being or actors with other beings or actors and how this interaction forms a framework or structure instead of individual behaviours, attitudes, and beliefs. The focal point of the social network analysis is not the individual characteristics of network members but relationships between the actors in the network (Wasserman & Galaskiewicz, 1994). At the second stage of the study, the content analysis was employed to find out the important hashtags (tags) in the network structure, which was included in the sample, and the tweets that stood out according to the link value within the network structure (Berelson, 1952).

3.2. Sampling or Study Group

The Turkish sample of this study is comprised of 2,790 individuals who tweeted on April 2, the Autism Awareness Day, on Twitter, which is a microblogging website, and 3,422 lines of interaction among these individuals. The Turkish sample has an error margin of 1.86 at a confidence interval of 99%. The second, global sample consisted of a total of 13,775 individuals and 20,545 lines of interaction among these individuals. This sample has an error margin of 1.10% at a confidence interval of 99%. Accordingly, the power of the findings in this study to represent the current situation can be said to be high (RaoSoft, 2020).

3.3. Data Collection and Analysis

The research data were collected from online networks using the NodeXL software and examined by the social network analysis method. The «betweenness centrality» metrics of the nodes in the data obtained were calculated. Advanced analysis methods were applied to determine the structure inside the network. The obtained sample was visualized with the Harel-Koren Fast Multiscale interface (Harel & Koren, 2001) and the Clauset-Newman-Moore clustering (Clauset et al., 2004) algorithms. The users' tweets were examined via content analysis. In the content analysis, the Leximancer software was used to determine themes, and the themes were then visualized in the form of concept maps. Using direct quotations about the relevant themes, the sample statements were specified, and thus, the research findings were supported.

4. Findings

4.1. The network structure and important nodes

The sampled Turkish network structure consisted of 2,790 individuals, and the global network structure included 13,775 individuals. The individuals in the Turkish network posted 3,103 unique tweets, and 319 of these tweets were retweeted and propagated. In the global network structure, a total of 17,523 unique tweets were posted, and 3,022 of them were retweeted. The maximum geodesic distance between the nodes in the Turkish network is 25, and the average geodesic distance is 7.36. In the global network, the maximum geodesic distance was calculated as 16, and the average geodesic distance was calculated as 5.006267. The threshold value of this metric is 6. Hence, it is possible to say that the participants in both networks are disconnected. This is also confirmed by the modularity value, which indicates the disintegration of the network structure. In this aspect, the Turkish network structure and the global network structure were calculated as 0.803686 and 0.701466, respectively. Although these values show similar results for both network structures, it is observed that the values taken by the global network structure are more positive,

and the average geodesic distance is below the threshold value of 6 in this structure and above the threshold value of 6 in the Turkish network. The density value, which demonstrates the interaction in the network and varies between 0 and 1, was calculated as 0.000344287 for Turkey and 0.000154 for the global network. According to these data, the mutual interaction in the network can be said to be quite low. The information on the network metrics emerging on the ASD Awareness Day for Turkey and the global context is given in Table 1.

Table 1.

ASD awareness day network metrics

Network metrics	Turkey	Global
Nodes	2,790	13,775
Unique interactions	3,103	17,523
Repetitive interactions	319	3,022
Total interaction	3,422	20,545
Self-cycle	596	4,768
Maximum geodesic distance	25	16
Average geodesic distance	7.369726	5.006267
Network density	0.000344287	0.000154
Modularity	0.803686	0.701466

Based on the numeric data obtained regarding the network structure, visuals defined as sociogram or network graphs were produced, and the network structure was analyzed. At this stage, the network graph subjected to no analysis was first obtained, and both networks about which data were collected were found to have a quite disorderly structure.

Turkey Global

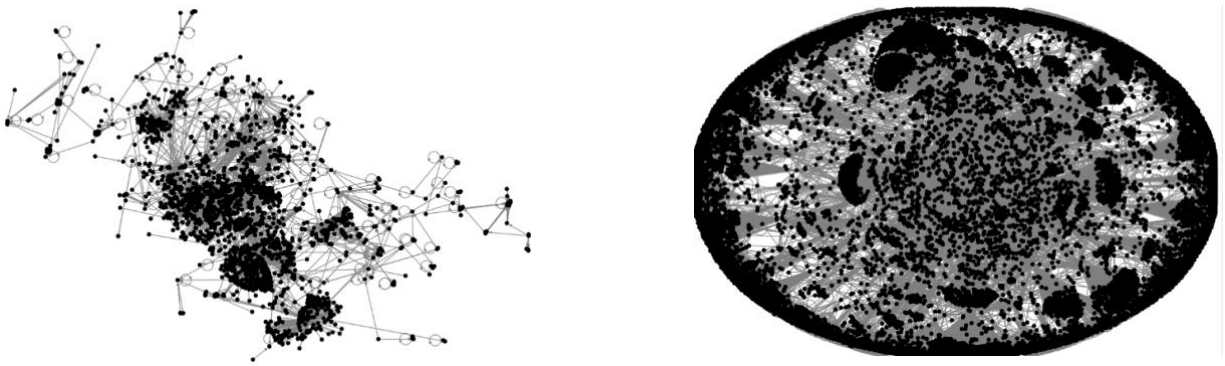

Figure 1. Raw view of the Twitter contents collected from Turkey and globally

For further analysis, advanced analysis methods were applied to determine the structure inside the network. The obtained sample was visualized with the Harel-Koren Fast Multiscale interface (Harel & Koren, 2001) and the Clauset-Newman-Moore clustering (Clauset et al., 2004) algorithms. The obtained network structure was classified according to the six network structures explained by Smith et al. (2014). These network structures are briefly stated below.

- Divided-polarized crowds
- Unified-tight crowds
- Fragmented-brand clusters
- Clustered-community clusters
- In hub & spoke-broadcast network
- Out hub & spoke-support network

Accordingly, the "Clustered-community clusters" network structure was observed to exist in both Turkish and global samples on the ASD Awareness Day. In this network structure, clusters are usually independent of each other and gather around the popular sources of information. It is an ineffective type of network in terms of the propagation of a thought, discourse, or idea (Smith et al., 2014). Thus, it can be said that an unorganized group exists on the ASD Awareness Day. This is considered as a situation, which also reduces the widespread impact of activities on online social networks on the ASD Awareness Day. At this point, the presence of an organized group regarding ASD awareness may affect information sharing between different disciplines. Taking into account that ASD is considered a complex and heterogeneous disorder, the interaction of many groups in educational fields such as special education and integration, health-related fields such as genetics, psychiatry and gastroenterology, and social-cultural field may enhance the power of awareness.

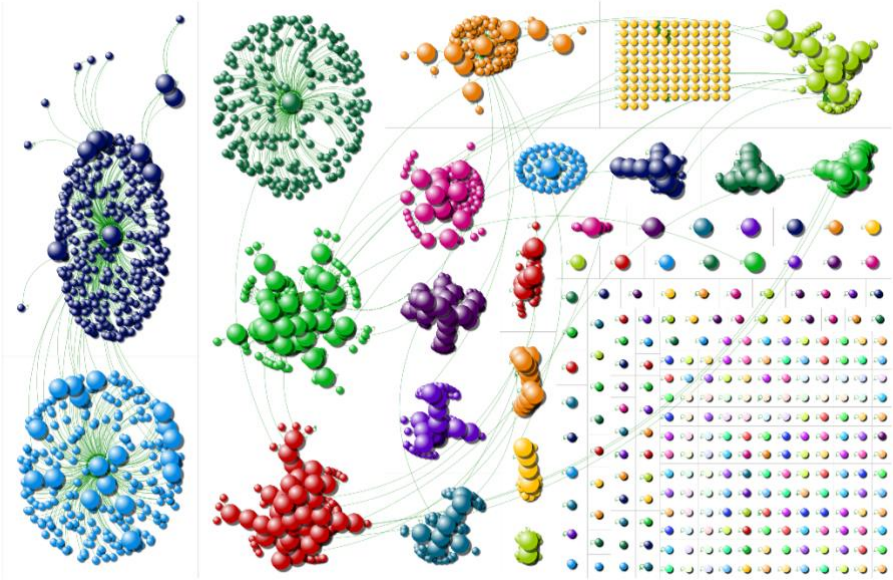

Figure 2. Turkish network structure

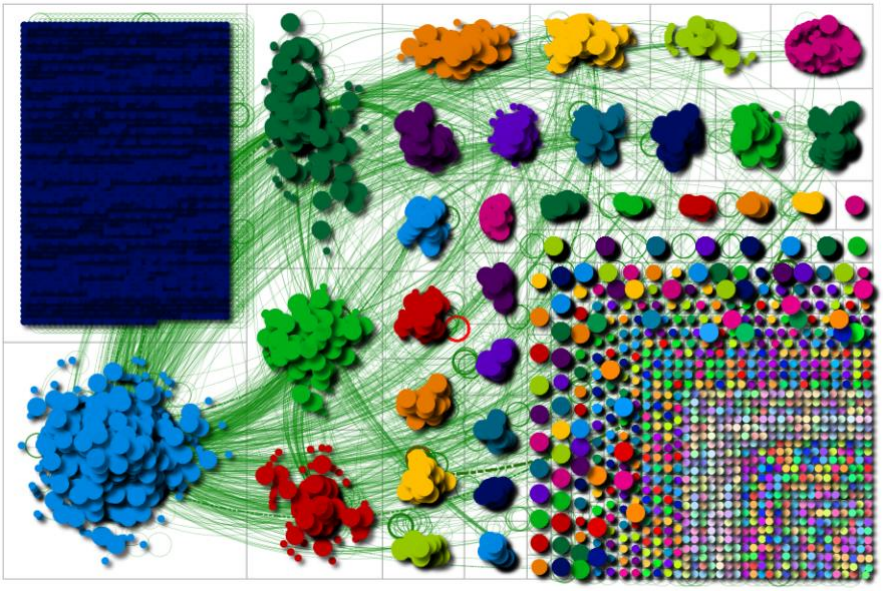

Figure 3. Global network structure

The striking point in the sociogram analysis (Figures 2 and 3) is that the nodes in the Turkish network and the interaction between the groups created by these nodes are highly sparse, and the nodes and the

interaction between the groups created by the nodes are denser although such structuring is more difficult in the global aspect. Hence, it is thought that this limitation in Turkey results from the approach on the basis of a single society. Therefore, the node interactions can be sparser compared to the global network structure. Moreover, this difference seems insignificant when both network metrics are examined (Table 1).

4.2. Influential User and Tag Analysis

At this stage of the study, the betweenness centrality value was calculated for each participant to determine which nodes were more influential. Betweenness centrality shows to what extent a node is in direct connection with the nodes which are not directly connected (Gürsakal, 2009). In this context, betweenness centrality is an important metric indicating the power of nodes to connect the other nodes (Hansen et al., 2010). According to the data obtained, the first 20 nodes are presented in Table 2; the names in individual accounts are anonymized, and the corporate accounts are stated directly.

Table 2.

Betweenness centrality of influential users

Turkey		**Global**	
Node	**Betweenness Centrality**	**Node**	**Betweenness Centrality**
D1	9999.0	autismspeaks	12343887.791
hergunyenibilgi	9608.1	D1	5807978.028
D2	8439.0	positanolimoser	3947281.164
kafiyelordu	8335.3	D2	3568934.991
10ikincigezegen	8090.3	lagnnjsf	3206274.656
D3	8052.4	luvwins2016	3025913.662
D4	7731.8	D3	2607600.952
D5	7085.8	D4	2557960.734
psikiyatrider	6252.0	spandandiagnost	2393788.579
D6	6173.5	nydailynews	2160223.078
D7	6118.7	sachin_rt	2061766.901
D8	5079.5	D5	2047175.490
otizmemavi	4235.1	kerrymagro	1680102.127
D9	4170.7	autismspeakscan	1557518.408
D10	3501.6	D6	1395880.877
D11	3381.9	hollyrpeete	1371408.691
D12	3381.9	rjszczerba	1341738.043
D13	3226.4	mark_wahlberg	1316724.087
D14	3201.1	tates5a	1297834.826
D15	2905.1	asdmumgilly	1275239.881

During the investigations on the Turkish sample, it was determined that 15 of the most influential 20 nodes were individual accounts, and 5 were corporate accounts or accounts which posted anonymously. Although only two accounts, @ailebakanligi and @tohumotizm, stood out for their ASD-related activities, the corporate activities were not prominent enough inside the network. Considering the Turkish sample, it was found out that NGOs, which carried out activities on ASD, and private or official institutions, which were also involved in ASD-related activities, were not organized sufficiently on online social networks on the ASD Awareness Day.

Interesting results emerge when it comes to the global sample. Contrary to the rates of the Turkish sample, 6 individual accounts and 14 corporate accounts, along with the athletes, artists, scientists, etc., renowned in their countries, were found to participate in the activities held on the ASD Awareness Day. One of the most significant opportunities on Twitter is to use the power of fame of celebrities from different fields such as sports and art to raise awareness on ASD. It can be considered as a significant factor that the possibility of the tweets posted by celebrities on how to promote ASD awareness to be liked and retweeted is higher. @autismspeaks, the most influential user in the global sample, is an institution that is centered in

New York, USA, and has adopted the dissemination of early diagnosis and treatment by raising awareness of ASD worldwide throughout April as a mission.

According to these analysis results, despite their ASD-awareness-related activities in different channels, institutions, directly or indirectly related to ASD, in the Turkish sample were found not to be active enough on online media. When the global activities are concerned, people who are liked and renowned and have followers in the society, as well as ASD-related institutions and organizations, are observed to participate in such activities. Following this analysis, the most preferred tags were reviewed and stated according to the frequency of their usage. Here, the remarkable point was the fact that the supporter clubs of the large football clubs were determined to carry out activities within the scope of social responsibility using the hashtags below. When the global sample is examined, it is observed that it was attempted to reach a larger mass using more hashtags, and the "mavi ışık yak/light it up blue" slogan was emphasized more frequently compared to Turkey. The most used hashtags and their frequencies are given in Table 3.

Table 3.

The most used hashtags

The most used hashtags-Turkey	Frequency	The most used hashtags-Global	Frequency
#2nisanotizmfarkındalıkgünü [April 2 AutismAwarenessDay]	3,276	#worldautismawarenessday	17,532
#otizmeksikdeğilfarklıolmaktır [autismisnotadisabilityitisadifference]	483		
#otizm [autism]	439	#lightitupblue	2,804
#otizmemaviışıkyak [lightitupblueforautism]	189	#autism	853
		#autismday2017	530
		#unique	463
		#autismawarenessmonth	401
		#lıub	336
		#globalgoodemiblue	246
		#diamundialautismo	212

4.3. Social Mood and Discourse Analysis

At the final stage of the study, it was tried to determine discourses in tweets, and relevant discourse examples were given. Then, the themes in these discourses were respectively presented in Figure 4 and Figure 5 with comparative concept maps. When the discourses were examined, it was revealed that individual tweets often adopted a manner of discourse oriented at raising awareness. In comparative concept maps, it is observed that fewer themes were approached in the activities in Turkey, and more themes were used in the global sense. In both samples, the social mood is positive. On the other hand, discourses in the form of slogans were preferred to change the social mood in the Turkish sample, whereas both slogan-type and informative discourses were used in the global sample. Some of these tweets in Turkey are briefly exemplified below.

- #2NisanOtizmFarkındalıkGünü [April 2 Autism Awareness Day] it is important for anyone with a baby to know about autism in terms of early diagnosis.
- #2NisanOtizmFarkındalıkGünü [April 2 Autism Awareness Day] Tell your child about autism so that your child can become a companion to a child with autism. So that your child can learn to accept and like what is different.
- AUTISM is not a Disability, it is a Difference!
- AUTISM is not a Disability, it is a Difference! We are aware of autism, we stand by people with autism.

- Be aware of differences, light it up blue💙 #2NisanOtizmFarkındalıkGünü [April 2 Autism Awareness Day] #otizmemaviışıkyak [light it up blue for autism] @tohumotizm
- 'Not Disabled. Different.'
- What is the Incidence of Autism? https://t.co/vPYzjvfPAQörülme+Sıklığı+Nedir+ #2NisanOtizmFarkındalıkGünü [April 2 Autism Awareness Day] @tohumotizm
- Happy Sunday! 🤗🤗🤗 Today is #2NisanOtizmFarkındalıkGünü [April 2 Autism Awareness Day]. To share life with love, #otizmemaviışıkyak... [light it up blue for autism]💙
- #yakininolmasigerekmez [you don't have to have a relative with it] #otizm [autism] #2nisan [April 2] #odfed [Federation of Autism Associations] #otizmeylemplani [autism action plan]
- Because every child is special, and life is beautiful with awareness. #2NisanOtizmFarkındalıkGünü [April 2 Autism Awareness Day]
- I wish awareness to all those who still haven't understood that autism is not a disability, it is a 'difference'. #2NisanOtizmFarkındalıkGünü [April 2 Autism Awareness Day]

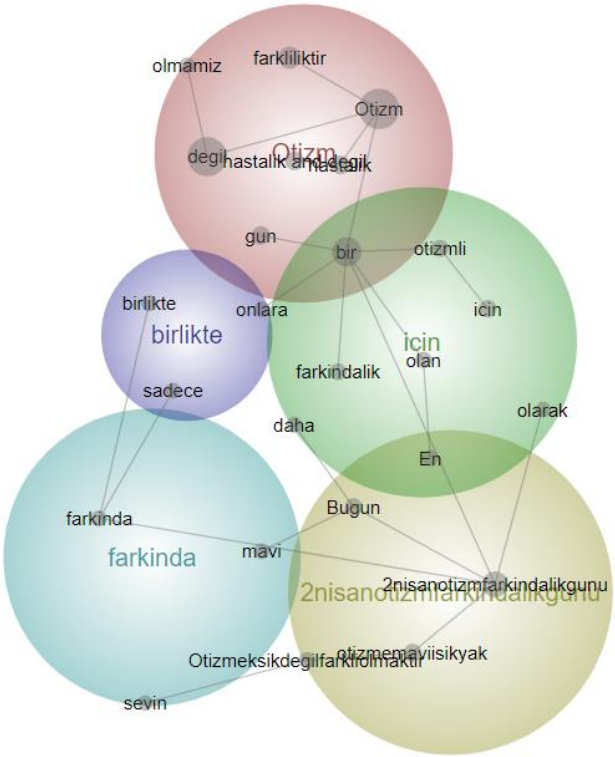

Figure 4. Tweets in Turkey

In the tweets posted for raising awareness, the topics of "difference" and "unique," "light it up blue," "love," and "acceptance" were mentioned. The informative tweets contained "a link shared about its incidence" and the topic of "autism action plan." In the tweets posted for raising awareness, the "Tohum Autism Foundation" was one of the prominent organizations which directly dealt with ASD. In the tweets posted in the global sample, the contents and discourses were aimed at raising awareness and informing.

- Hi friends!! Let's Light it up Blue for Autism Awareness #WorldAutismAwarenessDay #GlobalGoodEmiBlue
- Love to help spread awareness 💙 @autismspeaks @autism #GlobalGoodEmiBlue #WorldAutismAwarenessDay
- #WorldAutismAwarenessDay today + learn the facts about #Autism this #AutismAwarenessMonth 💙

- #WorldAutismAwarenessDay Peers unconditionally accepting a classmate w/autism. Never leaving them on the sidelines alone b/c they're different.
- #WorldAutismAwarenessDay When you see an adult w/ autism acting out, showing compassion; understanding. #Priceless
- #WorldAutismAwarenessDay Having an autistic student in your NT class and saying to the mom "I'll do whatever it takes to make this work."
- #WorldAutismAwarenessDay Making eye contact and interacting with my daughter even though she may appear not to notice or care. #Priceless
- #WorldAutismAwarenessDay Looking at my daughter with a knowing smile that says, "I see she's special & it's all good." #Priceless
- Biomedical Autism Treatment Improves Eye Contact And Speech In Children https://t.co/0apVRGrFuD #Nursing… https://t.co/z12wA2urwr
- We love featuring #WorldAutismAwarenessDay DOCTORS in interviews. Please tell us about or @ mention your FAVORITE d… https://t.co/xSYnLdu6zm
- More than 3.5 million Americans live with an autism spectrum disorder. #WorldAutismAwarenessDay
- Autism impacts the normal development of the brain in the areas of communication skills and cognitive function. #WorldAutismAwarenessDay
- Autism spectrum disorder (ASD) & autism are general terms for a group of complex disorders of brain development. #WorldAutismAwarenessDay
- Autism Myths: What You Think You Know Is Wrong https://t.co/BfJuBL5glY #Nursing #WorldAutismAwarenessDay https://t.co/T49HIEQKWi
- it's worth noting, as children, autism is supported but as adults ... pls hire my son-he needs a job to want to live #WorldAutismAwarenessDay
- I could tell a complicated story about my brother's tragic, lonely life or I could just say "he was autistic" #WorldAutismAwarenessDay

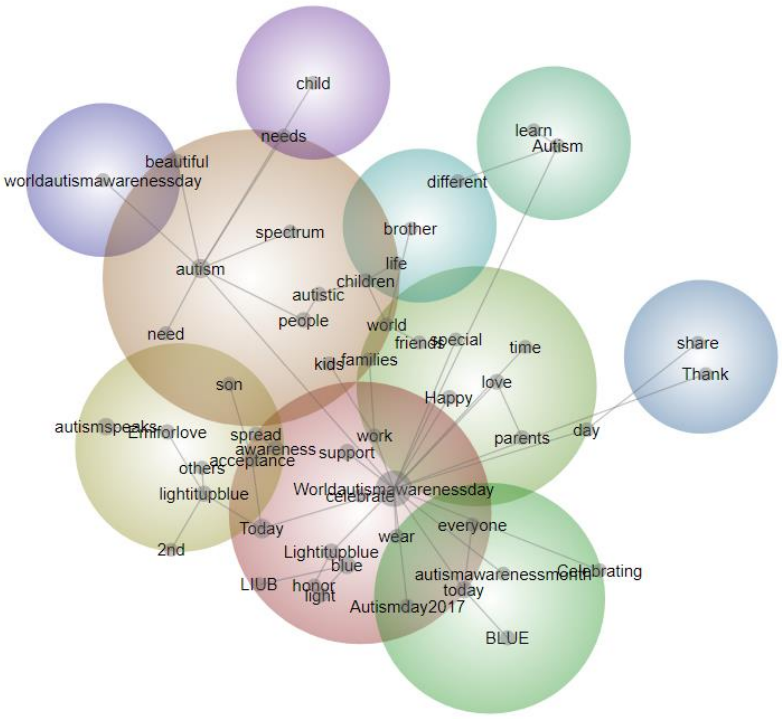

Figure 5. Global tweets

When the contents of the tweets posted globally are examined, the topics of "difference" and "special," "light it up blue," "love/affection," and "prevalence," which are similar to the topics in Turkey, stand out in respect of raising awareness. When the contents of the global tweets are reviewed, it is understood that most of the tweeters have children with ASD. It is expected from them to tweet for their children on this special day. The theme "social acceptance," one of the topics shared by families, is observed to be addressed, especially in terms of the classroom environment and peers. In the tweets posted to raise awareness, another remarkable point is that families touch upon the "adulthood" and "acquiring a profession" topics.

Within the scope of informative tweets, it attracts attention that there are many "false facts and myths" about ASD known to be correct; therefore, "links were shared" regarding this issue. Among these posts, in the global sample, the institution "Autism Speaks," which provides various information and carries out activities on this issue, comes to the fore. This result is similar to the results of the influential user and tag analysis mentioned previously. Autism Speaks was also a prominent institution when influential institutions were reviewed within the results of the user and tag analysis. In informative posts, the "definition" and "characteristics" of ASD are frequently emphasized. Concerning the definition and characteristics of ASD, it is observed that information contents related to its complex nature, brain development which is different from normal progress, and differences in eye contact, speech, social communication and cognitive development are shared. These posts can be said to be consistent with the diagnostic criteria of ASD and characterized by its most basic features.

5. Discussion, Conclusion and Suggestions

In this study, which examined the activities performed on Twitter on April 2, the World Autism Awareness Day, in Turkey and globally, the cooperation and common statements of different institutions and organizations in both Turkish and global samples appear as extremely significant topics for the activities to be more effective and serve the purpose of raising awareness. Such awareness activities carried out particularly by ASD-related institutions on online social networks will enable reaching larger masses and thus, raising awareness further. However, in both samples, interinstitutional cooperation can be said to be a "sparse" network. In the Report of the Turkey Autism Assembly (2019), it was stated that the communication and cooperation of the relevant institutions were highly poor, especially in the domestic sense, and the interinstitutional cooperation should be strengthened. As known, interinstitutional cooperation and especially common posts can significantly accelerate the dissemination of information and innovations and assume an important role, enabling the information within the network to reach others in a short time. Thus, it can be asserted that there is a higher need for effective inter-institutional cooperation, which addresses all the segments of society, particularly on this meaningful day with regards to ASD awareness. In line with this, to create sensitivity on ASD in cooperation with the responsible and relevant institutions, they can prepare public service ads and short films using online social media or organize social activities or various campaign supports which will directly help families and individuals with ASD, who can express themselves, to make themselves heard. They can also hold webinars involving different domain experts and online interactive scientific sharing activities on ASD. In this respect, the "Tohum Autism Foundation," which aims to provide all the individuals interested in the subject with information about ASD and skills and carries out activities for ASD awareness, has been organizing various campaigns, activities and studies, in different years. For example, "the Research on Individuals' Perception of Autism in Turkey" was conducted by the Tohum Autism Foundation, with the support of GFK Turkey, in 15 provinces in 2015, and according to the study results, it was revealed that only 3 of every 10 individuals in Turkey heard of ASD, 7% knew about the symptoms of ASD, and only 19% of the participants had accurate information about its causes. The study, which was carried out using the face-to-face survey technique, revealed that women had higher awareness than men, 63% of the participants did not have anyone with ASD in their environments, and only 18% of those who heard of ASD thought ASD could be treated, and the main method used in the treatment was mostly hospital treatment (Rakap, 2017). The results of this study suggest,

along with the results of other studies in the literature, that the knowledge and awareness level on ASD is generally quite low in our society. At this point, there is an urgent need for regular informative activities to raise awareness of ASD. The tweets from Turkey also support this idea. Although awareness tweets constitute the majority of the prominent tweets in Turkey, there are also tweets with informative content, although rarely. In this context, the emphasis put on "early diagnosis" can be evaluated as a pleasing situation because early diagnosis is the most important stage for the ASD risk (Guthrie et al., 2013; Vivanti et al., 2016). Early diagnosis is an extremely significant factor that helps the child and the family to draw a road map to plan and implement the child's education early and initiates this intervention. Awareness activities and inter-institutional cooperation, early diagnosis, the establishment of the treatment-intervention chain, development of family-oriented services, educational assessment, special education, development of support, education and rehabilitation services, employment, providing working life and social relief, and activities for participation in social life have been defined as the primary areas by the National Action Plan for Individuals with Autism Spectrum Disorder, the Ministry of Family and Social Policies (2016-2019) in Turkey. In line with the action plan, health professionals can be said to have significant responsibilities in increasing the ASD awareness level of the society and screening and monitoring for the early diagnosis of ASD.

When influential users, tags, and tweet contents were analyzed globally, the institution Autism Speaks came to the fore. As one of the leading institutions with a mission to provide the whole society, all the shareholders, especially including individuals with ASD and their families, with information on ASD awareness, Autism Speaks initiated awareness activities with its Light it up the blue campaign in 2014, and the statement' light it up blue' is a slogan that is one of the most repeated tweets worldwide. However, apart from these two institutions, many institutions carry out awareness activities such as seminars, speeches, informative or empathy or running activities on various media other than social media, although they do not come to the forefront on social media. Accordingly, it is hoped that awareness of ASD can be raised in a larger segment of society if institutions perform these activities, they plan on social media more often. The inclusion of individual nodes as well as corporate nodes in social media will be encouraging for participation independent of space and time. In this context, it is thought that ASD-related institutions and organizations can be among the intermediary institutions in the dissemination of information about the most popular available applications. This also emerges as an expected development in our technological era. Furthermore, it is considered that the inclusion of people who are renowned and accepted as role models by society and have a certain group of people following them in activities for raising ASD awareness, as in global activities, may positively affect increasing the widespread impact of awareness. However, the speed of the propagation of tweets is higher, which may pose some risks. For example, wrong information can be provided, such as the difficulty in understanding ASD, the possibility of confusing it with the diagnosis of other disability groups (Down syndrome, mental disability, etc.) or availability of no experience on ASD (Chansa-Kabali et al., 2019). Therefore, the content of the tweets posted may need to be checked by authorized and relevant institutions/people.

When the discourses in both samples are examined, topics such as differences, social acceptance and employment come to the forefront in addition to the definition and characteristics of ASD, prevalence and informative contents. Since ASD is a disorder characterized by deficiencies in social interaction and communication, it is expected from families of children with ASD to be worried about this issue. Many families who have children with ASD continuing their education face the rejection of their children in the social environment. In the relevant literature, many research findings are suggesting that an environment of social exclusion, social isolation, and pressure is created for individuals with ASD and their families worldwide, and therefore, children and their families have difficulty in adapting to society (Boyd et al., 2014; Divan et al., 2012; Ludlow et al., 2012; Marsack & Perry, 2018). In the contents of the tweets posted, this is clearly mentioned. Compared to other disability groups, individuals with ASD have more difficulty in finding a job and acquiring a profession due to their social interaction and communication skills and

repetitive-obsessive behaviours (Hayward et al., 2019; Hendricks, 2010; Henninger & Taylor, 2013; Taylor & Seltzer, 2011). These results stated in the literature overlap with supportive tweets on finding a job and acquiring a profession in this study. The involvement of individuals with ASD who are slightly affected and have no additional diagnosis in a profession may help them overcome the difficulties in social communication and integrate into society through the social support offered to them. Thus, there is a higher need for promoting activities about work and employment.

When the prominent topics on ASD awareness other than the previously mentioned are examined both for Turkey and in the global sense, there are some points worth discussing. Firstly, early diagnosis and early education come to mind when ASD awareness is mentioned. However, as a result of the tweet and discourse analysis, no contents proving this fact were encountered globally, while there was a content touching upon it in Turkey. This can be explained as follows. Tweet contents were produced by families rather than experts. Secondly, it draws attention that families mostly preferred posting emotional tweets about love, special and different children and tweets about social acceptance and support. However, in the literature, one of the issues frequently addressed by families is the difficulties experienced in the diagnosis (Gupta, 2007; Moh & Magiati, 2012; Pisula, 2011). Although links of doctor interviews were shared in two global tweets, early diagnosis and early education were not emphasized directly. In addition to early diagnosis, the deficiencies of children diagnosed with ASD can be reduced with systematic and continuous education (Brian et al., 2016; Schreibman et al., 2015). There is a need for experts experienced in ASD and relevant institutions to assume a more active role in sharing more contents emphasizing early diagnosis and early education on such an important day because there may be some families who are carrying the ASD risk but are not aware of the early symptoms or do not accept these differences. The awareness contents of the relevant, reliable institutions working directly on ASD can be motivating for families in terms of early diagnosis. Although many children diagnosed with ASD carry the risk of ASD before their second birthday, the study conducted by Maenner et al. (2020) suggests that the diagnosis of ASD is made in the 51st month on average across the world. Considering how important the first years of life are, as a period when brain development is the fastest (Schreibman et al., 2015; Zwaigenbaum et al., 2015), it should be remembered that delay in early diagnosis may result in many negative outcomes. This primarily leads to loss of time regarding the quality and intensity of education and prevents closing the gap between diagnosis and education. At this point, it can be said that relevant institutions should make more efforts to raise awareness of ASD on social media within the scope of the early diagnosis and early education theme. As another significant point, it is recommended not to limit the awareness activities performed in line with the significance of the month April and April 2 only to this month and day, but to increase the power of social awareness on ASD with organized and controlled activities via interinstitutional cooperation for 365 days.

This study has some limitations. The first one of these is the limitation of this study only to the activities held on April 2, 2017, on Twitter, which is a microblogging website. In this context, to support these data, tweets posted on social media can be examined, and comparative longitudinal studies can be conducted in the year range. Apart from Twitter, comparisons can be made on the data collected on different social platforms like Facebook. Social network analysis studies can be conducted over social media on the experiences and narrations of the families who have children with ASD. The second limitation is the inclusion of the tweets using the hashtags #otizm [autism], #2nisanotizmfarkındalıkgünü [April 2 Autism Awareness Day], #autism [autism], and ##worldautismawarenessday in the study. In this context, to support or diversify the results of this study, studies in the mixed research design can be performed to use social network and content analyses by including tweets with different contents.

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An investigation into pre-service teachers' online learning climate perceptions

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Abstract

Starting from the first half of 2020, educational institutions at all levels have had to switch to online education as an emergency solution for the global outbreak of Covid-19 pandemic. However, it would hardly be justified to argue that teachers and students were well-prepared for such a swift change. Accordingly, this transformation has resulted in many difficulties for teachers and students along with educational institutions. One of the primary challenges teachers have experienced throughout the process is creating a positive online classroom climate. Thus, the main purpose of the present study is to reveal the online learning climate perceptions of pre-service teachers by adapting and using the Online Learning Climate Scale (OLCS) in Turkish context. In a similar vein, such variables as gender, department or grade level, which may have an influence on the perceptions of pre-service teachers, are also aimed to be disclosed within the study. The research has been conducted with a study group of 348 pre-service teachers. It has been observed that the pre-service teachers' perceptions on online learning climate are at less than moderate level; therefore, far from satisfactory. Additionally, it has been noted that variables such as the department, grade level and level of digital literacy have an influence on the OLCS perceptions of the pre-service teachers. Finally, the overall results of the study suggest that the skill of creating a positive online learning climate needs to be improved for pre-service teachers via integrating courses into the curriculum of teacher training institutions and organizing subject-specific trainings.

1. Introduction

The continuous transformation caused by the Covid-19 pandemic can be observed in almost every field and sector globally and the field of education is no exception. In an effort to minimize people's mobility and contact, many countries have stopped traditional face-to-face education and adopted online education. As a result, online education is getting more and more widespread in tertiary education as well as primary and secondary education (Allen & Seaman, 2003; Devran & Elitaş, 2016; Gürer et al., 2016; Kaban & Çakmak, 2016; Kaufmann et al., 2016; Kavrat & Türel, 2013). In fact, this transformation was not completely unexpected because Boettcher and Conrad (2016) have projected that traditional face-to-face courses will be replaced by courses that employ digital communication tools via the internet. Consequently, many higher education institutions, partly in an effort to internationalize, had already commenced the process of digitalization within their operations in the form of hybrid and blended courses besides traditional face-to-face education. Such switch to online education implies that teachers are

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expected to take on new instructional roles and responsibilities in online education, one of which is constructing a positive online classroom climate. Although the construct of classroom climate has been studied extensively in traditional face-to-face educational settings, it would be hardly justified to argue the same for online contexts (Kaufmann et al., 2016) despite its tremendous influence on learners' level of achievement and on their satisfaction with the experience (Barksdale et al., 2021; Barr, 2016; Djigić & Stojiljković, 2011; Dwyer et al., 2004; Gezer & Şahin, 2017; Ghaith, 2003; Johnson, 2006; López et al., 2018; Marraccini et al., 2020; Shewark et al., 2018; van der Sijde & Tomic, 1992). In line with this, the following section of the study deals with the construct of classroom climate in online education.

2. Literature Review

2.1.Classroom Climate

The construct of classroom climate is closely associated with classroom management, which succinctly refers to "…creating safe and stimulating learning environment" (Djigić & Stojiljković, 2011, p. 820), covering components such as management of time, space, labor, materials, activities, behavior of learners and social relations. There are several approaches a teacher can employ to manage a classroom and it has been argued that, rather than an interventionist or non-interventionist approach, an interactionist style of classroom management, which "focuses on what an individual does in order to change the environment, as well as how the environment affects the individual" (Djigić & Stojiljković, 2011, p. 822), promises a positive and stimulating classroom climate.

Similarly, the instructional, social, psychological and emotional characteristics of a classroom have been referred to as the classroom climate although terms such as *classroom environment* or *classroom atmosphere* are also employed for the same concept (Barr, 2016; Lee & Mak, 2018). Accordingly, classroom climate can be regarded as the general collective feeling shared by all the participants in the classroom, which embraces "…students' perceptions of the rigor of the class, their interactions with their instructor and class peers, and their involvement in the class" (Barr, 2016, p. 1). The relationship between the teacher and the students as well as the design and structure of the course is determinant in terms of classroom climate and the teacher is expected to build intimate communication with the students by making use of affinity-seeking strategies (Myers, 1995) or making use of nonhostile humor (Stuart & Rosenfeld, 1994) with the aim of fostering a positive classroom climate. A positive classroom climate, thus, encourages learners' engagement, self-determined motivation and empathy towards others as well as satisfying learners' social, emotional and psychological needs and promoting enjoyment of the course (Barksdale et al., 2021; MacLeod et al., 2017).

Classroom climate has generally been regarded as a determining factor of learners' academic success, motivation and satisfaction (Anderson et al., 2004; Barr, 2016; Barksdale et al., 2021; Djigić & Stojiljković, 2011; Dwyer et al., 2004; Johnson, 2006; Johnson, 2009; López et al., 2018); accordingly, the elements of a positive classroom climate can be summarized as follows (Barr, 2016; Barksdale et al., 2021; Djigić & Stojiljković, 2011; Ghaith, 2003; Lee & Mak, 2018; van der Sijde & Tomic, 1992; Van Petegem et al., 2008):

-Greater cohesion and goal-orientedness;

-Less disorganization, reduced anxiety and fewer conflicts;

-More opportunities for learning;

-Mutual respect and understanding;

-Constructive and productive relationship;

-Learners' needs, interests and initiatives are valued;

-Responsibility is shared by the teacher and the learners;

-Good rapport exists between the teacher and learners;

-Collaboration rather than competition.

The teacher functions as the principal agent of building a positive classroom climate and the significant role played by academic self-efficacy and communication in creating a positive classroom climate has been underscored in the relevant literature (Gündoğan & Koçak, 2017). It should not go without saying that the seeds of a positive classroom climate can initially be found in the design of the course; therefore, teachers need to keep their learners' choices and interests in mind even in the planning stage of the course if they would like their learners to perceive their lessons as satisfactory (Barr, 2016). In addition to instructional practices, assessment procedures should also be taken into consideration for a more positive classroom climate. To be more precise, it has been argued that formative assessment supported with self-assessment and peer-assessment may enhance learners' motivation, leading to a more favorable classroom climate (Lee & Mak, 2018). The interdependent relationship between the classroom climate and the motivational instructional practices has also been highlighted in that the latter paves the way for a positive classroom climate while a favorable and relaxed classroom climate enhances the motivational instructional practices on the part of both the teachers and the learners (Lee & Mak, 2018).

As has been argued by Jorgensen (1992), the profession of teaching is a rapport-intensive field. The pivotal role of developing good rapport with and among the students has been well-documented (Barr, 2016; Frisby & Martin, 2010; Van Petegem et al., 2008). Rapport can be described as a mutual feeling between two people that involves trust and prosocial bond (Catt et al., 2007). It should be noted that the term *mutual* in the previous sentence suggests that rapport and the consequent classroom climate are co-constructed by the teacher and students, whose active participation is a requisite throughout the process. Accordingly, the concept of classroom climate can also be approached from the sociocultural perspective; namely, zone of proximal development and scaffolding in a combined fashion may bring about a positive classroom climate (Lee & Mak, 2018). In this respect, positive rapport does not only refer to the relationship between the teacher and the learners but also between and among the learners themselves as well (Barr, 2016). With the aim of achieving positive rapport, teachers need to make learners feel that they are cared for and valued with the help of certain confirming behavior strategies such as responding to their questions, showing interest in their actions and conveying concern towards both the class and the individual students (Barr, 2016). There is no need to say that whereas some learners are surprisingly self-motivated, some others need constant encouragement while following online education, implying that teachers need to be punctual and reliable in terms of responding to learner-initiated communication efforts.

2.2. Classroom Climate in Online Learning

Online education has emerged as the best option under the circumstances mandated by the Covid-19 pandemic for more than a year and it can be defined as "…the use of the internet to access materials; to interact with the content, instructor, and other learners; and to obtain support during the learning process, in order to acquire knowledge, to construct personal meaning, and to grow from the learning experience" (Ally, 2008, p. 5). Similarly, Burns (2011) defines online learning as a "…planned learning experience or method of instruction characterized by quasi-permanent separation of the instructor and learner(s)" (p. 9), focusing on structured planning, well-designed courses, special instructional techniques and communication via technology. The implementation of online education is based on four main components. First of all, the design of online education should be institutionally based, which renders it different from self-study. Secondly, the teacher and the students should be separated not only in terms of location but in terms of time as well. The third component of online education is interactive telecommunications, implying that the internet technology is to be utilized throughout the process. Finally, there should be a two-way communication between the teacher and the student to share and

exchange the content and resources to promote learning experiences. According to Simonson et al. (2015), if any of these components does not exist throughout the process, it is not possible to label it as online education. It should be noted at this point that while the traditional approaches to online education highlight the temporal space between the teacher and students, more recent approaches, thanks to the latest innovations in interactive technological facilities, view online education as taking place at the same time but in different places (Simonson et al., 2015). This shift in the understanding of online education is closely linked to the importance attached to interaction between and among the teacher and the students; thus, synchronous, rather than asynchronous forms of online education have become more favorable.

As a response to the developments in technology, many higher education institutions have already started offering online education to their students with the intention of obtaining financial gains or becoming internationalized and digitalized. In this context, the global outbreak of Covid-19 pandemic has accelerated this process and educational institutions at all levels have adopted online education as a substitution for traditional face-to-face education with the aim of eliminating physical contact between and among the teachers and the students. Such sudden switch to online education, not surprisingly, has resulted in certain challenges for both the teachers and the students. To be more precise, online education necessitates readiness on the part of all the stakeholders; namely, the educational institution, the teachers and the students (Simonson et al., 2015). It would be justified to argue that none of the stakeholders were quite ready for such sudden shift to online education. In this respect, the adoption of online education has led to transformations in the roles and responsibilities of both teachers and learners (Altmann et al., 2019; Boz Yüksekdağ, 2016; Devran & Elitaş, 2016). More specifically, transition to online education has charged teachers with some extra new tasks in that teachers need to become guides, mentors and effective communicators, improve learners' social skills and assist learners in technical issues as well as fulfilling their conventional pedagogical roles (Boettcher & Conrad, 2016; Kavrat & Türel, 2013; Yuan, 2021). In a similar vein, students need to take more responsibility of their own learning and manage their time more effectively in the process of online education.

Creating a positive classroom climate is one of these challenges since online courses have their *own* climates (Cole et al., 2019). Parker and Herrington (2015) offer a model with four sub-sections (namely, *physical environment*, *building rapport*, *emotional expression* and *instructional management*) for constructing climate in traditional face-to-face classrooms and suggest that the model "may assist online educators to develop physical, social, emotional and instructional supports to set a positive climate of open communication and friendly interaction to encourage student engagement in an online community of learning" (p. 7). Thus, it can be argued that creating a positive classroom climate is much easier in traditional face-to-face education in comparison to online education since communication between and among the teacher and the students may not occur as effectively and instantly as it does in face-to-face contexts. In this respect, online learning climate has been defined by Kaufmann et al. (2016) as "the emotional atmosphere, feeling, and or connection in the course with the instructor and students" (p. 312). Unquestionably, online education brings certain challenges with it as well as several benefits; however, constructing a positive classroom climate in online settings requires distinct competences on the part of the teachers. Furthermore, it can be argued that students have experienced intense social isolation for prolonged periods due to lockdowns across the country and lost their motivation towards online education. When compared with traditional face-to-face courses, online courses feature diverse components and considerations of accessibility; therefore, online courses need to be designed and delivered with the modality in mind (Kaufmann & Vallade, 2020; Yuan, 2021). Another challenge presented by online education is the learning management system, application or web-site that has been utilized for online education since it may also feature certain limitations, leading to difficulties in creating a positive classroom climate. It should also be admitted that there may also be shortcomings peculiar to individual students (such as lack of technical equipment, time or internet connection), which renders the

task of building a positive classroom climate almost impossible and, unfortunately, cannot be controlled or solved by the teacher.

The fact that both the teacher and the students are online does not necessarily come to mean that the online classroom climate is favorable. According to Kaufmann and Vallade (2020), online learning may turn out be a lonely experience for most of the students. In this respect, they have carried out a study aiming to reveal how rapport and climate may alleviate the perceptions of loneliness and underscored the importance of the teacher's role in building and maintaining rapport and climate (Kaufmann & Vallade, 2020). Likewise, Montebello (2018) and Cole et al. (2019) have observed that some students feel isolated despite being able to communicate with the teacher and their peers during online education because they wish to interact with them in a face-to-face fashion. The teacher or the instructor holds the main responsibility for helping learners to combat such sense of isolation by facilitating discussions related to learners' interests and making use of confirmation behaviors (Cole et al., 2019). In a similar vein, Alles et al. (2019) explored the development of the learning atmosphere and conversation culture in a longitudinal study and concluded that both of the constructs were relatively positive at the beginning and a slight increase was observed over time. Therefore, sense of community, or more commonly connectedness, stands out as a key feature of online classroom climate in that both the teacher and the students need to feel connected to the idiosyncrasies of the classroom to achieve a favorable classroom climate. Connectedness also refers to the relationship and interaction between and among the students as, in addition to the teachers, students should also be able to comment on and appreciate their peers' progress since the instruction does not just happen between the teacher and the students, but among the students as well. As has been reported by Barr (2016), Johnson (2009), Kaufmann & Vallade (2020) and Simonson et al. (2015), a connected classroom climate increases students' motivation, preparedness and participation as well as discouraging cheating.

It should also be noted that concerns as to lack of communication and interaction between the teacher and students in online education contexts have been reported (Allen, 2006). More specifically, lack of interaction between and among the teacher and the students due to technical problems has been argued to damage students' motivation, leading to disruptions in classroom climate (Birişçi, 2013; Bogolepova, 2021; Wiranto et al., 2021). In a similar vein, Vallade and Kaufmann (2018) have focused on the effects of instructors' communication and behavior on students' experiences in online learning and reported the detrimental effects of instructors' misbehavior on students' perceptions and satisfaction. On the other hand, the findings of the study conducted by Cole et al. (2019) indicate that collaboration and effective interaction among the students result in better online learning climate and higher student engagement. Interaction is a crucial factor in online education in that it shapes the level of social presence of the learners. When learners are socially absent in online education, they are likely to become inactive and disengaged throughout the process (Bayrak et al., 2017; Kaufmann et al., 2016). In line with this, it would be justified to argue that the design of online education platforms should be arranged in such a way that will enable the learners to become socially present by expressing themselves freely, sharing their opinions and feeling a sense of community. To summarize, Kaufmann et al. (2016) maintain that the behaviors of instructors play a significant role in constructing a positive online classroom climate in that the instructors need to be respectful, understanding, supportive, responsive, engaged and understanding. In addition, the structure and clarity of the course should be designed in such a way to enable students to communicate, interact and collaborate with their peers and their instructor. Student connectedness should also be paid attention by the instructors by encouraging respectful cooperation among the students since attitudes and perceptions of students have been closely linked to success in online education (Başar et al., 2019; Vallade & Kaufmann, 2018).

2.3.Purpose and Significance of the Study

Due to the global outbreak of Covid-19 pandemic, a harsh and compulsory transition to online education has been experienced by educational institutions across the globe. Nevertheless, the emergency of the situation has not made it possible to allow sufficient time for the stakeholders to get prepared for this shift. Considering the assertion that the attitudes of learners stand as the most important factor for success in online education (Başar et al., 2019) and the perceptions of learners are the key point for understanding classroom climate (Schenke et al., 2017), this study aims to investigate pre-service teachers' perceptions on classroom climate throughout the process of emergency online education. The significance of the present study lies in the fact that the construct of classroom climate has been explored extensively in traditional face-to-face settings whereas there is a scarcity of research as to classroom climate in online education contexts (Kaufmann et al., 2016). Furthermore, the prevalence of online education during the Covid-19 pandemic adds to the significance of the present study. Therefore, this study aims to shed light on the online learning climate perceptions of pre-service teachers in Turkish context and provide teachers and instructors with suggestions that can help to improve online classroom climate in line with the findings of the research.

2.4. Statement of the Problem and Research Questions

The main question of this research is:

-How do pre-service teachers perceive online learning climate and do the perceptions of pre-service teachers on online learning climate differ according to their gender, department, grade level, level of digital literacy and the time they daily spend online?

In response to this question, this study aims to identify online learning climate perceptions of pre-service teachers by shedding light on the variables that have an influence on their perceptions. Therefore, the research questions to be dealt with in this study are:

1. What is the level of overall perception of pre-service teachers on online learning climate?

2. Do the perceptions of pre-service teachers on online learning climate differ according to:

a) their gender?

b) their department?

c) their grade level?

d) their level of digital literacy?

e) the time they daily spend online?

3. Methodology

3.1. Research Model/Design

With the aim of answering the research questions, a quantitative research method, namely a single scan model, one of the general scan models, has been utilized in this study since the main purpose of the study is to reveal the current state of a situation that has been experienced or is being experienced (Karasar, 2000).

3.2. Data Collection Tool(s)

A self-report questionnaire (SRQ) has been employed with the aim of collecting relevant data within this study. SRQ can be defined as an instrument "…in which participants typically are presented with a set of specific statements, questions, or prompts and must respond to each by selecting one of several options provided on the instrument" (Wolters & Won, 2017, p. 308). The set of specific statements, questions, or prompts make it possible to collect the respondents' perceptions, attitudes, abilities, knowledge, beliefs or behaviors regarding the subject under study. The reason why a SRQ has been adopted within the study is that SRQ is comparatively more convenient and affordable to produce, administer, score and analyze. More specifically, the limitations mandated by the Covid-19 pandemic have rendered the SRQ the most convenient tool for this study.

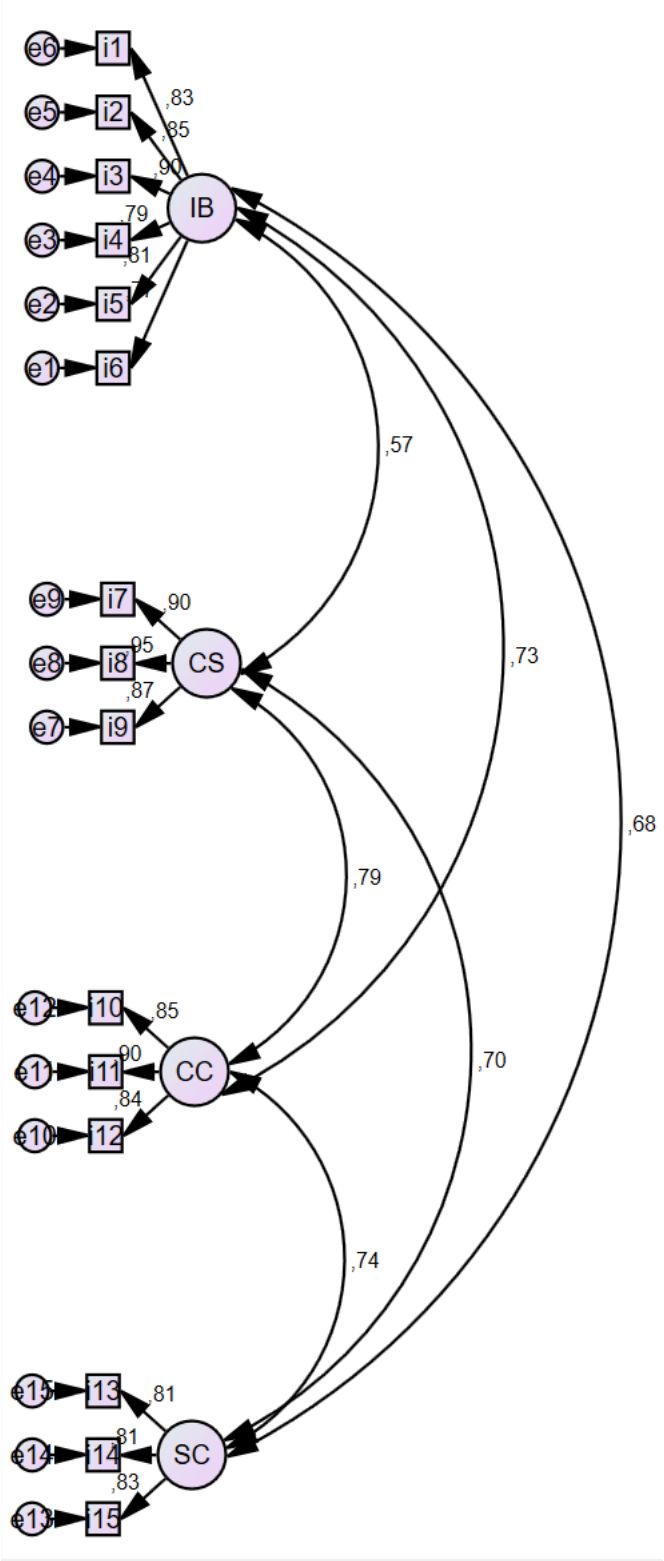
As a result, the data collection tool adopted with the aim of gathering the necessary data for the statistical analyses consists of two sections. In the first section of the data collection tool, participants are requested to provide their demographic information such as their genders, departments, classes, digital literacy levels and time they daily spend online. The second section of the data collection tool aims to collect participants' perceptions of online learning climate; thus, 'Online Learning Climate Scale' (OLCS), developed and validated by Kaufmann et al. (2016), has been employed. The procedures of adaptation of OLCS into Turkish and details as to the validity and reliability of OLCS have been explicated below.

3.2.1. Online Learning Climate Scale (OLCS)

The OLCS consists of 15 items, distributed under four factors, and it aims to explore classroom climate in online settings, which is co-constructed by the teacher, students and course design. More specifically, the OLCS has been structured in a 7-point Likert-type design (*1: strongly disagree and 7: strongly agree*). Items between 1 and 6 (6 items) comprise *Instructor Behaviors* (IB); items between 7 and 9 (3 items) comprise *Course Structure* (CS); items between 10 and 12 (3 items) comprise *Course Clarity* (CC); and items between 13 and 15 (3 items) comprise *Student Connectedness* (SC) factors. As can be understood, the OLCS covers variables such as the roles and behaviors of teachers, characteristics of students and aspects of the structure and design of the course with the aim of identifying learners' perceptions of the online learning climate. In this respect, the OLCS aims to shed light on *instructor behaviors*, *student characteristics and behaviors*, and *course-specific structural issues* with a specific reference to understanding their influence on the perception of classroom climate (Kaufmann et al., 2016). It should also be noted that in the item generation process of the OLCS, the Instructional Beliefs Model (Weber, Martin & Myers, 2011) has been adopted as the theoretical framework.

The first step of the adaptation process of the OLCS involves the translation of the scale into Turkish by one of the researchers. As a next step, the original and the translated forms of the OLCS have been examined by three experts who hold PhDs in the field of English language teaching. Their suggestions for revision have been implemented and the final version of the Turkish form of the OLCS has been checked by another expert holding her PhD in the field of Turkish language education. The final version of the Turkish form of the OLCS has been obtained in line with the recommendations of the Turkish language education expert. At the end of this process, it has been regarded by the researchers that the content validity of the OLCS has been mastered. After the final version of the Turkish form of the OLCS has

been arrived at, the first stage of pilot study with 10 English Language Teaching department students has been conducted and the readability as well as comprehensibility of the OLCS has been assured. Finally, the second stage of the pilot study has been conducted with 300 pre-service teachers to demonstrate the confirmatory factor analysis (CFA) (see Figure 1).



(IB: Instructor Behaviors, CS: Course Structure, CC: Course Clarity, SC: Student Connectedness)

Figure 1. OLCS Factor Analysis

Figure 1 presents the relationship between the factors of the OLCS and the items in each factor. It has been observed that the correlation coefficients calculated between the factors and their items vary between .75 and .91. According to Büyüköztürk (2002), the relationship coefficient of 0.60 and above can

be interpreted as high-level correlation. When the numerical values are examined, it can be argued that the correlation coefficients calculated between the factors and their items are perfectly acceptable. As a result of the analyses, it is seen that $\chi 2 = 327.70$, $p = .000$, $df = 84$, $\chi 2 / df = 3.90$ are significant. Furthermore, Figure 3 demonstrates that the adapted form of the OLCS includes four factors and it is compatible with the original form of the OLCS. Table 1 gives corrected item total correlation.

Table 1.
Item-Total Correlation

Item No	Corrected Item Total Correlation
1	0.697
2	0.711
3	0.772
4	0.715
5	0.650
6	0.676
7	0.727
8	0.767
9	0.722
10	0.778
11	0.793
12	0.743
13	0.678
14	0.666
15	0.742

When Table 1 is examined, it is seen that all the values are greater than 0.50 (Francis & White, 2002; Kim & Stoel, 2004). As has been stated by Lord and Novick, "the higher the item-test correlations, the higher the coefficient α" (2008, p. 331). Results of the confirmatory factor analysis (CFA) have been provided in Table 2.

Table 2.
Confirmatory Factor Analysis Results for OLCS

Index	Perfect fit criteria	Good fit criteria	Research finding	Result
x2/df	0-3	3-5	3.90	Good fit
RMSEA	$.00 \leq RMSEA \leq .05$	$.05 \leq RMSEA \leq .10$	.098	Good fit
CFI	$.95 \leq CFI \leq 1.00$	$.90 \leq CFI \leq .95$	.94	Good fit
SRMR	$0 \leq SRMR \leq .05$	$.05 \leq SRMR < 0.10$	0.045	Perfect fit
NNFI (TLI)	$.95 \leq NNFI (TLI) \leq 1.00$	$.90 \leq CFI \leq .95$	0.92	Good fit
NFI	$.95 \leq NFI \leq 1.00$	$.90 \leq NFI \leq .95$	.92	Good fit
RFI	$.95 \leq RFI \leq 1.00$	$.90 \leq RFI \leq .95$	.91	Good fit
GFI	$.95 \leq GFI \leq 1.00$	$.90 \leq GFI \leq .95$	0.93	Good fit
AGFI	$.90 \leq AGFI \leq 1.00$	$.85 \leq AGFI \leq .90$	0.86	Good fit

When Table 2 is examined, the value ($\chi 2 / df = 3.90$) obtained by proportioning the chi-square fit index value to the degree of freedom indicates that it is below 9, which is regarded as an acceptable or perfect value (Marsh & Hocevar, 1988). In addition, when RMSEA, CFI, SRMR, NNFI, NFI, RFI, GFI, AGFI

values are examined, it is seen that the model features good fit or perfect fit (Fan et al., 1999; Hu & Bentler, 1999).

The internal consistency coefficient, which indicates the reliability of the scale, has been found as stratified coefficient alpha = .85. Likewise, the reliability of the factors are computed as: Instructor Behaviors α = .93, Course Structure α = .93, Course Clarity α = .90, Student Connectedness α = .86. Therefore, the scale is considered to have internal consistency. It should also be noted that the obtained results concur with the findings reported by Kaufmann et al. (2016). In this respect, as a result of the CFA conducted, it can be argued that the adapted form of the OLCS is a valid and reliable data collection tool.

3.3. Study Group

The study group of the present research consists of a total of 348 volunteer pre-service teachers studying in six different departments at the Faculty of Education, Süleyman Demirel University. The technique of *convenience sampling* (Dörnyei, 2007; Nunan, 1992) has been employed within this study in that the participants have been selected because of their convenient accessibility and proximity to the researchers. Since all the participants provided the requested information, there was no lost data. Demographic information of the participants has been presented in Table 3.

Table 3.
Demographic Information of the Participants

Department	**Number of Participants**			
	Female	**Male**	**Total**	**Department %**
English Language Teaching	46	12	58	17
Elementary Mathematics Education	33	5	38	10
Science Education	37	10	47	14
Primary School Teacher Education	87	28	115	33
Turkish Language Teaching	35	12	47	14
Social Studies Education	37	6	43	12
Total	275	73	348	100

It should also be noted that pre-service teachers from different grade levels have participated in the study. More specifically, of the 348 pre-service teachers who participated in the study, 121 are freshmen; 109 are sophomore; 61 are junior; and 57 are senior.

3.4. Data Analysis

The assumptions of a CFA include multivariate normality, a sufficient sample size (n >200), the correct a priori model specification, and data must come from a random sample. It is seen that all assumptions are met for the confirmatory factor analysis. For the analysis of the data obtained, parametric analysis methods; namely, independent samples t-test and one-way analysis of variance (ANOVA) are to be employed. However, prior to the analyses, the number of the participants (N=348) and continuity of the data (OLCS scores) have been checked and it has been observed that the data are suitable for the analyses. As a next step, the values obtained by dividing the skewness (-0.486) and kurtosis (-0.455) coefficients of the data into standard errors have been examined to ensure normality (McKillup, 2012; Tabachnick & Fidell, 2014; Wilcox, 2012) and it has been observed at the end of this analysis that the both of the values

are outside the ± 2 limit. It should also be noted that skewness-kurtosis alone is not enough to decide on normality. Thus, since the total number of participants is over 35, Kolmogorov-Smirnov test has been implemented and, in line with its results (0.08, p=.00), it can be argued that it does not meet the normal distribution condition. Similarly, the Q-Q charts support this finding as well. Finally, it has been decided that the data are not distributed normally. As a result, Mann-Whitney U test and Kruskal-Wallis H test, which are non-parametric tests, have been employed for the analyses.

3.5. Research Procedures

The data collection process for this study started in October, 2020 following the approval of Süleyman Demirel University Ethics Board and ended at the end of November, 2020. Due to the restrictions mandated by Covid-19 pandemics, no physical contact has been allowed; therefore, the data collection tool has been uploaded on an online platform (forms.google.com) and the link has been shared with the pre-service teachers. Participants have been informed about the content as well as the aim of the study and their consents have been obtained before they have been asked to participate in the study.

3.6. Ethical Procedures

The implementation of the present study has been approved by Süleyman Demirel University Ethics Board (September 14, 2020 / 96-11). The researchers have adhered to all ethical principles and rules in the collection, analysis, and reporting of the data for the study.

4. Findings

In this section of the study, the results of the analyses conducted for each research question have been presented.

Research Question 1. What is the level of overall perception of pre-service teachers on online learning climate?

The arithmetic mean and standard deviation values for the OLCS are given in Table 4 with the aim of answering the first research question.

Table 4.
Statistics for OLCS and its Factors

Factors / OLCS	N	X	Percentage of scores (%)	Standard deviation	Minimum and maximum scores that can be achieved
Instructor Behaviors	348	31.66	75.38	8.14	6-42
Course Structure	348	11.69	55.67	5.78	3-21
Course Clarity	348	13.43	63.95	4.95	3-21
Student Connectedness	348	14.32	68.19	5.04	3-21
OLCS	348	71.10	67.71	20.48	15-105

All the items in the OLCS are positive and the mean scores of the responses given to all the items have been computed accordingly. Since the OLCS consists of 15 items, the maximum possible score is 105 whereas the minimum score is 15 within the scale. As the number of items in the first factor is 6 while the number of items in other three factors is 3, the total scores that can be obtained are different. Therefore,

with the aim of making a comparison among the factors possible and easier, the mean scores have been converted into percentages by correcting them according to the total score. As a result, the highest mean score has been observed in the '*Instructor Behaviors*' factor with a score of % 75.38. There are 6 items in this factor of the OLCS. The highest score that can be obtained here is 42 whereas the lowest possible score is 6. Similarly, the percentage of mean scores in the '*Student Connectedness*' factor is % 68.19. There are 3 items in this factor of the OLCS. While the highest score that can be obtained in this factor is 21, the lowest possible score is 3. Likewise, the percentage of pre-service teachers' mean scores in the '*Course Clarity*' factor is % 63.95. Finally, the percentage of pre-service teachers' mean scores in the '*Course Structure*' factor is % 55.67. It should be noted that pre-service teachers' perceptions on the factor of course structure is the lowest in comparison to the other factors. When it comes to the pre-service teachers' overall perceptions of the OLCS, the percentage of their mean scores has been computed as % 67.71.

Research Question 2. Do the perceptions of pre-service teachers on online learning climate differ according to:
a) their gender?

Mann-Whitney U test has been conducted to reveal whether the perceptions of pre-service teachers on online learning climate differ according to their gender. The findings of the analysis have been presented in Table 5 below.

Table 5.
U-Test Results for OLCS according to Gender

Gender	N	Mean rank	Sum of rank	U	p
Female	275	175.98	48393.50	9631.50	,59
Male	73	168.94	12332.50		

*p<0.05

As can be understood from Table 5, the mean scores of female pre-service teachers on the OLCS (175.98) are higher than those of their male counterparts (168.94). However, Mann-Whitney U test results indicate that the observed difference is not statistically significant (U=9631.50; p>0,05). To put it differently, the perceptions of pre-service teachers on online learning climate do not differ according to the gender of participants.

b) their department?

Kruskal-Wallis H test has been conducted to reveal whether the perceptions of pre-service teachers on online learning climate differ according to the department they study. The findings of the analysis have been presented in Table 6 below.

Table 6.
Kruskal-Wallis H Test Results for OLCS according to Department

Department	n	Mean rank	sd	$\chi 2$	p	Significant difference	Effect size
English Language Teaching	58	162.95	5	13.40	.02	Elementary Mathematics Education – Primary School Teacher Education	0.50
Elementary Mathematics Education	38	216.87					
Science Education	47	199.32					
Primary School Teacher Education	115	159.89					
Turkish Language Teaching	47	163.35					
Social Studies Education	43	176.78					

Table 6 shows that the mean scores of pre-service teachers studying at the department of elementary mathematics education are the highest (216.87) whereas the mean scores of pre-service teachers studying at the department of primary school teacher education are the lowest (159.89). Moreover, Kruskal-Wallis H test results show that the difference observed is statistically significant (χ^2 (5) = 13.40, p< 0.05). Subsequently, Mann-Whitney U test has been implemented to determine the level of difference between and among the groups. The findings show that the mean scores of pre-service teachers studying at the department of elementary mathematics education are higher than the mean scores of pre-service teachers studying at the department of primary school teacher education, with the difference being at moderate level.

c) their grade level?

Kruskal-Wallis H test has been conducted to reveal whether the perceptions of pre-service teachers on online learning climate differ according to their grade level. The findings of the analysis have been presented in Table 7 below.

Table 7.
Kruskal-Wallis H Test Results for OLCS according to Grade Level

Grade Level	n	Mean rank.	sd	χ^2	p	Significant difference	Effect size
Freshman	121	199.17	3	192.23	.00	Senior - Junior	0.52
Sophomore	109	154.26				Freshman - Junior	0.52
Junior	61	144.16				Freshman - Sophomore	0.46
Senior	57	193.31					

Table 7 indicates that the mean scores of freshman pre-service teachers are the highest (199.17) whereas the mean scores of junior pre-service teachers are the lowest (144.16). Furthermore, Kruskal-Wallis H test

results indicate that the difference observed is statistically significant (χ^2 (3) = 192.23, p< 0.05). As a next step, Mann Whitney U test has been conducted to determine the level of difference between and among the groups. The findings show that the mean scores of senior pre-service teachers are higher than the mean scores of junior pre-service teachers, with the difference being at moderate level. Similarly, it has been observed that the mean scores of freshman pre-service teachers are higher than the mean scores of both junior and sophomore pre-service teachers, again with the difference being at moderate level.

d) their level of digital literacy?

Kruskal-Wallis H test has been conducted to reveal whether the perceptions of pre-service teachers on online learning climate differ according to their level of digital literacy. The findings of the analysis have been presented in Table 8 below.

Table 8.
Kruskal-Wallis H Test Results for OLCS according to Level of Digital Literacy

Digital Literacy Level	n	Mean rank	sd	χ^2	p	Significant difference	Effect size
Basic	155	167.99				Very Good - Basic	0.38
Good	161	172.02	2	6.87	.03		
Very Good	32	218.48					

Table 8 shows that the mean score of pre-service teachers with basic digital literacy is the lowest (167.99) whereas the mean score of pre-service teachers with very good digital literacy is the highest (218.48). Furthermore, Kruskal-Wallis H test results indicate that the difference observed is statistically significant (χ^2 (2) = 6.87, p< 0.05). As a next step, Mann Whitney U test has been conducted to determine the level of difference between and among the groups. The findings show that the mean scores of pre-service teachers with very good level of digital literacy are higher than the mean scores of pre-service teachers with basic level of digital literacy, with a small effect size.

e) the time they daily spend online?

Kruskal-Wallis H test has been conducted to reveal whether the perceptions of pre-service teachers on online learning climate differ according to the time they daily spend online. The findings of the analysis have been presented in Table 9 below.

Table 9.
Kruskal-Wallis H Test Results for OLCS according to the Time Daily Spent Online

Time Daily Spent Online	n	Mean rank	Sd	χ^2	p	Significant difference
1-2 hours	81	163.09				
3-4 hours	138	167.30	3	4.97	.17	No difference
5-6 hours	77	193.68				
7+ hours	52	182.53				

Table 9 indicates that the mean score of pre-service teachers who daily spend 1-2 hours online is the lowest (163.09) whereas the mean score of pre-service teachers who daily spend 5-6 hours online is the highest (193.68). Nonetheless, Kruskal-Wallis H test results suggest that the observed difference is not

statistically significant (χ^2 (3) = 4.97, p>.05). More plainly, the perceptions of pre-service teachers on online learning climate do not differ according to the time they daily spend online.

5. Discussion and Conclusion

The main aim of this study is to investigate pre-service teachers' perceptions on the construct of online classroom climate. The results of the analyses indicate that the pre-service teachers' overall perceptions on the OLCS are at less than moderate level. More precisely, in line with the wording of the 7-point Likert-type items in the OLCS, their mean score is somewhere between 'neither agree nor disagree' and 'somewhat agree' rather than 'agree' or even 'strongly agree', which implies that the construct of climate in online courses need to be paid more attention with the aim of enhancing pre-service teachers' online learning climate perceptions. This interpretation concurs with the findings of a previous research conducted by Gündoğan & Koçak (2017) with pre-service teachers in Turkish context in that their participants' perception of the school climate is also at less than moderate level. As to the factors of the OLCS, it can be argued that pre-service teachers' perceptions on the instructor behaviors factor of the OLCS are the highest and they mostly agree with the items under the factor of instructor behaviors. In other words, pre-service teachers perceive their instructors as understanding, respectful, responsive, engaged, approachable and supportive. This finding demonstrates that instructors have been able to construct a positive online classroom climate by building good rapport with their students. It should be noted at this point that the findings of another study conducted by Koç (2020) in Turkish context have revealed that lack of communication and interaction has negative effects on both the instructors and the students. However, the factor of instructor behaviors, which contains items as to the communication and interaction between the teacher and the students have been positively perceived in the present study. In a similar fashion, it can be argued that the pre-service teachers' perceptions on the student connectedness and course clarity factors of the OLCS are somewhat high. On the other hand, pre-service teachers' perceptions on the factor of course structure are the lowest in comparison to the other factors. This may be related to the urgent switch to online education due to Covid-19 pandemic, which has hardly allowed enough time for the instructors to design and arrange their courses in line with the requirements of online education context. More precisely, the instructors may not have had enough experience to design and deliver their courses online. Another reason for this may be the lack of sufficient training as to the design and delivery of online courses.

This study has also aimed to investigate the independent variables that may have an influence on the OLCS perceptions of pre-service teachers. To start with, the perceptions of pre-service teachers on online learning climate do not differ according to gender, which conflicts with the findings of Başar et al. (2019) as they have reported that online education perceptions of male pre-service teachers are higher than their female counterparts. In contrast, it has been argued by Crawford and MacLeod (1990) that female teachers are usually better at constructing a positive classroom climate and a positive classroom climate for female learners turns out to be a better learning environment for all learners. As to the departments of the participants, it has been observed that the perceptions of pre-service teachers studying at the department of elementary mathematics education are the highest. The reason for this finding may be the fact that the instructors employed in the department of elementary mathematics education utilized a learning management system prior to the Covid-19 pandemic, and as a result, the pre-service teachers in this department have longer experience in online learning. With regard to the grade levels of the pre-service teachers, Wang et al. (2020) have reported at the end of their meta-analytic study that grade level of the students does not have an influence on their classroom climate perceptions. On the other hand, Özdemir et al. (2020) conclude at the end of their study in Turkish context that as the grade level of the students increase, their perceptions of the classroom climate decrease. Nevertheless, the results of the present study indicate that pre-service teachers in their first and final years have more positive perceptions

towards classroom climate than their sophomore and junior counterparts. In a similar vein, a correlation between the digital literacy levels and the OLCS perceptions of pre-service teachers has been observed in that the higher their digital literacy levels, the higher their perceptions on the OLCS. This interpretation has also been supported by the findings of Macleod et al. (2017), who conclude that higher technological competency enables learners to feel more connected in online classroom climate. Furthermore, in terms of time pre-service teachers daily spend online, it can be contended that as the time pre-service teachers spend online increases, their digital literacy level also improves, which directly contributes to their perceptions of online learning climate.

Moos (2017) argues that integration of technology into educational settings with the aim of improving quality of learning experience for students is not a new phenomenon; however, "current integration reflects a growing trend to design environments that enable students to learn *with*, as opposed to *from*, classroom technology" (p. 243, *italics in original*). In line with this, as has been observed by Devran and Elitaş (2016), it is highly likely that using technology in the process of online education may turn out to be a challenge for the teachers and students. Thus, it would be fair to argue that both parties need to be trained prior to the implementation of online education. Moreover, the design of online courses need to be executed with a specific reference to the needs, interests, resources, affordances, preferences and perceptions of the learners (Başar et al., 2019). Furthermore, the important role of classroom climate in fostering the overall quality of education and promoting learners' academic, emotional, social and psychological well-being has been recognized by an increasing number of countries (Barksdale et al., 2021; López et al., 2018; Van Petegem et al., 2008) and enhancement of classroom climate has become a main goal of educational institutions in the process of reform efforts (Shewark et al., 2018; Wang et al., 2020). With the aim of achieving a positive classroom climate, teachers need to create a safe and supportive atmosphere, revise their attitudes towards learners' mistakes and errors, make use of motivational instructional strategies, balance formative and summative assessment practices, build good rapport with the students and encourage them to develop good relationships with their peers (Lee & Mak, 2018). Motivation is a crucial construct in any instructional context; however, its importance in online learning is even greater (Montebello, 2018).

It is clear that online education brings certain challenges with it; however, the sudden outbreak of Covid-19 pandemic has left no options other than online education, which functions as an emergency solution. In this context, with the aim of achieving success in online education and building positive classroom climate, a teacher needs to design the content and delivery of the course in line with the restrictions and opportunities of online education (Kaufmann et al., 2016) and evade from transplanting traditional face-to-face course onto the internet since "while teaching online can be informed by the same theories of learning as face-to-face instruction, the enactment of the online experience, for both teachers and students, will - and should - differ significantly from the physical classroom" (Boettcher & Conrad, 2016, p. xviii). As has been suggested by Simonson et al. (2015), teachers need to put their creativity and imagination into the design and structure of their online courses in order to engage learners. Additionally, the organization of the course and requirements expected of the learners should be made clear to the learners as soon as possible. Needless to say, there should be intimate communication between the teacher and the learners; thus, learners should be kept informed constantly. In a similar vein, an online discussion forum inviting learners to ask their questions and express their opinions may prove useful because the teacher can get continuous feedback from the learners as to the process of online education. The platform or interface used for online education may also be a challenge for some of the learners; therefore, training(s) as to the operation of the platform or interface should be provided for such learners in advance. In addition, teachers should try to see technology as a facilitative tool rather than an obstacle, implying that the power of technology can be integrated into the course especially during the delivery of the course. It should not go without saying that instructional methods employed by the teacher should also be suited to the aims and peculiarities of online education. More precisely, instead of traditional lecturing style,

teachers should encourage learners to participate and communicate both with the teacher and their peers. The teacher may achieve this by assigning group works on the part of the students, which will enhance interaction among them and lead to collaboration (Ghaith, 2003). Furthermore, assessment of students' performances in online education also stands as a challenge both for the teachers and the students. In response to this challenge, formative rather than summative assessment techniques can provide a more reliable and valid view of the learners' progress. More precisely, alternative assessment procedures such as e-portfolio, project work and/or self-/peer-assessment may be utilized along with traditional assessment procedures. All in all, teachers need to exhibit sympathy, understanding, support and availability throughout the whole process in order to build a positive online classroom climate (Kaufmann et al., 2016).

5.1. Implications

It is highly likely that online education will not be quitted in the period of so-called 'new normal' when Covid-19 pandemic is over (Wiranto et al., 2021). Thanks to the advantages it offers, online education will probably continue to be utilized either as a substitution or as a supplement to traditional face-to-face education (Altmann et al., 2019; Karasu & Sarı, 2019; Wieser & Seeler, 2019). Thus, as an educational implication, the findings of the study may prove useful for the development of future online courses and in the training of pre-service or in-service teachers for conducting online courses. Furthermore, the findings of the present research may enable course designers, instructors and teachers to become more aware of the perceptions of their learners on the issue of classroom climate in online education. Such data may be considered as valuable since it directly shapes emotional, social and psychological well-being of the learners as well as their academic achievement and satisfaction with the course. More specifically, as has been suggested by Gündoğan & Koçak (2017), courses may be integrated into the curricula of teacher training institutions with the aim of constructing positive classroom climate not just for traditional face-to-face education contexts but for online contexts as well. In a similar vein, in-service trainings may be organized for in-service teachers to update and enhance their practices in terms of creating positive classroom climate. Finally, it would be justified to argue that a valid and reliable scale has been offered to Turkish context with the aim of shedding light on the construction and nature of classroom climate in online settings.

6. Statement of Responsibility

Ahmet Önal; design of the project, conceptualization, methodology, resources, adaptation of the data collection tool, data collection, writing - original draft, writing - review & editing. Atilla Özdemir; design of the project, conceptualization, methodology, resources, validation, data analysis, writing - review & editing.

7. Conflicts of Interest

No potential conflict of interest has been reported by the authors.

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Appendix

Çevrimiçi Öğrenme Ortamı Ölçeği

	1*	2	3	4	5	6	7**
Çevrimiçi derslerde eğitmenle etkileşimimi temel alarak, eğitmen hakkında düşüncelerim şu şekildedir:							
1. Anlayışlıdır.							
2. Bana karşı saygılıdır.							
3. Destekleyicidir.							
4. Dönüt vermeye duyarlıdır (örneğin ödevlere zamanında geridönüt verir).							
5. Dersiyle ilgilidir.							
6. Ulaşılabilirdir (örneğin e-posta atabilir veya sanal danışma saatlerinde ziyaret edebilirim).							
Çevrimiçi derslerle yaşadığım tecrübelerime ve algılarıma dayanarak:							
7. Derslerin tasarımı öğrenciler arasındaki etkileşimi teşvik etmektedir.							
8. Derste kullanılan teknoloji öğrenciler arasında işbirliğini teşvik etmektedir.							
9. Çevrimiçi dersler öğrenciler arasında iletişim açısından bolca imkan sunmaktadır.							
Çevrimiçi derslerle yaşadığım tecrübelerime ve algılarıma dayanarak:							
10. Ders açık ve net şekilde yapılandırılmıştır.							
11. Teknoloji kullanımı için verilen yönergeler açık ve nettir.							
12. Ödevler için verilen yönergeler açık ve nettir.							
Çevrimiçi derslerde sınıf arkadaşlarımla etkileşimlerimi temel alarak, düşüncelerim şu şekildedir:							
13. Öğrenciler birbirlerine karşı saygılıdır.							
14. Öğrenciler birbirleriyle işbirliği içerisindedir.							
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Pre-service teachers' perceptions of social media – A qualitative survey study in Turkey and Sweden

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Abstract

The purpose of this study was to investigate pre-service teachers' perceptions of social media. The phenomenology approach, one of the qualitative research methods, was used in the study. The participants of the study included 201 pre-service teachers studying at two state universities, one in Turkey and the other in Sweden, in the spring term of the 2018-2019 academic year. In the study, metaphors were used to reveal pre-service teachers' perceptions of social media. The pre-service teachers were asked to fill in the following query: 'Social Media is like …… because ……'. The collected qualitative data were analyzed by using content analysis method. The findings indicated that the pre-service teachers from both countries perceived social media mostly as a tool for communication and access to information and that a very few of them associated social media with education. In addition, it was found that pre-service teachers from Turkey had more negative perceptions of social media compared to those from Sweden. The pre-service teachers from Turkey who had negative perceptions associated social media mostly with addiction.

1. Introduction

In recent years, we have experienced many technological developments that affect our daily life. One of these technological developments that stand out especially in the lives of young individuals is social networking sites. Social networking site (SNS) is a platform where users can jointly investigate network contents, share their experiences, and establish relations for different purposes such as social and educational purposes (Jiao, Gao, & Yang, 2015). Hughes, Rowe, Batey, and Lee (2012) define social networking sites (SNSs) as a list of virtual user profiles that can be shared with other users. These lists show links to be accessed by other people to the profile of each user (Correa, Hinsley, & De Zuniga, 2010). SNSs provide an environment where people can interact with others (friends, family) (Raacke & Bonds-Raacke, 2008). Although the main purpose of SNSs is to connect people to each other, they also function as platforms that facilitate information and media sharing, interaction and collaboration. Therefore, SNSs can be used for many different purposes in addition to establishing and maintaining social connections (Somroo, Kale, & Zai, 2014). Although users have various reasons for using SNSs, these reasons can be listed mostly as communicating with family and friends, maintaining the communication, meeting new people (Alhabash & Ma, 2017; Balakrishnan & Griffiths, 2017; Boyd & Ellison, 2007; Khan, 2017; Kircaburun, Alhabash, Tosuntaş, & Griffiths, 2018; Lee, Chou, & Huang, 2014), accessing and sharing information (Alhabash &

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Ma, 2017; Balakrishnan & Griffiths, 2017; Khan, 2017; Kırcaburun et al. 2018; Park & Kim, 2013; Sendurur, Sendurur, & Yılmaz, 2015) and entertainment (Balakrishnan & Griffiths, 2017; Khan, 2017; Kırcaburun et al., 2018; Lin, Hoffman, & Borengasser, 2013; Piwek & Joinson, 2016). In a study conducted by Pew Research Center, around seven out of 10 Americans use social media to communicate with each other, share information, entertain and to engage in news contents (Pew Reseach Center, 2019).

Despite the increasing number of SNSs users in various age groups, university students are still among the primary SNSs users (Lipsman, 2007; Miller & Melton, 2015). For this reason, researchers have investigated the SNS usage of many age groups in population, especially younger generations such as school and university students, in order to understand the applications and the effects and importance of SNSs (Hamade, 2013). Some of these studies focused on the perceptions of university students towards SNSs. According to the findings of these studies, students mentioned the positive aspects of SNSs such as the ability to participate in social, political and cultural activities (Hamade, 2013), academic and social communication (Hamade, 2013; Haneefa & Sumitha, 2011; Iordache & Lamanauskas, 2013; Kitsantas, Dabbagh, Chirinos, & Fake, 2015; Mirabolhasemi, Iahad, & Rahim, 2016; Sendurur et al., 2015), participation in academic and social activities, cooperation and social presence (Mirabolghasemi, Iahad, & Rahim, 2016), studying (Kitsantas et al., 2016), spending leisure time (Iordache & Lamanauskas 2013), accessing and sharing information (Iordache & Lamanauskas, 2013; Kitsantas et al., 2016; Mirabolhasemi, et al. 2016; Sendurur et al., 2015).

On the other hand, some of these studies revealed that students also had negative views about SNSs such as neglecting school/work life and social activities and spending too much time in SNSs (Hamade, 2013; Kitsantas et al., 2016), creating privacy and security concerns, preventing critical thinking, causing social isolation and other negative emotions (Haneefa & Sumitha, 2011; Mirabolhasemi et al., 2016; Sendurur, et al., 2015), distracting attention and addictive behavior. (Kitsantas et al., 2016; Sendurur et al., 2015). Regarding the issue, Iordache and Lamanauskas (2013) asked university students to evaluate the functions of SNSs in order of their importance. The students evaluated and ranked these functions as (1) communication, (2) learning and exchanging information, (3) exchanging the items such as photos and videos and (4) friend search.

1.1. Social Media in Education

The fact that SNSs are so popular among high school and university students made educators think that they can be used for educational activities, and various studies focusing on this subject have been conducted. These studies emphasized mostly the qualities of SNSs which support educational activities in higher education. The qualities mentioned in these studies can be listed as interaction, communication, collaboration, exchange of information and resource (Al-Dhanhani, Mizouni, Otrok, & Al-Rubaie, 2015; Al-Rahmi, Alias, Othman, Marin, & Tur, 2018; Mazman & Usluel, 2010; Sendurur et al., 2015), learning performance and critical thinking (Al-Rahmi et al., 2018; Kara, Çubukçuoğlu, & Elçi, 2020), enhancing learning motivation and experience, increasing motivation, engagement and satisfaction with learning (Hosny & Fatima, 2012; Imlawi, Gregg, & Karimi, 2015), and improving academic performance through collaboration (Al-Rahmi, Othman, Yusof, & Musa, 2015). However, some researchers stated that only a small proportion of young people use SNSs in sophisticated ways that educators might value (Eynon & Malmberg, 2011; Ito et al., 2009). For example, Hew (2011) stated in his review that the education-related usage of Facebook was low and that most of these usages were for administrative tasks such as sending lecture schedules and assignments instead of pedagogical aspects of teaching and learning. In another study, Caraher and Braselman (2010) revealed that students used SNSs to communicate with their classmates, work on assignments, and to some extent, communicate with the faculty members. Selwyn (2009), on the other hand, analyzed the university students' education-related activities on Facebook and reported five main themes as a result of this analysis. These were (1) recounting and reflecting on the university experience, (2) exchange of practical and academic information, (4) displays of supplication and/or disengagement, (5) bantering (e.g. exchanges of humor and nonsense). While most of the research on SNSs

have been done with the general population of university students, similar findings have been found in studies focusing on the views of pre-service teachers about SNSs. In relation to this, Sendurur et al. (2015) and Somroo, Kale, and Zai (2014) reported in their studies that the pre-service teachers' primary reason for SNSs use was communicative needs. In another study, pre-service teachers regarded the benefits of use of Twitter in lessons as establishing contact with educators in and out of class, sharing sources and communicating with each other (Carpenter, 2015). Foss and Olson (2013), on the other hand, found that pre-service teachers appreciated Facebook's ability to maintain their friendships and that they were professionally aware of its possible harmful effects, though.

In general, it is seen that the formal use of SNSs for educational purposes is low and that the education-related use is mostly informal such as communication, cooperation and exchange of information (Caraher & Braselman, 2010; Hew, 2011; Prescott, Wilson, & Beckett, 2013; Selwyn, 2009; Somroo et al., 2014). This probably reveals the fact that students perceive the purpose of SNSs as social rather than academic (Madge, Meek, Wellens, & Hooley, 2009). In addition, as mention above, some studies reported that students had some privacy and security concerns and negative opinions about SNSs. For example, Yaman and Yaman (2014) revealed that the students mostly emphasized the negative aspects of SNSs and did not perceive it as an educational tool. As a result, students' perspectives on SNSs may change the usage of SNSs in educational settings (Dyson, Vickers, Turtle, & Cowan, 2015). For future generations, pre-service teachers are those who will be part of forming educational experiences decades from now and the attitudes, perceptions, experiences, and expectations of those pre-service teachers are therefore important. In this paper, we investigate how pre-service teachers in Turkey and in Sweden perceive social media through metaphors. Although not so common, metaphors have the benefit to investigate perceptions on both a creative and associative level. Metaphor is to understand and experience a phenomenon according to another phenomenon (Lakoff & Johnson, 2005). According to Aydın (2010), metaphor refers to an individual's expressing a concept or a phenomenon in the way s/he understands it with the help of similes. In the present study, the purpose of metaphor use was to reveal pre-service teachers' mental images regarding social media and to better understand social media use. In this respect, the present study aimed to reveal Turkish and Swedish pre-service teachers' perceptions regarding social media via metaphors.

2. Literature Review

Recently there has been an increase in the methods used to investigate student perceptions of social media. In a study on self-regulated learning and social media among teachers in the Netherlands, Matzat and Vrieling (2016) found that teachers who practiced self-regulated learning in their classroom were more inclined to use social media. Using a narrative methodology, Turvey (2012) captured and conceptualised perceptions and experiences of teachers on an initial teachers education programme regarding SNSs and professional practice. Using both qualitative and quantitative methods, Neier and Zayer (2015) investigated perceptions and experiences of students in a US university regarding social media in education. The researchers showed that the students viewed some potential in using social media as a learning tool and that the students were however cautious as to which tool and what the purpose could be.

A survey study conducted in Pakistan by Soomro et al. (2014) with pre-service teachers and teacher educators aimed at understanding their experiences and attitudes toward SNSs for collaborative learning showed that their motives were limited to social purposes. Recepoğlu and Ergün (2013) analysed Turkish pre-service teachers' perceptions about their media literacy and found that their perception about their media literacy competence was high. US pre-service teachers' participation and perceptions of twitter was investigated through a multiple case-study design (Luo, Sickel, & Cheng, 2017), showing that prior perceptions had significant impact on the pre-service teachers' perceived usefulness. Kitsantas et al. (2016) examined college students in the US and their perceptions on positive and negative effects of SNS. Perceptions on positive effects included gathering information, communicating, and engaging in studies. Negative perceptions included distraction and emotional health factors. Sendurur et al. (2015) have applied

an open-ended questionnaire to 426 teachers from Turkey in order to determine their views about the daily use of SNSs, and they showed that the most commonly expressed advantage of SNSs is interaction with friends, exchange of files and information about courses. They also stated in their study that SNSs had the potential to be used as educational tools. Finally, pre-service teachers' perceptions of social media were explored through the use of metaphors by Köseoglu (2018) showing that pre-service teachers perceived social media both positively and negatively, as educational, technological, entertaining, and as an integral part of life.

3. Methodology

3.1. Research Design

In this research, a phenomenology approach was used implying a qualitative research method. Simply, phenomenology can be defined as a research approach that aims to define the essence of a phenomenon from the perspectives of those who have experienced that phenomenon (Teherani et al., 2015). By examining individuals' views about a phenomena they have personally experienced, studies conducted using the phenomenological approach aim to reveal the cognitive structures in their minds (Creswell, 2015). In such studies, open-ended questions could be used as a data collection tool together with the in-depth interview method or written data (Christensen, Johnson, & Turner, 2011).

3.2. Participants

The participants of the study included 201 pre-service teachers studying at two state universities, one in Turkey and the other in Sweden, in the spring term of the 2018-2019 academic year. While the Turkish sample consisted of 118 pre-service teachers from different departments of faculty of education, the participants from Sweden were 83 pre-service teachers from teacher-training programs spanning from the earlier years of compulsory school to upper secondary school. The participants were determined using the convenience sampling method, one of purposeful sampling methods.

3.3. Data Collection

In the study, metaphors were used to reveal pre-service teachers' perceptions of social media. In order to reveal the perceptions of the participants with metaphors, a form including an open-ended question (Social Media is like ..., because ...) was prepared. The open-ended question was directed to the Swedish pre-service teachers in English and to the Turkish pre-service teachers in Turkish. Following this, the pre-service teachers were asked to complete the open-ended question given. The data collected from the Turkish pre-service teachers were translated into English, and the data collected from the Swedish pre-service teachers were reported in its original language.

3.4. Data Analysis

In the study, content analysis method was used to analyze the data collected. Content analysis is a technique mostly used in the social sciences. The main purpose of content analysis is to explicate concepts and relationships that will provide an opportunity to understand the data collected. Through content analysis, phenomena that may be hidden or implicit in the data are articulated, and concepts and themes similar to each other are combined and interpreted in a language that the reader will be able to understand (Yıldırım & Şimşek, 2011).

While analyzing the data, these phases were followed: (1) numbering/elimination, (2) category development, and (4) ensuring validity and reliability.

Numbering/elimination: In this phase, each form filled in by the participants was numbered, and the metaphors produced were examined. The statements which were not full or relevant were not included in the analysis. In the end, among the 201 sentences, 193 of them were taken into consideration.

Category development: In this phase, a total of 193 statements (81 of them from Swedish pre-service teachers, 112 of them from Turkish pre-service teachers) were associated with a certain theme and divided into groups based on the similarities and differences. By associating each group with a specific theme, 11 categories were created in the Turkish group, and 12 categories were created in Swedish group separately.

Validity and reliability: In order to ensure the validity of the study, the data collection and analysis process was described in detail. In addition, the research data were supported with the quotations of the participants. In the study, to ensure the reliability, first, the metaphors were matched with conceptual categories by the two researchers. Following this, an expert on qualitative research was asked to write down the metaphors in the related category. Next, the groupings by the expert and by the researchers were compared. The number of the agreements and disagreements revealed via the comparisons helped determine the reliability of the study. By using the formula put forward by Miles and Hubarman (1994), the reliability was calculated. The fit between the expert and the researchers was calculated as 92%. Since this value was over .90, a desirable level of reliability was achieved.

For the analysis of the data, qualitative analysis software, Nvivo 12.0, was used. Frequencies and percentages were used for the interpretation of the data via content analysis. In addition, direct quotations were included to reflect the participants' perceptions on social media.

4. Results

The findings obtained from the pre-service teachers with the help of content analysis were evaluated under two headings: the pre-service teachers' perceptions of social media in Turkey and in Sweden.

4.1. The Pre-service Teachers' Perceptions of Social Media in Turkey

Themes and examples of metaphors obtained from the pre-service teachers' views on social media in Turkey are shown in Table 1.

Table 1.

Themes and examples of metaphors related to the pre-service teachers' perceptions of social media in Turkey

Themes	Sub-Themes	f	%	Examples of Metaphors
Source of information		29	24,4	News source Information dissemination tool
Communication		15	12,6	Communication network Communication tool
Useful or harmful according to use		8	6,7	Something both sweet and also bitter Knife
Part of everyday life		7	5,9	Life Bread-water
Self-presentation/Social comparison		6	5,0	Insincerity Incentive tool
Education		5	4,2	School Computer
Ease		5	4,2	A tool making life easier To get things done shortly
Development		3	2,5	Change
Spending time		2	1,7	Friend
Sharing		1	0,8	Information exchange tool
Game		1	0,8	A game platform
Negative aspects	Addiction	23	19,3	Alcohol Cigarettes
	Waste of time/Nonsense	9	7,6	Waste of time Unnecessary tool
	A tool limiting communication	5	4,2	Non-communication Isolation from society

As can be seen in Table 1, 11 themes were created within the framework of the common features of the perceptions obtained from the pre-service teachers from Turkey. It was found that the pre-service teachers associated social media mostly with the themes of "source of information", "communication" and "negative aspects". The other themes were "useful or harmful according to use", "part of everyday life", "self-presentation/social comparison", "education", "ease", "development", "spending time", "sharing" and "game". When their negative opinions about social media were analyzed, it was seen that three sub-themes emerged as "addiction", "waste of time/nonsense", and "the tool limiting communication".

The pre-service teachers from Turkey who associated social media with the "source of information" mostly emphasized the capabilities of social media such as accessing information quickly and easily and following current news in the world and in their country instantly. Moreover, many pre-service teachers referred to social media as an environment in which they could learn about the lives of others and reflect the information learned:

"Social media is like a news source because I sometimes learn via social media what I don't know."

"Social media is like information exchange tool because we can easily reach a large amount of information and a great number of up-to-date developments with the help of social media."

Another category that the pre-service teachers associated mostly with social media was "communication". In this category, the pre-service teachers from Turkey stated that social media facilitated communication and allowed them to keep in touch with distant people and with the family, friends and relatives around them. One of the pre-service teachers stated that social media is the easiest way to stay in touch with the world:

"Social media is like a communication tool because thanks to social media, I can communicate with distant relatives and friends."

"Social media is like a communication network because I can communicate with people around me in this way, and I am aware of them."

In the category of "useful or harmful according to use", many pre-service teachers pointed out that social media might have benefits or harms depending on the intention and intensity/amount of its use. The pre-service teachers thought that social media could be beneficial when used consciously in a moderate amount of time or could harm the person if used excessively. One pre-service teacher stated that social media contained useful and harmful information:

"Social media is both sweet and bitter because its intended use can be true or false. It depends on the person."

"Social media is like medicine because it provides benefits as long as it is used correctly and consciously."

In the category of "part of everyday life", the pre-service teachers perceived social media as a basic need and an indispensable part of their lives:

"Social media is like food because it has become a mandatory basic need of our lives."

"Social media is like bread and water because now it is a must for many of us."

When the "self-presentation/social comparison" category was analyzed, the pre-service teachers saw social media as a platform where users try to show themselves differently and to reflect their traits in they want and where other people's lives seem to be more attractive:

"Social media is like incentive tool because other lives are always attractive."

"Social media is like utopia because nobody is as smart, beautiful, fun and cool as on social media."

It was found that the pre-service teachers from Turkey did not associate social media mostly with education and that the pre-service teachers who associated it with education mostly emphasized "access to information" (See Table 2). While some pre-service teachers stated that social media facilitated their education life and that a lot of information about the courses could be accessed via social media, one of the pre-service teachers thought that social media speeded up their research which he/she had done.

"Social media is like practicality because it is important in terms of facilitating our work and education life."

"Social media is like a school because we can get information about the lessons from there."

The pre-service teachers from Turkey had a lot of negative opinions about social media. When the negative opinions were examined, social media was associated mostly with the category of "addiction" (see Table 1). In this category, the pre-service teachers stated that social media was addictive and difficult to quit after starting to use social media:

"Social media is like a black hole because there are so many things on social media that attract people, and once you get inside, you cannot get away from it."

"Social media is like a cigarette because it is hard to stop once you start using it."

Another category that the pre-service teachers related mostly to the negative aspects of social media was "waste of time/nonsense". In this category, many pre-service teachers defined social media as a waste of time and emphasized that too much time was spent on social media. Some of the pre-service teachers characterized social media as a tool that prevented the development of individuals and was thus of no use:

"Social media is like a waste of time because I think it does nothing but a time loss."

"Social media is like an unnecessary information pit because the individuals' intended use is not at a level to benefit people."

4.2. The Pre-service Teachers' Perceptions of Social Media in Sweden

The categories obtained from the views of the pre-service teachers from Sweden about social media are shown in Table 2.

Table 2

Themes and examples of metaphors related to the pre-service teachers' perceptions of social media in Sweden

Themes	Sub-Themes	f	%	Examples of Metaphors
Communication		51	39,8	A network A meeting place
Source of information		34	26,6	A knowledge bank A news feed
Sharing/Social presence		8	6,3	Visibility Confirmation
Self-presentation/Social comparison		8	6,3	Ideal body Peer pressure
Education		6	4,7	Teaching tool Inspiration tool
Ease		4	3,1	Easy way to keep in touch Easy access
Entertainment/Stress relief		3	2,3	A relaxation place
Part of everyday life		2	1,6	A natural part of everyday life
Shopping		2	1,6	Marketing in fitness
Development		2	1,6	A supplementary world
Source criticism		2	1,6	Source criticism

Spending time		1	0,8	Pastime
Negative aspects	Waste of time/Nonsense	3	2,3	Nonsense
	Addiction	2	1,6	Excessive

As can be seen in Table 2, 12 different themes were created within the framework of the common features of the perceptions obtained from the pre-service teachers from Sweden. The pre-service teachers in Sweden associated social media mostly with “source of information” and “communication”. The other categories were "negative aspects", "sharing/social presence", “Self-presentation/Social comparison”, "education", "ease", "entertainment/stress relief", "part of everyday life", "shopping", "development", "source criticism" and "spending time". When the negative opinions about social media were analyzed, two sub-themes emerged as “waste of time/nonsense” and “addiction”.

The pre-service teachers from Sweden associated social media mostly with "communication" (see Table 2). In this category, the pre-service teachers from Sweden associated social media mostly with communicating and maintaining contact with family, relatives and friends around them and with whom they often could not meet face-to-face in real life. Some of the pre-service teachers emphasized such capabilities of social media as communicating quickly and easily, meeting new people, reaching many people at the same time, using multimedia (such as pictures, videos) in communication and holding social meetings:

> *“Social media is like communication system because you can have contact with many in a simple way and with people all over the world. “*

> *“Social media is like a communication network because I can communicate with my friends, get to know new people and maintaining contacts”*

Another category that the pre-service teachers from Sweden associated mostly with social media was “source of information”. In this category, the pre-service teachers associated social media mostly with being aware of the events which developed around the world and which were related to different interests, activities and magazines. Some pre-service teachers stated that they could access all kinds of information on social media:

> *“Social media is like a knowledge bank because everything is available online”*

> *“Social media is like a news feed because news about what's happening in the world is easy to reach and is collected in one place today.”*

In addition, in the context of “source of information”, most of the pre-service teachers used expressions for social media like getting information easily about what people do in their personal lives and about their thoughts, while some pre-service teachers perceived social media as a way to get inspiration from other people:

> *“Social media is like a source of information because I use it daily to find info and keep me updated on what friends and relatives do.”*

> *“Social media is like inspiration because you can observe and draw inspiration from others.”*

In the context of “sharing/social presence”, the pre-service teachers associated social media mostly with information and photo sharing. In addition, they emphasized such capabilities of social media such as attention-drawing, confirmation and social presence:

> *“Social media is like confirmation because I get attention”*

> *“Social media is like visibility because it is to get likes and views. It's good to be seen.”*

In the context of "self-presentation/social comparison", the pre-service teachers perceived social media mostly as a platform where people gave a positive or unrealistic image about themselves and compared people's lives with others to get social acceptance:

> *"Social media is like a peer pressure because you must perform in order to be socially accepted. People compare their lives with each other and no one would be worse than others."*

> *"Social media is like ideal body because they show things that are either not true or publish such that gives a favorable image of themselves"*

The pre-service teachers from Sweden did not associate social media mostly with "education" like the pre-service teachers from Turkey, and the teachers who associated it with "education" perceived social media mostly as an informal learning tool. In this category, the opinions of the pre-service teachers were gathered under three sub-themes: communication, exchange of information and inspiration. It was found that the pre-service teachers associated social media mostly with communicating with their classmates and colleagues. They also stated that groups could be created on social media and that information could be shared via these groups quickly. Some pre-service teachers used expressions for social networks as a way of getting inspiration from different ideas in creating more educational materials and creative activities:

> *"Social media is like teaching tool because it (Facebook) is easily accessible and it is easy to connect with others in the class, and groups that are working on similar things, for example 'thing of the day', a way to work in school."*

> *"Social media is like inspiration tool because you can find inspiration for the creation of educational materials and other creative activities. It is easy to search for what you are interested in, so you can get ideas for teaching aids among other things."*

5. Discussion

According to the findings of the present study, the pre-service teachers from Turkey associated social media mostly with the categories of "negative aspects", "source of information" and "communication", while a majority of pre-service teachers from Sweden associated social media with "communication" and "source of information".

The pre-service teachers from Turkey and Sweden who viewed social media as a source of information referred to social media's ability to access information quickly and easily, to learn about others' thoughts and lives, to follow current news and events. The pre-service teachers in Sweden differently from those in Turkey perceived social media as a way of getting inspiration from other people. In addition, the pre-service teachers from Sweden emphasized getting information about people's lives and thoughts more than the teachers from Turkey. Similarly, a study with Swedish participants found that a vast majority of participants viewed Facebook as a way to update information about their friends' lives (Denti et al., 2012). In addition, the pre-service teachers in both groups did not place much emphasis on sharing, and they associated social media mostly with access to information. According to the results of the present study, it could be stated that the pre-service teachers mostly used SNSs for viewing rather than posting and were passive recipients of information, and these findings support those of Hamade (2013). According to another finding of the present study, the pre-service teachers from Sweden who associated social media with communication perceived it as an easy way to keep in touch with people whom they often could not meet in real life and to communicate with friends, family and relatives. Similarly, the pre-service teachers from Turkey perceived social media mostly as a way to communicate with family, friends and other people. Similar findings were found in other studies conducted with pre-service teachers and university students in literature. For instance, in a study conducted with pre-service teachers from Turkey, the main reason for the pre-service teachers' SNS usage was to communicate with friends whom they did not meet frequently (Sendurur et al., 2015). When studies carried out in Sweden are examined, it is similarly seen that the main reasons for using

Facebook are to communicate and to maintain existing social contacts (Aghazamani, 2010; Denti et al., 2012). Although they may differ in certain Internet applications, people often use internet technologies to access information in a practical way, spend their free time and communicate properly with others (Alhabash & Ma, 2017; Balakrishnan & Griffiths, 2017; Khan, 2017; Kim, Sohn, & Choi, 2011). Similarly, in many studies conducted with university students in literature, it is reported that the positive aspects of SNSs and the reasons for primary use are mostly communication and access to information (Hamade, 2013; Haneefa & Sumitha, 2011; Kitsantas et al., 2015; Mirabolghasemi et al., 2016; Pempek, Yermolayeva, & Calvert, 2009; Sendurur et al., 2015). In the present study, the pre-service teachers might have associated social networks mostly with sources of information and communication as they mostly used social media to communicate and access to information.

According to another finding of the study, the pre-service teachers from Turkey and Sweden associated social media with self-presentation/social comparison. In this category, the pre-service teachers perceived social media as a platform where people compared their lives with each other and gave an unreal or positive image about themselves to receive social acceptance. Facebook is an attractive platform for self-presentation because users can take their time to strategically construct online personalities that emphasize the traits they desire mostly (Gonzales & Hancock, 2011). The structure of SNSs suitable for self-presentation and other opportunities that are provided by SNSs may affect social comparison activities and results (Cramer, Song, & Drent, 2016). Given SNS users' access to more people than ever before (Denti et al., 2012), the density of information and the wide range of available multimedia content, Facebook and other relevant SNSs provide an ample opportunity to make social comparisons (Denti et al., 2012; Haferkamp & Kramer, 2011; Vogel, Rose, Roberts, & Eckles, 2014). On these sites, people tend to present themselves positively in their social network profiles (Chou & Edge, 2012; Denti et al., 2012). For example, Denti et al (2012), who conducted Facebook-related studies in Sweden, stated that the participants shared things that were positive or important, and the distress and bad emotions were less common. He also noted that younger users were more likely to make social comparisons because they spent more time on Facebook.

In the present study, the pre-service teachers from Turkey had a high level of negative opinions about social media, but this level was low for those from Sweden. The pre-service teachers from Turkey mostly stated that social media was addictive and that a lot of time was spent on social media. In addition, some pre-service teachers viewed social media as a useless tool. When studies in literature are reviewed, similar findings were obtained in previous studies conducted with pre-service teachers from Turkey (Erdem, Alkan, & Erdem, 2017; Köseoğlu, 2018; Sendurur et al., 2015). In some studies, university students in Turkey were social media addicts at moderate and low levels (Keçe, 2016; Kırcaburun, 2016; Şahin, 2017). Also, according to the 2020 report of We are Social Media Agency, which examined individuals' daily average usage time of social media, Turkey is above the world average ranking the 15th among 46 countries (2.51 minutes), while Sweden is below the world average ranking the 35th (1.48 minutes) (Kemp, 2020). Accordingly, pre-service teachers in Turkey might have emphasized addiction more than those in Sweden as they spend much more time in SNSs.

In the context of education, pre-service teachers from Turkey emphasized social media's capability of accessibility to information about the lessons. On the other hand, the Swedish pre-service teachers mostly used expressions to communicate with their classmates and colleagues for social media. They also emphasized social media's abilities of inspiration from others and exchange of information through groups in the process of creating educational materials and creative events. It could be stated that the great majority of pre-service teachers in both groups did not associate social media with education directly, and those who associated emphasized mostly the informal use of social media in education. It is reported in many studies that pre-service teachers use SNSs for educational purposes at a low level and that they use them mostly for social purposes (Hughes et al., 2015; Sendurur et al., 2015; Somroo et al., 2014). In addition, similar findings were obtained in other studies conducted with university students. For example, as a result of review of the literature, Hew (2011) found that the educational Facebook usage of students and teachers

was low. Hrastinski and Aghaee (2012) stated that Swedish university students used SNSs extensively, but few of them felt that they used SNSs to support their academic studies. Its use for educational purposes is mostly for short questions and answers and to coordinate group work and to share files. Prescott et al. (2013) stated that university students are cautious about using SNSs as a formal learning tool, and they are willing to use it mostly for lessons related to communication and informal learning enabling access to information and resources. These studies support the findings of the present study.

6. Conclusion and Future Research

In this study, the pre-service teachers' perceptions of social media in Turkey and Sweden were investigated through the use of metaphors. According to the results of the present study, the pre-service teachers in both Turkey and Sweden perceived social media mostly as a tool for communication and access to information, and a few of them perceived it as a tool for education. SNSs have been claimed to have the potential to increase the quality of teaching activities in teacher education (Sendurur et al., 2015). Failure of pre-service teachers to raise awareness of the educational potential of SNSs may affect their use of SNSs as an educational tool in the future. Vidal, Martínez, Fortuño, and Cervera (2011) stated that the greater the awareness and use of SNSs, the greater the expected educational benefit. In this context, it will be an important contribution for teacher educators to realize more applications to support the use of SNSs in formal or informal ways in order to expand awareness about the use of SNSs in educational environments. Therefore, more research is needed on different teaching methods and techniques that can help instructors make decisions to increase the effectiveness of the use of SNSs in educational settings. Another finding of the present study was that the pre-service teachers especially in Turkey had a high level of negative perceptions of social media. This rate was low for the pre-service teachers in Sweden. Although there are some discussions about the reasons for this result in the present study, in-depth qualitative research may be conducted in the future.

This study focused on pre-service teachers' perceptions of general social media. Information about which SNSs are used by participants and their experiences related to this use were not included in this study. There are differences and similarities between SNSs such as Facebook, Twitter and Instagram. Therefore, different experiences of pre-service teachers about different SNSs may change their perceptions regarding SNSs. In this context, the inclusion of more specific information about pre-service teachers' SNS usage in future studies could help reveal pre-service teachers' perceptions of SNSs. Additionally, this study was conducted by collecting qualitative data from a limited number of participants from two universities in Turkey and Sweden. For this reason, quantitative studies to be conducted using a questionnaire with a higher number of participants could yield different results, and these findings could be generalized to a larger population.

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English language teaching and learning during Covid-19: A global perspective on the first year

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Abstract

The world recently witnessed the unexpected emergence of a coronavirus that caused the Covid-19 pandemic and severely impacted all aspects of human life. The sudden lockdown that came with the announcement of the pandemic affected health systems, the world economy and, inevitably, education systems across the globe. Due to the pandemic, schools and universities were closed, face-to-face education was suspended and a shift to emergency online teaching was instituted. English language training took its share in this transition and several studies were conducted to investigate the effects of the pandemic on emergency online teaching and the learning of English. This integrative literature review study analyses and synthesizes the research studies conducted between March 2020 and February 2021 to illustrate the first year of the pandemic in terms of English language teaching and learning globally. Thus, 69 research studies were selected for analysis. Findings show that the emergency online teaching and learning of English mainly created challenges due to the internet connection problems and students' access to computer or smart phones. On the other hand, contributing the teachers' digital literacy skills, the significance of online teaching and learning in case of emergency situations was highlighted as the findings showed. The studies produced conflicting results in terms of the implementation of emergency online teaching and learning practices, English language teachers and students' perceptions and attitudes, the affective, motivational and cognitive aspects, and the impact of emergency online teaching on the language development of students.

1. Introduction

The emergence of the novel coronavirus known as Covid-19 and the pandemic announced by the World Health Organization (WHO, 2020) following the rapid spread of the virus across borders created an unexpected lockdown in nearly all parts of the world. The uncertainty caused by the pandemic challenged almost all aspects of human life, including the field of education. In this situation, schools and higher education institutions across the globe needed to end face-to-face education and continue through online courses, which created confusion and directly impacted all stakeholders such as students, teachers, families and administrators. According to UNESCO (2020), more than 90% of students all over the world were affected directly or indirectly by school closures and emergency online learning. New data reported by UNESCO (2021) shows that nearly 1.5 billion students across the world have been affected by this sudden change in instructional delivery, and more than 800 million students have experienced serious challenges in terms of disruption to their education. According to this report, 31 countries implemented full school

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closures while 48 countries continued their education via reduced and part-time schedules. At the same time, to mitigate the pandemic in this transition period, several academic fields were seriously affected, and the teaching of English was not an exception.

Due to English being the lingua franca, it is taught in almost all segments of education from kindergarten to higher education across the world (Baird & Baird, 2018; Deniz et al., 2016; Nunan, 2003). Considering this long-established value of English among other world languages (Li et al., 2020), the teaching and learning of English proportionally shared the problems caused by the pandemic. However, one advantage that most language teachers and learners gained during this period of uncertainty is that online teaching of English was already being practised prior to the Covid-19 outbreak and some English language teachers and learners have become accustomed to online lessons in English courses (Atmojo & Nugroho, 2020). In fact, as Bailey and Lee (2020) assert, Computer Assisted Language Learning (CALL) has been used for language teaching and learning purposes for more than 40 years. With the advances in technology, English language teaching and learning evolved considerably, which paved the way for online language learning. Thus, the teaching of English through online or distance courses is not a new phenomenon, yet the urgent transition to emergency online language teaching may exhibit certain challenges for teachers and students.

The transition to remote teaching worldwide created a need to differentiate the terms used for the modes of instructional delivery. Generally, online learning and emergency remote teaching are used interchangeably to refer to the case of teachers and students' practices during the pandemic period, which started in March 2020 and has continued since then. However, Hodges et al., (2020a) explained that online teaching, like face-to-face teaching, was a planned activity from the very beginning. Nevertheless, they highlighted that emergency remote teaching (ERT) is a solution provided as an alternative to customary education modes due to the crisis circumstances. Emergency remote teaching is different from online and face-to-face education in a number of ways; it is a temporary change in educational delivery and occurs suddenly in an unplanned manner. The temporary nature of emergency remote teaching comes from the fact that when the crisis mitigates or ends, then face-to-face, online, or blended education will take the place of emergency remote teaching. Thus, creating an alternative and temporary solution to provide access to education in a reliable way during times of emergency, the emergency remote teaching approach differs from online teaching, although they may be considered the same in some respects. Although emergency remote teaching may not necessarily require online instruction or technology in its delivery, as Moser et al. (2021) stated, the remote teaching implemented during the Covid-19 pandemic has mostly been based on the online format. Thus, throughout this study, emergency online teaching or learning (EOT-L) will be referred to for any emergency remote teaching activity based on online teaching.

From the onset of the Covid-19 pandemic, several research studies were conducted that focused on various aspects of emergency online teaching in different disciplines and fields in education. Ranging from science to geography in different segments of education, the effects of Covid-19 were studied in the literature (see, for example, Schultz & DeMers, 2020; Naji et al., 2020). On the other hand, due to the unplanned nature of emergency online teaching, the studies focused on various aspects of education involving, for instance, the availability of online teaching resources and tools (Dhawan, 2020), the effects of the pandemic on teachers (Talidong & Toquero, 2020), instructors' teaching practices, strategies and activities (König et al., 2020; Mahmood, 2020; Noor et al., 2020; Rapanta et al., 2020), the students (Coman et al., 2020; Shahzad et al., 2020; Son et al., 2020), key challenges or opportunities (Adedoyin & Soykan, 2020; Donitsa-Schmidt & Ramot, 2020; Heng & Sol, 2020), and policy management in education (Zhang et al., 2020).

Regarding English language teaching and learning through emergency online teaching, several research studies were conducted dealing with various aspects involving teachers, students, teaching practices, technological resources, teaching platforms, and the teaching of language skills from primary to university education (see, for example, Andriivna et al., 2020; Jones, 2020; Maican & Cocoradă, 2021; Nartiningrum & Nugroho, 2020; Russell, 2020; Sepulveda-Escobar & Morrison, 2020). In fact, not only for the existing situation of English language teaching during emergency online teaching but also for the occurrence of a

crisis in the future necessitating a sudden shift to emergency teaching, the evidence and experience gathered from research studies may provide valuable insights into the nature of English language teaching in such periods.

Building upon research findings based on the challenges faced, solutions to problems, the advantages or disadvantages of emergency online teaching, teaching practices and platforms, technological resources and student and teacher-related issues, the general picture of English language teaching requires a comprehensive study based on an integrative literature review. When the literature is reviewed, it is seen that there is a critical gap in terms of an integrative literature review study reviewing and synthesizing studies in the existing literature for this critical period. The first-year experience of the Covid-19 pandemic taking language teaching and learning within emergency online education is significant for some reasons. Initially, it is critical for the researchers, academics, English language teachers, students and the related stakeholders to understand the global impact of the pandemic specifically on language education. Next, learning from the weaknesses and strengths of the emergency online teaching and learning from a global perspective may guide the program designers, teachers, students, families and school administrators in increasing the effectiveness and efficiency of language teaching during such critical periods. From the research perspective, drawing generalizable conclusions is possible through integrative review studies. Thus, a review study illuminating the world's experience of emergency online teaching of English language in the first year of the Covid-19 pandemic may provide critical insights into the pedagogical and techno-pedagogical aspects. With this aim in mind, and based on English language teaching/learning related studies, this study seeks answers to the following research questions:

1- What are the commonalities of the Covid-19 studies regarding their focus, participants, education segment and country?

2- What is the impact of the Covid-19 pandemic on English language learning and teaching on a global scale in terms of the implementation of emergency online teaching and learning based on;

a) strengths, weaknesses, and challenges as well as opportunities

b) the effectiveness of online platforms and learning management systems

c) language skills development and language courses?

3- What are language teachers and students' attitudes and motivations towards emergency online teaching and learning?

2. Methodology

The primary purpose of this study is to gain a deeper understanding of the global aspects of English language teaching during the first year of the Covid-19 pandemic. This study was therefore designed as a descriptive study making use of the qualitative approach based on a systematic integrative literature review. Integrative literature review as a distinctive research method aims at creating new knowledge by reviewing, synthesizing, evaluating, and setting new frameworks making use of the representative literature on a specific topic (Torraco, 2005). Integrative literature studies are conducted in a systematically way to generate generalizable data on the topic that is under scrutiny. In this integrative literature review study, document analysis was used to collect the necessary data. According to Bowen (2009), document analysis is a procedure for reviewing or evaluating documents which is then used for interpreting and eliciting the meaning to gain an understanding and develop empirical knowledge. At the same time, the integrative literature review aims at synthesizing the existing research knowledge by identifying gaps in the current research, answering new questions, and determining the direction of research tendencies in future studies (Russell, 2005).

2.1. Procedure

From the onset of Covid-19 until the present, namely, in the first year of the pandemic, many studies were conducted and published in various countries regarding English language teaching and learning. The data used in this study comes from those studies conducted within the first year of the pandemic. In selecting the documents, the research studies published were examined and processed every three months based on certain criteria. Starting from March 2020, the online databases were checked every three months to find new research documents. While searching for research papers, firstly, the studies that were conducted during the pandemic based on English language teaching were selected. In this process, peer-reviewed and data-driven research studies in various indexed journals were utilized. Mainly, SSCI (Social Sciences Citation Index), ERIC (Education Resources Information Centre), Scopus, ESCI, DOAJ (Directory of Open Access Journals), ERIH Plus, Index Copernicus, ULAKBIM, and other related indexed journals were searched while selecting studies as the documents for this review.

The search for research studies as the documents to be used for the analysis in this study was conducted online with a number of keyword combinations. While searching for the documents, "Covid-19 + English language + teaching", "Covid-19 + English language + learning", "pandemic + English + language + learning/teaching", "coronavirus + English language + learning", "lockdown + English language + learning/teaching", "English", "language", "teaching", "learning", "EFL", and "ESL" key word combinations were used interchangeably and separately in each search on Clarivate, Wiley online, Taylor and Francis Online, Elsevier, MDPI, Springer, Emerald Insight, De Gruyter, Sage, Frontiers, ERIC, Google Scholar, Mendeley, ResearchGate, academia.edu and Dergipark (Turkey) online websites as well as other related journal websites on the net. The studies found were carefully checked based on the inclusion criteria, and those which were published in languages other than English, ones that did not include the keywords above in their titles or abstracts, and papers that were not based on research data (such as reports, etc.), conference proceedings and book chapters were omitted as being outside the scope of this study.

Following the search for documents in the form of research studies focusing on English language teaching and learning during the pandemic, several studies were excluded as not fitting into the scope of the research. Finally, a total of 69 research studies carried out in different countries around the world were selected for analysis, as shown in Table 1 below.

Table 1.

Studies analyzed as the documents of this study.

Study Focus	Authors	N
English language related studies during the Covid-19 process (between March 2020 and February 2021)	(Aji et al., 2020; Allo, 2020; Almekhlafy, 2020; Andriivna et al., 2020; Ariyanti, 2020; Astuti & Solikhah, 2021; Atmojo & Nugroho, 2020; Bailey & Lee, 2020; Chiatoh & Chia, 2020; Dahmash, 2020; Davies et al., 2020; Destianingsih & Satria, 2020; Farrah & Al-Bakry, 2020; Fatima, 2020; Fitria, 2020; Forrester, 2020; Fuad et al., 2020; Fuentes Hernández et al., 2020; Gao & Zhang, 2020; Hadianti & Arisandi, 2020; Hafidz, 2020; Hakim, 2020; Hamid, 2020; Hartshorn & Mcmurry, 2020; Hazaea et al., 2021; Hodges et al., 2020b; Hopp & Thoma, 2020; Huang et al., 2021; Kamhi-Stein et al., 2020; Karakuzu et al., 2020; Karataş & Tuncer, 2020; Karim & Hasan, 2020; Kawinkoonlasate, 2020; Khafaga, 2021; Kholis, 2020; Krishan et al., 2020; Kusumawati, 2020; Li et al., 2020; Lie et al., 2020; Loo, 2020; Luporini, 2020; MacIntyre et al., 2020; Maican & Cocoradă, 2021; Marstaller, 2020; Mohanad Alfiras et al., 2020; Moser et al., 2021; Mustadi et al., 2021; Nartiningrum & Nugroho, 2020; Ng, 2020; Novikov, 2020; Patricia Aguilera-Hermida, 2020;	69

	Popova & Rozhdestvenskaya, 2020; Pustika, 2020; Rahayu & Wirza, 2020; Rahman, 2020; Rifiyanti, 2020; Rinekso & Muslim, 2020; Şendoğan Erdoğan, 2020; Sepulveda-Escobar & Morrison, 2020; Setyaningrum et al., 2020; Shaaban, 2020; Shahzad et al., 2020; Situmorang et al., 2020; Svalina & Ivić, 2020; Turchi et al., 2020; Wen & Hua, 2020; Wong, 2020; Yi & Jang, 2020; Zboun & Farrah, 2021)

The selected studies shown in Table 1 were analyzed in terms of English language teaching and learning on a global scale during the Covid-19 pandemic. In the analysis of the data based on which research questions were formulated, recurrent themes and sub-themes were identified and tabulated using a six-step iterative and reflective thematic analysis for reliability with the help of a co-analyzer:

Step 1: familiarization with data

Step 2: generating initial codes

Step 3: searching for themes

Step 4: reviewing themes

Step 5: defining and naming themes

Step 6: producing the report (Nowell et al., 2017).

In the thematic analysis, the documents as the research articles utilized in this study were initially grouped by two analyzers and based on their findings they were coded in terms of their focus. The analyzers individually created their own themes and categories. While doing so, the recurring themes were grouped for categories and reviewed by more focused re-reading as specified by Bowen (2009). In case of disagreement in terms of selecting the recurrent themes and categories, the analyzers worked on the themes from the beginning and tried to reach agreement through discussing the classification of the data. The final themes of the analyzers were compiled then, and the final version following the constant comparison was tabulated.

2.2. Findings

This integrative review aimed at understanding the features and findings of research studies carried out specifically during the Covid-19 pandemic period focusing on English language teaching and learning across the world. In the analysis of research papers covering the first year of the pandemic in terms of English language teaching and learning from the global perspective, the findings conflicted somewhat in the addressed research questions.

2.2.1. Findings of the first research question based on the commonalities of the studies based on their study focus, participants, education segment and country

Analysis of the papers revealed that the focus of the studies utilized as the documents of this study was grouped under two major themes along with their sub-themes. The major focus of the studies was related to 'the impact of Covid-19 on English language teaching and learning' (n=47, 68.1%) which included four different sub-themes, as seen in Table 2. Also, the second recurrent theme was perceptions and attitudes towards online language teaching and learning (n=22, 31.9%). It should be noted here that some studies included a focus in other categories. However, this categorization was made considering the main purpose of the studies and their research questions.

When the participants of the studies were examined, findings showed that the data from Covid-19-related studies in the field of English language teaching were collected from students studying in various segments of education (K-12 or university) (n=33, 47.8%), teachers (n=31, 44.9%) and both (n=5, 7.2%). In terms of the educational segments from primary to tertiary education, a great majority of the studies were conducted

in tertiary education (n=53, 76.8%) and the others in K-12 (n=16,23.2%) during the pandemic. Finally, the examined studies as the research documents of this study were conducted in various countries around the world including Bahrain, Cameroon, Chile, China, Colombia, Croatia, Germany, Hong Kong, Indonesia (as the country where the highest number of language related studies were conducted), Ireland, Italy, Malaysia, Oman, Pakistan, Palestine, Romania, Russia, Saudi Arabia, Singapore, South Korea, Thailand, the USA, Turkey and Ukraine. In this respect, it can be said that this integrative study strongly reflects the teaching and learning of the English language on a global perspective during the Covid-19 outbreak and its impact on this field across the world.

The thematic analysis of the data for the research questions below was tabulated to make data and findings manageable. For recurrent themes and sub-themes based on the research questions, please see Table 2.

Table 2.

Summary of thematic analysis for studies related to English language teaching and learning worldwide during Covid-19

Themes	Sub-themes	n	%
The impact of Covid-19 on English language teaching and learning	Implementation of emergency online teaching & learning.	47	68.1
	Strengths, Challenges, Weaknesses, Opportunities.		
	Effectiveness of online platforms and educational technologies.		
	Impact of pandemic on language skills and language related courses.		
Perceptions and attitudes towards emergency online teaching & learning	Perceptions and attitudes of teachers and students.	22	31.9
	Affective, cognitive, motivational, and other related aspects.		

2.2.2. Findings of the second research question based on the impact of Covid-19 on English language teaching and learning from the global perspective

As evidenced by almost all the findings, the abrupt transition to emergency online teaching was the most direct impact of the Covid-19 pandemic on English language teaching (Moser et al., 2021; Novikov, 2020; Turchi et al., 2020). Specifically, results showed that online teaching has gained a permanent status as the preferred mode of teaching for English, even for the post-pandemic period, although it was, initially, an option to mitigate the effects of the pandemic (Andriivna et al., 2020; Karakuzu et al., 2020; Scully et al., 2021).

The transition to online teaching or emergency remote teaching impacted the teaching of English from several viewpoints. The findings showed that the institutions, teachers and students as well as other stakeholders were caught off-guard, and due to the unplanned abrupt transition to remote teaching, the teaching and learning practices of English language courses were transformed (Andriivna et al., 2020; Moser et al., 2021; Turchi et al., 2020). One of the basic concerns in this process was sustaining the quality of language education in spite of the clear effects of the pandemic on English language teaching programs, pedagogy and evaluation aspects (Atmojo & Nugroho, 2020). More specifically, the findings indicate that the Covid-19 pandemic presented strengths, weaknesses and opportunities for language teachers and students (Hadianti & Arisandi, 2020; Huang et al., 2021; Karakuzu et al., 2020; Moser et al., 2021; Situmorang et al., 2020; Svalina & Ivić, 2020). In emergency online teaching, the teachers used online teaching platforms and applications (Zoom, Google Meet, etc.) and teaching management systems that

required technological literacy from the teachers and students. In this respect, one of the strengths of online teaching was that technological and digital resources were already integrated into English language teaching (Turchi et al., 2020). It is clear that language teachers and learners had been familiar with CALL (Computer Assisted Language Learning) for quite a long time and this turned out to be a strength during the pandemic (Bailey & Lee, 2020; Fatima, 2020; Huang et al., 2021). Teachers with prior experience in the online teaching of English made use of more engaging activities for the students in addition to being role guides and models for their students and colleagues (Bailey & Lee, 2020).

Emergency online teaching of English also involves certain constraints, as the findings show. The sudden and unplanned transition to emergency remote teaching left all parties in education, including language teachers, students and their families, in a challenging situation (Hadianti & Arisandi, 2020) since online teaching necessitated access to a stable internet connection, an effective online platform or learning management system and access to smartphones, computers and desks that were reported to be lacking, hindering the effectiveness and efficiency of English language teaching during the pandemic (Almekhlafy, 2020; Atmojo & Nugroho, 2020; Huang et al., 2021; Nartiningrum & Nugroho, 2020; Novikov, 2020; Rahman, 2020; Shahzad et al., 2020; Turchi et al., 2020). Apart from these, teachers and learners having insufficient knowledge about online teaching and learning, teachers' lack of control over online teaching platforms, and making use of less varied and engaging teaching activities or lack of direct interaction during the courses were among the most reported weaknesses of online teaching during the pandemic (Bailey & Lee, 2020; Huang et al., 2021; Nartiningrum & Nugroho, 2020; Sepulveda-Escobar & Morrison, 2020; Shaaban, 2020).

Based on the findings of this study, two groups of countries were identified in terms of the challenges of online teaching during this period: high-tech and low-tech countries. While technical and pedagogical challenges were seen in the former, technological infrastructure was the main obstacle in the latter (Hazaea et al., 2021). Another significant finding regarding the challenges of online teaching is that due to the teachers' lack of knowledge and experience in online learning, they are unprepared for this mode of instruction and feel that online teaching is simply moving face-to-face teaching into an online environment, which makes it frustrating and less effective (Atmojo & Nugroho, 2020; Sepulveda-Escobar & Morrison, 2020). From the students' perspective, lack of technological literacy as well as the inability to afford a computer, smartphone and internet access yields negative consequences, even causing a complete suspension of education as a whole (Atmojo & Nugroho, 2020). It was also highlighted that some students are negatively affected by the pandemic for reasons such as having low language proficiency, being unmotivated to actively participate in online English courses, misperceptions regarding online learning (seeing it as informal and a holiday due to lack of responsibility), concentration and behavioural problems as well as low self-regulation in the online learning environment (Atmojo & Nugroho, 2020; Chiatoh & Chia, 2020; Huang et al., 2021).

In spite of the weaknesses and challenges, online teaching and learning of English offers a number of opportunities, as the findings show. The transition to online teaching of the English language created an alternative online English communitive means that has enabled learners to have the opportunity to practice English through supplemental media. Through being part of this online community, students continue to be exposed to the language, which could be said to be unique to the pandemic era (Hadianti & Arisandi, 2020). At the same time, online teaching of English during the pandemic created an opportunity, particularly for disabled students who needed special care. The findings suggest that when courses are designed in an inclusive way, students with disabilities benefit from such an online program (Svalina & Ivić, 2020). Apart from these benefits, the transition to online teaching due to the pandemic has increased the experience and knowledge of the teachers and students by envisioning new possibilities for the richness of language teaching, since this period necessitated creativity and collaboration in teaching from a global perspective (Yi & Jang, 2020). Additionally, the digital literacy of the students as a 21st century skill was triggered by this transition, which also contributed positively to the experience of future language teachers

in terms of them being equipped with new language teaching platforms and technologies (Chiatoh & Chia, 2020; Sepulveda-Escobar & Morrison, 2020).

The researchers who studied the effects of the Covid-19 pandemic on the teaching and learning of the English language focused inevitably on educational technologies and online teaching platforms, since the schools and teachers facilitated various online platforms for teaching and social media applications for smartphones. The findings show that Zoom, Moodle, Google Meet, WhatsApp, Facebook, Blackboard and other platforms were commonly used for delivering the courses and providing intra-communication during the pandemic (Almekhlafy, 2020; Fitria, 2020; Hakim, 2020; Hamid, 2020; Nartiningrum & Nugroho, 2020; Ritonga et al., 2020; Shaaban, 2020). Based on the online platforms and social media networks, teachers adopted various teaching practices and methods to comply with the aims of the course and turn them into achievable outcomes. As Andriivna et al. (2020) reported, educational technologies and online platforms were more than just an alternative to face-to-face classrooms; teachers used them for various purposes, namely, communicative teaching, modular instruction, individualized teaching, testing and assessment, and teaching materials. In fact, in the transition process, online teaching platforms and learning management systems proved to be helpful for the teachers and students (Fitria, 2020) by making students feel confident and attracting their attention to learning the language, thereby increasing their motivation, while providing a richness of free online materials for teachers (Kawinkoonlasate, 2020; Shahzad et al., 2020).

The studies show that teachers mostly made use of online video conferencing platforms such as Zoom, Google Meet and Microsoft Teams for the interactive features they offered in synchronous teaching of the language (Almekhlafy, 2020; Destianingsih & Satria, 2020; Hakim, 2020; Hamid, 2020; Nartiningrum & Nugroho, 2020). These platforms took the place of brick-and-mortar classrooms in the offered course subjects and engaged the students by providing a sense of the online classroom environment. One of the most remarkable findings of this study is that Zoom, Google Meet and Microsoft Teams were also favoured for some of their default features, such as recording the sessions, which contributes to the flexibility of online teaching and learning, narrowing the power/status distance between students and teachers, and offering screen sharing opportunities and chat rooms (Destianingsih & Satria, 2020; Hamid, 2020; Wong, 2020). Apart from these, WhatsApp was also much favoured by students and WhatsApp created an online language community where language use continued even while everyone was staying at home during quarantine (Hadianti & Arisandi, 2020; Kholis, 2020). Findings also show that learning management systems such as Blackboard and mixed reality learning environments such as Mursion were reported to contribute positively to student learning during the pandemic (Almekhlafy, 2020; Hakim, 2020; Kamhi-Stein et al., 2020).

The studies conducted to measure the impact of emergency online teaching on students' language development, based on language skills and areas, found some important effects, although the findings of the studies utilized for this study were conflicting. Initially, the school closures and temporary suspension of lessons during the pandemic were found to have no clear effect on students' foreign language development, particularly language areas (grammar and vocabulary), when compared to the pre-pandemic period (Hopp & Thoma, 2020). In terms of language skills, it was found that listening and writing skills developed less in online teaching (Şendoğan Erdoğan, 2020), yet for the development of writing skills, blended teaching or synchronous online teaching were found to be effective (Dahmash, 2020). The listening skill was reported to be the most difficult skill for the students to develop (Rifiyanti, 2020). In another study, it was revealed that the speaking skill was mostly ignored and the writing skill was fostered most since it was the skill used in online communication for homework and assignments in online environments such as WhatsApp (Hartshorn & Mcmurry, 2020; Karataş & Tuncer, 2020). On the other hand, the speaking performance of the students in ESP classes was found to be satisfactory in online teaching (Kusumawati, 2020). In this regard, for the speaking skill to develop in emergency online teaching, synchronous online discussion sessions with proper task negotiation, task planning and other teaching methods such as question

and answer sessions was reported to increase students' speaking skills (Rinekso & Muslim, 2020). Also, social media-based blended teaching contributed positively to improving the active English skills of the students during the pandemic (Mustadi et al., 2021).

2.2.3. Findings of the third research question based on the attitudes and motivations of teachers and students towards emergency online teaching

Regarding the teachers and students' perceptions and attitudes in terms of the effectiveness and implementation of the emergency online teaching of English, some conflicting findings came to light. While some teachers of English upheld the idea that the transition to emergency online teaching would sustain the quality of language teaching and develop students' language skills, other teachers held negative opinions. On the beneficial side, findings showed that the usefulness and ease of online teaching platforms and learning management systems as an alternative to sustain education during times of emergency, such as with Covid-19, were regarded positively by the teachers (Rahayu & Wirza, 2020; Rifiyanti, 2020). One of the aspects that the teachers valued is that during this pandemic they adopted new roles as remote instructors and gained experience in terms of teaching online, while also increasing their technological knowledge to integrate pedagogical and content knowledge, an important component of teacher competencies (Lie et al., 2020; Moser et al., 2021). Apart from teaching purely online, blended teaching was regarded positively by English language teachers, which they believed to be effective and contributed to autonomous learning (Aji et al., 2020; Dahmash, 2020).

Students favored emergency online learning more than teachers of English around the globe; however, some studies also found inconsistencies (Allo, 2020; Karim & Hasan, 2020). These studies showed that students view learning English online during the pandemic positively because of the flexibility and autonomy provided, as well as the confidence that students gained. At the same time, students found online learning motivating. The interactive course environment improved not only their language skills but also their ICT skills (Aji et al., 2020; Rahman, 2020). The students' tendency to adapt to online learning was also enhanced by social media; this helped to focus the online learning community, in which they reproduced linguistic content by making use of free online resources and were involved in social interaction with their peers and teachers (Krishan et al., 2020; Mustadi et al., 2021). It was also reported that another aspect the students regarded positively is that online learning was appropriate for visually-impaired students, who were learning English remotely at home (Hamid, 2020).

In spite of all the positive attitudes towards emergency online teaching, teachers and students also held negative perceptions and attitudes towards the effectiveness of emergency online teaching. Findings show that the sudden and unplanned transition to emergency online teaching was not a seamless one. Although teachers tried hard to provide productive online teaching by engaging students in learning to increase their competence and to find new alternatives in their teaching sessions, they did not agree on the effectiveness of emergency online teaching. Among the reasons for teachers and students' negative attitudes are lack of prior experience and knowledge in online teaching or learning and lack of affinity with technology, particularly in the case of older teachers (Aji et al., 2020; Astuti & Solikhah, 2021; Fuad et al., 2020; Lie et al., 2020; Moser et al., 2021; Novikov, 2020; Rahayu & Wirza, 2020). It was found that although the students were ready to adapt to emergency remote learning, the unvaried and monotonous online learning environment (Fuad et al., 2020) made face-to-face learning more favourable for students (Patricia Aguilera-Hermida, 2020; Zboun & Farrah, 2021). The quality of online education was reported to be low and the courses were found less facilitating because of unclear learning instructions and tasks (Hamid, 2020; Rahman, 2020; Rinekso & Muslim, 2020). Accessibility-related factors such as possession of a reliable internet connection, smart phones and computers were also reported to contribute to students' negative attitudes towards emergency remote learning (Ariyanti, 2020). Thus, due to certain problems encountered

equally worldwide, findings show that language teachers generally voiced their concern about the lower outcomes resulting from online teaching of English.

The studies in the literature related to English language teaching and learning during the Covid-19 crisis focused also on the affective, motivational, and cognitive aspects. It was found that this challenged all parties. Teachers explored solutions to the problems faced based on their cognitive perspective in terms of emergency online teaching. Exploiting new ways of overcoming the challenges of this new method was an important part of their coping strategies (Gao & Zhang, 2020). Findings also show that some teachers applied active coping strategies rather than avoidance strategies while increased levels of stress and negative emotions necessitated avoidant coping strategies (MacIntyre et al., 2020). Emergency online learning of English increased defeatist emotions and brought out certain stressors for the teachers and students (Hartshorn & Mcmurry, 2020; Maican & Cocoradă, 2021). Due to this new and unfamiliar form of teaching during the pandemic, most teachers experienced worry and anxiety (Gao & Zhang, 2020). Among the stressors during the Covid-19 outbreak were the heavy workload, irregular hours and online teaching itself (MacIntyre et al., 2020).

In this respect, some teachers and students regarded emergency online learning and teaching as an obstacle to language development (Hartshorn & Mcmurry, 2020). The problems encountered during the emergency online teaching caused a decrease in students' motivation to learn English (Hafidz, 2020; Zboun & Farrah, 2021), as well as other aspects such as lack of concentration and self-discipline during the crisis (Popova & Rozhdestvenskaya, 2020). Not only student motivation but also their self-efficacy and engagement in online learning were negatively affected (Patricia Aguilera-Hermida, 2020). Online learning was reported to pose certain threats such as coping with strategy use, control of learning and decreased self-efficacy, particularly for low achieving students. They reported positive emotions in terms of attending online classes but had negative feelings due to the stress caused by worries regarding their progress in language learning, as well as the change in their study habits (Maican & Cocoradă, 2021).

3. Discussion and Conclusions

The surfacing of the illness Covid-19 followed by the pronouncement of a worldwide pandemic altered and affected many aspects of daily life all around the world. The partial or full lockdown due to Covid-19 that was imposed in March 2020 adversely impacted people's lives in all fields including health, economy, and education. English, as a global language, is taught in all segments of education in most countries in the world. With the rapid changeover to emergency online instruction, the teaching and learning of English was provided either in blended form or fully online. With this shift, it became clear that in order to continue teaching and learning activity without interruption or cancellation, online teaching was not just an option but a necessity, as stated by Andriivna et al. (2020). Although online teaching was already being applied within language education, the Covid-19 pandemic secured the place of online teaching, even in emergency situations. It can be assumed that online teaching will dominate education practice worldwide, even in the post-Covid-19 period. Thus, the experience gained in the first year of the pandemic, as reflected in this study, may provide valuable insights for the future.

This study has a number of significant findings which can be grouped under three categories: access, implementation and pedagogical aspects. The first year of Covid-19 in terms of teaching English through emergency online teaching showed that the education systems in many countries were not ready for a global crisis that necessitated implementing the planned teaching of English (Andriivna et al., 2020; Atmojo & Nugroho, 2020). Findings showed that although emergency online teaching is somewhat unplanned and used during times of pandemics and a global crisis, it is different from conventional online teaching because the latter is planned and not an extension of face-to-face teaching. Teachers of English across the world tended to carry out online teaching synchronously or asynchronously as an extension of face-to-face teaching, yet findings generally showed that several problems emerged in teaching English remotely. Hence the emergency online teaching of English raised some contextual concerns regarding the accessibility of

the necessary infrastructure (internet connection, computer, or smart phones), educational planning, management, guidance and expertise in the use of educational technologies (Andriivna et al., 2020). It should be emphasized here that access to the internet and computers or smart phones was one of the biggest challenges in delivering effective English courses online. The inequalities between countries and societies created challenges in students' access of the necessary infrastructure to receive the courses online, which also leaves teachers helpless in reaching them. It can therefore be concluded that unequal contextual conditions will inevitably continue to pose difficulties for the effective and efficient online delivery of English courses, even in the post-pandemic period.

The findings in this study showed that the teaching of English online did not yield the intended outcomes due to pedagogical factors such as lack of preparation, planning, educational policies for emergency cases and teachers' insufficient technological and pedagogical content knowledge. Atmojo and Nugroho (2020) highlighted how some teachers were not knowledgeable and skillful enough to teach English online since they did not have adequate awareness regarding the distinction between face-to-face and online teaching. Our findings show that teachers were particularly weak in teaching English online since most of them had little inexperience prior to transition. On the other hand, while this was also true for students, they were more experienced in dealing with technological issues. Despite this, most teachers and students regarded emergency online teaching as a hindrance for language development (Hartshorn & Mcmurry, 2020; Moser et al., 2021; Patricia Aguilera-Hermida, 2020). In fact, it is seen that the research studies analysed in this study all yielded conflicting results for the aspects investigated. While some teachers saw emergency online teaching as an opportunity to increase their expertise and knowledge in the remote teaching of English (Chiatoh & Chia, 2020; Hadianti & Arisandi, 2020), others regarded it as an obstacle which raised their anxiety level (Gao & Zhang, 2020). Expectations regarding the effectiveness of emergency online teaching were diverse. The findings indicate that unless a number of factors are carefully handled, such as preparing a good plan for online teaching, supporting teachers and students in accessing the necessary infrastructure, taking the necessary precautions in motivating the students, and lowering teacher anxieties, as reflected in this study, global practices of teaching English online may yield similar weaknesses in terms of teaching and learning.

Consequently, for quality online teaching of English in schools, the policy makers and teacher training programs need to make alterations in terms of equipping the teachers with the necessary pedagogical knowledge on these different modes of teaching. Apart from this, not only the teachers but also students worldwide came up against several obstacles. Among these globally-reported obstacles were non-accessibility of the internet or computers and low digital literacy; these were the most reported problems in several studies. Because few teachers and students had experience of online teaching and learning, both parties could not adapt properly to the new conditions and their new roles (Moser et al., 2021). It seems that even after one year of global experience in teaching and learning under pandemic conditions, these hindrances will continue and will not be solved before the end of the Covid-19 pandemic.

It can be concluded that both the teachers and students need to be prepared for emergency teaching and learning in the future. To do this, the first major precaution should be to redesign English language teacher education programs at universities. Although a common strength ensuing from the pandemic for teachers and learners of English was to gain experience in online teaching and learning of English on a global scale, findings revealed that this was a novel experience for them (Bailey & Lee, 2020; Carrillo & Flores, 2020; Heng & Sol, 2020; Moser et al., 2021). From the teachers' perspective, this indicates that they received little or no theoretical and practical knowledge in teaching English online. Therefore, teacher education programs should equip them not only for classroom teaching, but also for online teaching. Courses which are devoted to educational technologies or directly address online teaching with the necessary pedagogical contributions should be increased in English language teaching departments. At the same time, in-service teachers need to be given training and practice to ready them for teaching online effectively and efficiently. This study, concerning the teachers and students as well as other stakeholders' first year experience in

emergency online teaching, provides a global insight into the general picture of English language teaching; the results of which may guide researchers and the future practice of teachers, students, policy makers, teaching programs and governments in the event of ongoing or new crises and emergencies affecting educational activities.

4. Limitations of the study

This study has some limitations. It is limited to the studies as the documents used as the data of this integrative literature review study. Apart from this, the study is limited to the studies conducted from the onset of the pandemic until February 2021 when the compilation of the research studies was finalized. Another limitation of the study is the methodology as the integrative literature review study. The study can be conducted as a meta-analysis study in the further studies.

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Book Review: ICT: Changing Education

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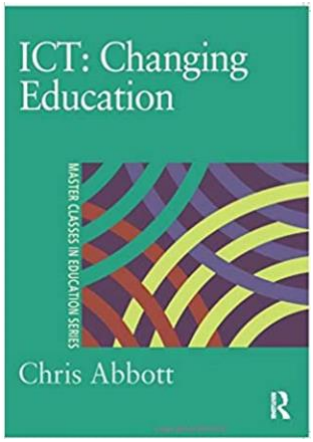
Abstract

"ICT: Changing Education" is edited by Chris Abbott. The book was published in 2001 and it has 142 pages. The ISBNs of the book for different versions are as follows; ISBN-10: 0750709502; ISBN-13: 978-0750709507. The book describes the evolution of computer use in education and addresses the notion of virtual learning communities through case studies involving learners, parents and educators along with national education policies of some countries, such as the UK and Sweden.

1. Introduction



"ICT: Changing Education" is edited by Chris Abbott. The book was published in 2001 by Routledge and it has 142 pages. The ISBNs of the book for different versions are as follows; ISBN-10: 0750709502; ISBN-13: 978-0750709507. The book describes the evolution of computer use in education and addresses the notion of virtual learning communities through case studies involving learners, parents, and educators along with national education policies of some countries, such as the UK and Sweden.

The ultimate aim of the respective book is to shed light on how the use of technology in education has been changing over years, and to presume some projected impacts of technology on teaching practices. It provides readers with a comprehensive understanding of the use of ICT in education both in the past and at present by demonstrating the national education policies of some countries. To fulfill its goals, the topic has been discussed in seven chapters which are going to be taken into consideration singly in this review.

2. Review of the Chapters

Chapter One: ICT and Literacy

Chapter one begins by the fact that with the advent of technology, there have been changes in varied practices including shopping, banking. Education is not far from these changes led by the use of the internet.

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What the first chapter puts forward is that the use of technology in education has called forth changes in teaching practices. To clarify it, computers, which used to be regarded as solely text-based until recently(White,1985), provided scant facilities in the past compared to today's unlimited perks of the technology. That is to say, current internet access offers a variety of sources including images, videotape, and cassette to be used in teaching unlike the one offered in the past, so it is indicated by the author that the use of book in education will be out of fashion very soon, and there will be a possibility of teaching knowledge through the use of motion picture. Eventually, there will be a shift in teaching setting from the formal educational setting to home-based educational setting.

The first chapter, 'ICT and Literacy,' addresses this central issue and explains how notions of literacy are evolving as a consequence of the use of Information and Communications Technology (ICT). The author indicated that the use of ICT in education does have a profound impact not only on changing schooling but also on the notion of literacy. Namely, though literacy was composed of the only word–based texts till the end of the twentieth century, now it is a more comprehensive concept that also holds inside multimedia, picture, sounds, and moving image. Today, it is possible to speak about multiliteracies due to advancing technology. Street (1996) criticized multi-literacies by providing his definition of multiple literacies. What he alleged is that literacy consists of three models including Autonomous model, Critical Literacy, and New Literacy Studies. The first chapter provides readers with information regarding these three models.

All in all, the first chapter of the book is mainly concerned with the developments in technology, and the impact of technology on education. In addition to these, it is emphasized by the author that the concept of literacy has been evolved and fragmented into different sections in consequence of ICT.

Chapter Two: Virtual Communities

The second chapter, 'Virtual Communities,' explains how ICT is altering communities and forming new, mostly virtual groupings. It is stated in the chapter that although it might be difficult to relate the words of online and community at first, it shows that it is actually possible to associate these two notions with one another. That is to say; as a result of developing technology there is no need to become a member of a community physically, so it can be said that communities are beyond borders through the instrument of the technology. In this respect, this chapter demonstrates previous initiatives to develop online communities, and it also touches upon the close relationship which takes place between community and identity.

The second chapter underlines that there have been attempts to create virtual communities even before computers. The use of telephone and Citizens' Band (CB) radio were indications of how people formed communities through technology. However, these communities were limited in number compared to the ones which have been created recently through a computer or the internet.

In the second chapter, the close relationship between identity and community is also explained. The author's opinion on this subject is that self-defining choices of young people enable them to create their identity and to become autonomous adults. As a result of increased use of internet, and existence of virtual communities, it is probable to say that online platforms also play a decisive role in establishing the identity of a young adolescent in the sense of allowing them to make choices about varied aspects of their life. Even it is said that people view computers as a way of creating their identity.

Newsgroups and Into the Dungeons are among those virtual communities mentioned above that contribute to the formation of identity. Whereas Newsgroups, usually known as Usenet, allows its users to become a member of groups that are related to their practices, and hobbies, Into the Dungeons provides its users with adventure stories in which users are given choices, and they are asked to decide on one thing among choices, so that users lead the stories with their choices that they make.

Lastly, the second chapter shows how long it took to make people become aware of the significance of the internet. Furthermore, it is indicated that online communities mostly comprised of the young, middle class,

male, either European or American people. Also, the reason why virtual communities consisted of lonely young people is that virtual communities were found more welcoming compared to real life settings.

To sum up, the second chapter is mainly about virtual communities, and their effect on identity formation.

Chapter Three: Changing Schools

The movement of educational technology from its conventional foundation, the classroom, to the home setting is discussed in the third chapter, 'Changing Schools.' The chapter firstly puts emphasis on a significant point that learning is not only limited to school, so it is not wrong to claim that life outside school comprises of the most of the learning. In medieval times, education was regarded as "complex, lifelong, and unplanned" (Illich, 1973). On the other hand, in today's world, the concept of lifelong has started to attract attention recently. Till the end of the twentieth century, there were some concerns related to the efficiency of the model which views school as the most substantial part of learning, so the home-school movement gained popularity in the second half of the twentieth century by the help of technology.

The third chapter also discusses library practices affected by advancing technology. The author provides the following example; the Blair government has become aware of the importance of online content in education, so the government has provided its librarians with training regarding the development of online content.

It is also revealed in the third chapter that in the 1960s, there was a kind of misconception on the part of teachers regarding the point that technology is all about machines which would replace the teacher. Thus, teachers did not always appear to welcome these teaching machines in their classrooms. Yet, some training programs like the New Opportunities Fund made a contribution in a way that teachers started to view the computer or teaching machines as a useful tool rather than a teacher.

Having a look at the situation in England in terms of the place of computers in education, the UK government, like Sweden government, seems fully aware of the substantial position of ICT in education so that the government has made investments in education by ensuring teachers in-service training concerning the use of ICT, and integrating ICT in the curriculum.

The final point that the third chapter discusses is basically concerned with whether ICT is a subject or a tool. Whereas some view ICT as a tool to help people gain knowledge in subjects of curriculum, others dissimilarly see it as a subject in its own right.

Chapter Four: Learning, Computers and Social Interaction

Chapter 4, 'Learning, Computers, and Social Interaction,' expands on the debate about how ICT is changing education and focuses on social interaction between students. A case study of a young person who developed professional IT skills in this manner is demonstrated in this part. There are connections made between educational theory and ICT use, and the concept of post-geographical learning is proposed: learning that occurs by the online social networking of communities whose members do not live in the same physical location.

The fourth chapter explains changing perceptions regarding learning in the sense of some learning theories. The distinct views these theories hold with regard to how learning occurs are explained in the section as well. Behaviorists' perspective advocates the necessity and importance of "stimulus-response", and it puts emphasis on drills and practice in the learning environment. In this way, early software developers adopted this view in their pieces. On the other side, there have been attempts to create alternative programs to which basically depends upon drill and practice. Papert's computer program called LOGO is one of these initiatives in which the main focus is on making students use computers to think, and carry out exploration on their own rather than using computers to program learners. Though LOGO was a favored program all

over the world in the 1980s, later on, the use of LOGO in education was limited to mathematics and geometry; in fact, this program could be used in varied disciplines. Papert, who is the developer of the program, lays weight on the issue by saying that schools should change. For doing so, alternative school models in which learners will actively engage in learning need to be developed. Paper also takes the interaction between learners and computer into account from two distinct program developers' view; the instructionist and the constructionist. Instructionist presents school style learning through a game that a designed program asks questions, and learners are supposed to give reaction to those questions. On the other hand, constructionist draws attention to making students enable to design the game.

The fourth chapter also explains that due to advancing technology the home school movement gained popularity all around the world, especially in the US, in the 1960s and 1970s. However, this movement is not without its drawback. It is criticized since it does not provide the learner with enough social interaction.

Chapter Five: Educational Responses to Technology

In Chapter 5, 'Educational Responses to Technology,' a variety of alternatives are examined, ranging from the 1960s teaching machines to today's multimedia connected PC. It provides a complete understanding of the use of technology in education before computers.

In the chapter, it is highlighted that new technologies in educational systems are not embarked swiftly. Because, conservative views with respect to commonly accepted methodologies and understandings hold schools off technological developments. This is also valid on the part of teachers. As to give an example, Mellon, though who is a professor in Educational Technology department, still believes in substantial position of teacher in classroom in spite of a variety of sources available, and she stated that "Technology cannot guarantee learning; students cannot be forced to learn; learning styles differ widely; and teachers are more important than even the most sophisticated educational tools." (Mellon, 1999)

This chapter also demonstrates the insight of educational software. As it is already mentioned in the previous chapter, the use of the computer in early times was based upon behaviorist view. Accordingly, early educational programs mostly included drill and practice exercises for pedagogical reasons.

In the chapter, it is highlighted that in the UK, local authorities took a leading role in promoting the use of computers in education, so Computer Software Packages were prepared for education in order to improve teaching quality, to enable individual learning, to save teaching time, and to boost motivation on the part of learners. These packages consisted of different kinds of programs to be used in teaching practices. Yet, only LOGO and Developing Tray among varied programs maintain their popularity even at recent times.

In addition to these, the chapter provides information in detail regarding a program named Integrated Learning Systems (ILSs) which has been created in the UK. Integrated Learning System is a computer-aided program that provides learners with individual curriculum material, and feedback regarding their performance with the aim of facilitating their learning.

Chapter Six: The Rise of the Internet and the Race to Connect

Chapter six basically discusses the rise of the internet, and countries' competition for connecting internet to their schools.

It is connoted by Abbott that the common reaction given to the internet has been one of the following; "either wild unsubstantiated assertion or blanket denials of relevance" (2001). In addition to this, in the early reactions the internet was mostly regarded as paper-based media, notwithstanding, it offered a lot of distinct features.

The chapter shows how countries are in for setting targets concerning the use of ICT for their schools. It is indicated in the chapter that a set of targets have been put forward by the UK government in order to

promote the use of ICT in the community. The UK government is fully aware of the fact that the internet will notably change the educational system in a sense that more focus should be put on distance learning methodologies, and informal learning.

Chapter Seven: Towards a New Understanding of ICT and Schools

Chapter 7, titled "Towards a New Understanding of ICT and Schools," brings together this range of change and growth to suggest a new insight into the potential and shortcomings of ICT within an evolving educational system. It also touches upon some countries' national ICT policies as a result of the rise of the internet and Information Technologies.

Initially, what the chapter claims is that each county adopts different ICT policy due to its approaches and priorities. In this regard, the chapter takes policies in the UK and Sweden into consideration in an effort to make comparison and contrast in initiatives set in different countries with regard to ICT.

It is indicated that the European Union also seems more interested in supporting the use of ICT in education. Thus, the Commission of Union offers a report named "Tomorrow's Education: Promoting Innovation with New Technologies" with the object of addressing the following issues; equality and access.

Once for all, the seventh chapter, as the other chapters have done, explains the profound impact of ICT on changing education and schooling. Furthermore, it also gives information regarding how virtual classes will take over conventional classes in terms of enabling learners to have lesson whenever and wherever they want it to happen.

3. Conclusion

This book can be favored since it provides its readers with a profound understanding of the use of ICT in education. In addition to this, the book is substantially useful particularly for professionals in terms of allowing them to gain knowledge concerning the place of ICT both in the past and at present. Although each chapter provides insight into different points, the main focus of the book is all about the impact of the use of ICT on educational practices. In this way, the book gives information regarding national educational policies of some countries including the UK and Sweden that changes in policies are caused by the development of ICT. It should be noted that this book was published in 2001, so it can be considered historical in the sense of educational technology, so this gives readers the chance to evaluate today's educational technology from the past perspectives.

All in all, it is possible to say that this book can be regarded as a valuable source especially for professionals who are into Information Technologies.

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