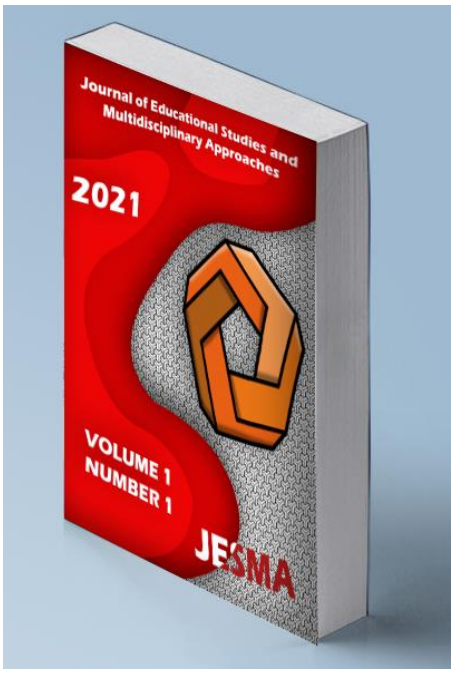

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Mathematics Teachers and Pre-service Teachers' Opinions on Distance Education

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Mathematics Teachers and Pre-service Teachers' Opinions on Distance Education

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ABSTRACT

School closures during the COVID-19 pandemic have made education dependent on online teaching. It turned into an unprecedented experience for teachers and students. Therefore, this study examines the views of mathematics teachers and pre-service mathematics teachers on distance education practices. The data of the study were collected through a written and online questionnaire to thirty-seven mathematics teachers working in secondary/high schools in Turkey and final year pre-service mathematics teachers continuing their education in universities. The data were analyzed through descriptive and content analyses. At the end of the study, pre-service teachers expressed a high level of positive opinion on distance education practices. Teachers, on the other hand, expressed approximately equal numbers of positive and negative opinions on distance education practices. In addition, participants characterized distance education practices in similar categories as negative. These categories include the inadequacy of technological infrastructure, the inadequacy of teacher– student interaction, and the impossibility of access. Similarly, participants expressed positive opinions in different categories. These categories were easy to access, repeatability, and economy. In addition, students and parents expressed concerns about the functionality of distance education applications in mathematics education, such as insecurity, family unrest, and financial problems.

Keywords: Distance education, mathematics teaching, mathematics teacher, mathematics pre-service teacher, COVID-19.

Introduction

The latest developments in technology have sped up education for individuals and spread distance education rapidly. Today, the changing environments and conditions also encourage educational institutions to seek additional platforms to continue to provide quality education. Distance learning is a commonly used method of providing education by using interconnected, network-like technologies. technology will play a primary role in the future of the education sector. When education is the matter of discussion, teachers, beyond building knowledge, are the main entities of the academy for which they are responsible , and as it is in each education, teacher– student interaction should also be effective in distance education.

Distance education appears before us as an educational content that achieves the separation of teachers and students physically from each other in terms of their main elements (Berg & Simonson, 2002). Distance education is defined as providing students with any teaching content and related support services online in cases where physical education is missing (Pena-Bandalaria, 2009). In parallel to technological developments, the increasing internet infrastructure possibilities also eliminate the place limitations in individuals' reaching knowledge (Ergüney, 2015). Therefore, like many other areas, education has been affected by changes and transformations in the world. From this perspective, distance education, which decreases teaching place limitations in the field of education and facilitates accessibility everywhere, is gradually becoming more common (Haymana & Dağhan, 2020) and a settled part of the education world together with the development tendencies that it shows (Berg & Simonson, 2002).

Together with the widespread use of the Internet, the existence of institutions such as Coursera, Edx, Udacity, Khan Academy, Futurelearn, Openstudy, Codeacademy, Openlearning, NPTEL, Udemy, and ALISON providing open-sourced MOOC distance education services that provide individuals with opportunities for learning and education in digital environments has been known since 2011 (Ergüney, 2015). Online teaching and learning has been commonly used in higher education for nearly for twenty years. To support online interactions such as discussions, evaluation, sharing, and interaction, various tools and platforms are being developed and tested and reaching a relatively high level of acceptance (Mues & Howar, 2020). However, adoption is taking place slowly in primary and secondary school education. The COVID-16 pandemic, which developed unexpectedly and affected life rapidly, is affecting education, particularly teacher education, in various ways. Because of the closing of universities and schools, teachers and students had to adapt rapidly to distance education. Teachers, many of whom had never taught online before, had to redesign their programs to support their students fully online. In this case, the pedagogical approach to teaching and learning involved a complete change and the use of a range of new technologies (Gürley, 2018). Moreover, the need to create learning environments for pre-service teachers made it necessary to change not only students' expectations but also the requirements of teacher education and both universities and schools' decisions, choices, and adaptations in order to meet the conditions in which they are (Assunção-Flores & Gago, 2020). This rapid, unexpected, and compulsory transition from face-to-face to distance education has brought opportunities that require examination in addition to a series of difficulties and limitations. This form of teaching, defined in the current literature as "emergency distance teaching" (Bozkurt & Sharma, 2020) or "emergency e-learning" (Murphy, 2020), has revealed the existence of a knowledge gap in teacher education and difficulties related to poor online teaching infrastructure in a complicated environment at home (Zhang et al., 2020). In addition to these difficulties, it was understood that there were problems related to mentorship and lack of support (Smith, Kahlke & Judd, 2020) and problems related to teachers' competencies in using digital teaching materials (Huber & Helm, 2020).

In previous studies in this field on teachers' developments and problems, in addition to explanations about how institutions and stakeholders had adapted to distance learning created due to the COVID-19 pandemic (Hasan & Bao, 2020; Assunção-Flores & Gago, 2020; Quezada, Talbot & Quezada-Parker, 2020; Zhang et al., 2020), some explanations were also made in relation to education strategies and innovation experiences (Ferdig et al., 2020). While digital education is an industry-wide priority, the pandemic has required the adoption of new approaches (Lockee, 2021). To prevent this from becoming

a state of technology that dictates pedagogy or seeks impossible requirements, an iterative process has been developed. Simultaneous fully online teaching was also considered for courses, but asynchronous courses were preferred (Daniel, 2020). While various approaches have been tried, a flexible online, offline, and hybrid approach known as HyFlex has allowed students to attend classes on campus or online, and both groups learn together simultaneously (Beatty, 2019). Although the explanations about how the teachers and the pre-service teachers responded to the transition from face-to-face teaching to online teaching are valid, it is necessary to determine and explain in detail the difficulties they had in relation to this matter.

Since it provides the opportunity to study courses at any time when students and teachers are convenient and at any place with Internet access, distance education creates advantages for students and teachers. The fact that students are less disturbed during distance learning compared to classroom learning, they do not need to feel embarrassed because of a mistake which they make in front of their friends, they do not feel stressed, and they undertake the responsibility of time management by planning when and what to study are mentioned among its benefits for students (Katane, Kristovska & Katans, 2015). Although flexible distance education imposes too many responsibilities on students, it allows students to become independent and study without needing any supervision by another person within the course of time. For students avoiding undertaking responsibilities, distance education becomes a disadvantage. Because students are not face-to-face in the classroom environment, there appears to be a loss of interaction between students. In-class interactions help students develop critical thinking and problem-solving skills (Vlasenko & Bozhok, 2014). Because some of this interaction occurs between students in distance education, a decrease can be seen in critical thinking and problem-solving skills.

In the research studies, Acar and Peker (2022) investigated the mathematics teachers' opinions about live (synchronic) distance education; Aknc and Pişkin-Tunç (2021) investigated the problems that the secondary school mathematics pre-service teachers encountered and proposed some suggestions; Aydoğdu, Iskenderoğlu and Konyalihatipoğlu (2021) investigated the mathematics teachers' teaching experiences in the mathematics teaching practice performed via distance live courses; Coşkun-Simşek et al. (2022) examined the teachers' knowledge and awareness levels in relation to the process of distance education and their opinions about their self-efficacies and practices; Ersen and Yumak (2021) examined the primary school mathematics pre-service teachers' opinions about distance education; Korkmaz (2021) examined the pre-service teachers' opinions and attitudes about the Google Classroom digital platform used in the process of distance education and distance education; Ozdemir-Baki and Celik (2021) investigated the secondary school mathematics teachers' problems in the spring semester, the precautions that they took in the fall semester to solve these problems, the methods, the techniques, and the educational contents that they used; Sen (2021) investigated the secondary school mathematics pre-service teachers' suggestions in relation to the evaluation and the development of TRT EBA TV mathematics course programs; Tican and Toksoy-Gökoğlu (2021) investigated the secondary school mathematics teachers' opinions about distance education mathematics subject.

It is important to gain more knowledge about the potential and use of productive distance teaching and learning tools. Therefore, it is essential to go beyond emergency online practices and develop quality online teaching and learning resulting from careful teaching design and planning (Hodges et al., 2020). There is support through the comparison of course level factors that students can learn online as much as they learn face-to-face. Bernard et al. (2004), in their meta-analysis of 232 online learning studies, concluded that there was no significant difference between online and face-to-face learning. Driscoll et al. (2012) obtained similar results in online assessment and evaluation. Numerous studies in the literature (Ashby, Sadera & McNary, 2011; Bowen et al., 2014; Brown, 2012; Cavanaugh & Jacquemin, 2015; Dell, Low & Wilker, 2010; Enriquez, 2010; Holmes & Reid, 2017; Jones & Long, 2013; Lyke & Frank, 2012; McCutcheon et al., 2015; Mollenkopf et al., 2017; Nemetz, Eager & Limpaphayom, 2017; Stocker, 2018; Wagner, Garippo & Lovaas, 2011; Wu, 2015; Zhao et al., 2005) support that face-to-face education and online education do not have a positive or negative effect on outcomes. Therefore, a consensus has been expressed that there is little difference in student performance between instructional environments for courses in which both environments are available (Pattnaik, Nath & Nath, 2023).

Focusing on how the current context forces many teacher education programs to adapt to an online format might provide a wide understanding of the adopted practices. However, it is necessary to make these practices effective. For this reason, it will be useful to provide knowledge for future practices and determine the precautions that need to be taken in relation to the education of teachers and pre-service teachers. This period of change not only provides a point of view based on evidence about what is useful and what is not useful, but it also, perhaps most importantly, puts forward the necessity of understanding the characteristics, processes, consequences, and effects of online practices. Recent studies have shown that both individual and institutional factors affect teachers' capacity to adopt new digital practices (Ertmer & Ottenbreit-Leftwich, 2010; Howard, 2019). For this reason, to be able to clearly reveal teachers and pre-service teachers' situations, it is necessary to take their opinions about distance education into consideration. This approach provides a clearer understanding of what support is needed to support the process of distance education in terms of determining the agenda of education and the school. Thanks to the presence of such factors as the possibility of benefiting from online educational activities in a desired period of time by decreasing their disadvantage of being far from the education created by the location and the place in which a person is and the flexibility that it provides for students and teachers, its use is gradually increasing in many educational institutions and institutional areas day by day. With the recent COVID-19 crisis, distance education has come to the fore as a necessity, making it inevitable and undesirable to study the effectiveness of this type of education and the changes it brings to education systems. That the topic of online learning and teaching is excluded from the teacher training program and many teachers have limited knowledge and experience about online learning and teaching makes us consider that teachers and pre-service teachers are unknowledgeable about online pedagogies or how to support online learning (McAllister & Graham, 2016). For this reason, this study aims to investigate the effectiveness of distance education.

There are various previous studies on teachers' distance learning and teaching. It was revealed in Turkey that the teachers had a moderate level of technological readiness, and there was not a significant difference between the teachers in terms of readiness to technology according to their ages and branches, but there was a significant difference between the levels of readiness to technology and gender (Summak, Bağlıbel & Samancıoğlu, 2010). Moreover, a study found that teachers' motivation and education were the most important factors in e-learning (Hung, 2016). It is important to determine the areas in which teachers' knowledge should be developed, the difficulties encountered in the application process, and the opinions related to the use of digital online technologies. The questions related to online teaching might include how open education will be provided, how communication will be established and how learning will be evaluated (Gürley, 2018).

In the research conducted by Cakn and Kürekçi-Akyavuz (2020), one of the studies conducted recently on distance education in Turkey stated that teachers have communication problems with parents and students in distance education. Bayburtlu (2020) stated that the teachers could not attend the live courses because some of their students did not have the infrastructure, some of the parents were uninterested in this process, and they did not follow the courses while their students were on the computer. By citing these problems, it has been tried to define that both the quantity and quality of distance and face-to-face education are important (Can, 2020). It has been stated that the problems related to distance education in Turkey stand out as technical inadequacy, lack of information, lack of communication, indifference of teachers, and lack of planning (Cakın & Külekçi-Akyavuz, 2020; Bakırcı, Doğdu & Artun, 2021; Arslan & Sumuer, 2020). It was observed that teachers expressed positive opinions on the use of technology in mathematics courses (Boz & Özerbaş, 2020; Sarı & Akbaba-Altun, 2015). Considering the literature summarised above, it is known that distance learning and teaching teachers, especially mathematics teachers, have a medium level of technology readiness, and that there are no significant differences in technology readiness among teachers according to their age and sector, but there is a significant difference between levels of technology readiness.

In this study, starting from mathematics teachers' experiences in the period of rapid transition to online teaching, particularly during the COVID-19 pandemic, their opinions about the practices of distance education in the teaching of mathematics (its positive and negative effects on mathematics education) were investigated. Hence, it is considered that these experiences will contribute to schools and

educators' preparation for online and hybrid learning in the future. The presence of online teaching forms the framework of this study, and the investigations are being undertaken from this perspective. Starting from mathematics teachers' opinions, answers are being sought for the following research problems:

1. What are the mathematics pre-service teachers' positive and negative opinions on distance education practices in mathematics education?

2. What are the mathematics teachers' positive and negative opinions on distance education practices in mathematics education?

3. What are the mathematics pre-service teachers' expressions about students' and their parents' worries related to the functionality of distance education practices in mathematics education?

4. What are the mathematics teachers' expressions about the students' and their parents' worries related to the functionality of distance education practices in mathematics education?

Methods and Materials

The mathematics teachers' and pre-service teachers' opinions on distance education in teaching mathematics were analyzed via qualitative analysis methods. In this respect, the design of the study was determined to be a case study.

Case study is one of the techniques used commonly in educational sciences and is used to investigate a certain event within its own systematic in detail (Creswell, 2009; Merriam, 2009). In a case study, an event or phenomenon is examined holistically in detail by taking the perspective of relevant participants (Yıldırım & Simşek, 2005). A case study explains an event to a reader in a real manner and in the way it was lived by providing stable and useful meanings (Gall, Gall & Borg, 2007). In this respect, in this case study related to distance education practices, the teachers' and the pre-service teachers' opinions were determined as a case and they tried to be explained.

Sampling

In this study, the participants' positive or negative opinions about distance education in mathematics education and their expressions about the students' and their parents' worries related to the functionality of distance education practices in mathematics education were analyzed under different dimensions. With this aim, the participants of the study were determined from among the teachers and pre-service teachers taking education at universities present in the cities of Konya, Alanya, Istanbul, and Bursa in the three geographical regions (Marmara, Central Anatolia and Mediterranean) taken within the scope of the study during the fall semester of the 2021–2022 academic year2021–2022. The researchers first analyzed the questions developed for data collection with their own students and teachers in postgraduate education. This was a preliminary pilot study. Following the corrections made in this process, the questions were given their final version by subjecting them to expert opinion. In this scope, 90 mathematics pre-service teachers who were willing to participate in the study and 37 mathematics teachers who were currently working in the same region participated in the study.

Three open-ended questions prepared by the researchers with the aim of taking the participants' mathematics teachers' and mathematics pre-service teachers' opinions were addressed to the participants. They were asked to provide detailed answers to these questions. These questions were as follows:

1. What are your positive opinions on the practices of distance education?
2. What are your negative opinions on the practices of distance education?
3. What are your students' and their parents' worry about the functionality of distance education practices?

There was no time limit during the answering process. The answers given to these questions were collected via pen and paper in written form in some cities and with Google Forms in the electronic environment in some other cities. In the analysis and interpretation of the data, including the answers

that the participants gave to the three open-ended questions given above and recorded in written and electronic environments, the content analysis and descriptive analysis methods, two of the qualitative data analysis methods, were used.

For the first and second research problems, the content analysis method was applied. Content analysis has various definitions. While content analysis is interpreted by Holsti (1968; Cited by Berg, 2004) as a technique used to make deductions by systematically and objectively determining certain characteristics of messages, it is defined by Bogdan and Biklen (2007) as a coding procedure and a data interpretation process. Content analysis covers the examination of content by referring to the meanings, contexts, and intentions included in messages (Prasad, 2008). In content analysis, researchers examine the frequency of words and main themes through systematic observations and analyses and determine the content and characteristics of knowledge embedded in the text (Hair et al., 2003: 126). The data obtained in the content analysis are conceptualized first, then arranged logically according to these concepts, and finally, the themes explaining the data are determined by starting from this arrangement (Yıldırım & Simşek, 2005: 227). The stages of coding the data, coding the themes, and arrangement of the data according to the codes and themes are realized, and the analysis is completed.

In content analysis, the research data gathered from the first two open-ended questions were analyzed by coding the data, coding the themes, and organizing and defining the data according to the themes. At the stage of coding the data, first of all, the participants were asked questions. The answers they gave were read many times, and the dimensions important for the research were determined. Then, the expressions obtained because of the examinations were examined and found to be meaningful. It has been divided into sections, and we have tried to understand what each section means conceptually. During the coding of the themes, these sections, which constitute a meaningful whole in themselves and contain the answers related to the research, were coded. Then, the codes that were similar were brought together in these codes. In the meantime, some codes that were not suitable for the research were removed, and some codes that were suitable for the purpose were added when necessary. Thus, themes at the most general level and sub-themes under these themes were revealed. Codes were organized and defined under these subthemes. The data were then organized and described according to emerging codes and themes (Yıldırım & Simşek, 2005: 228-239). In this study, the first two open-ended questions that provided the research data formed the two themes at the most general level of this part of the research. For these two themes obtained from the research data, three different sub-themes were determined as positive thought, negative thought, and neutral. Then, codes were determined using these sub-themes, and the findings of these codes and themes were reported. With the interpretation of the findings, we attempted to reveal the thoughts of the mathematics teachers and pre-service teachers participating in the research on distance education.

Among the research problems, the qualitative data obtained within the scope of the third and last research problem were analyzed using the descriptive analysis method. The aim of descriptive analysis is to organize the findings and present them to the reader in an interpreted form. In this analysis method, data are systematically and clearly described. The results obtained can be related to themes, interpreted, and predicted for the future (Yıldırım & Simşek, 2005: 224). The research data obtained from the answers given to the last research problem within the scope of the research were analyzed by creating a framework, processing the data according to the thematic framework, and defining and interpreting the findings.

At the stage of establishing a framework for descriptive analysis, the third research problem established the most general level framework for data analysis. At the stage of processing the data according to the thematic framework, the data for the third research problem are under 6 different themes: general worries, distrustfulness, domestic unrest, financial difficulties, fruitlessness, and lack of knowledge. At the stage of defining and interpreting the findings, the data obtained according to the determined themes were read and organized. The organized data were then defined and the findings were interpreted through these themes. Finally, research findings were supported by direct quotations where appropriate. Thus, we attempted to reveal the concerns and thoughts of the participants of the research.

The research data were analyzed using categorical analysis and frequency analysis using Microsoft Excel. Due to the need for more than one coder in the process of analyzing complex qualitative datasets and the large number of datasets, the data were stored and encrypted in a cloud. The coding process was then detailed during the analysis process using the Nvivo software. In these analyses, the qualitative

data in written form obtained within the aim of the research were reduced to numbers by going through the processes required by the content and descriptive analysis described above. With the aim of achieving validity and reliability in relation to the process of data collection and analysis, the coding was compared by the researchers independently and then shared codes and sub-themes were determined in the meetings held. According to Miles and Huberman (1994), when two researchers code using the same dataset, definitions become clearer. In this way, it is possible to reach a common understanding of what coding means and which piece of data belongs to which code. During the analysis process, the inter-coder reliability coefficient was 86%. This was found to be in line with the criteria established by Miles and Huberman (1994). Moreover, the technique of participant confirmation was also beneficial. Thus, we tried to ensure the reliability of the research and to reduce its bias. The validity and reliability of this qualitative research was ensured by considering the credibility, transferability, consistency, and confirmability strategies (Yıldırım and Simşek, 2005: 264-272).

Ethical Considerations

Data were collected electronically, and the lack of demographic information collection allowed for anonymity. Consent information was hosted on the researchers' personal computer and safeguarded by a password. Study participation resulted in minimal risks to respondents. In this study, all rules stated to be followed within the scope of theHigher Education Institutions Scientific Research and Publication Ethics Directive" were followed. None of the actions stated under the title "Actions Against Scientific Research and Publication Ethics", which is the second part of the directive, were not taken.
Ethical review board name: Necmettin Erbakan University Sciences Scientific Research Ethics Committee.
Date of ethics review decision: 09/07/2021.
Ethics assessment document issue number: :2021/414.

Findings

The research findings reached because of the analyses realized with the aim of examining the participant mathematics teachers and pre-service teachers' opinions about the practices of distance education and the expressions about students' and their parents' worries about the functionality of the distance education practices in mathematics education are given in this section. In this scope, the findings reached as the results of the descriptive and content analysis of the data obtained for the three research problems included are explained in this part.

Primarily, the two themes determined to answer these research problems, which were "What are the mathematics teachers' positive and negative opinions about distance education practices?" and "What are the mathematics pre-service teachers' positive and negative opinions about distance education practices?". These themes were examined by gathering under the sub-themes of the mathematics pre-service teachers' and pre-service teachers' positive and negative opinions about the practices of distance education in mathematics, with the aim of examining the participants' mathematics teachers' and pre-service teachers' opinions about the practices of distance education. The data obtained because of gathering the answers given by the participants to these problems under these three different sub-themes is presented below.

In this study, the distribution of the expressions used by the participants according to three general themes in which the opinions of 37 mathematics teachers and 90 pre-service teachers participating in the research on distance education were examined is given in Table 1.

Table 1. Distribution of participants' statements to themes

	Pre-service teachers		Mathematics teachers		Total	
	f	%	f	%	f	%
Positive and negative opinions on the Distance education practices of participants	25	12.2	16	9.2	10	7.8

Participants' Opinions on Distance Education Practices

The 90 participants answered the research problem addressed to themselves and stated as "What are the mathematics pre-service teachers' positive and negative opinions about the practices of distance education?" by using 675 statements. In addition, 37 participant mathematics teachers answered the research problem addressed to themselves and stated as "What are the mathematics pre-service teachers' positive and negative opinions about the practices of distance education?" by using 258 statements in the study. The distribution of these participants' statements in relation to their positive and negative opinions about the practices of distance education for the three sub-themes of the study is given in Table 1.

Table 2. Distribution of positive/negative opinionsandsub-themes for distance education

	Pre-service teachers		Mathematics teachers		Total	
	f	%	f	%	f	%
Positive Thought	398	58,9	112	43,4	510	54,7
Negative Thought	222	32,9	116	45,0	338	36,2
Neutral	55	8,2	30	11,6	85	9,1
Total	675	100,0	258	100,,	933	100,0

From the varied data analyses, it was observed that an important part of the participants' statements related to their opinions about the practices of distance education was positive. They were observed to use positive (54,7%), negative (36,2%), and neutral (9,1%) statements. For participant mathematics teachers, it was found that nearly half of the statements (43,4%) related to the mathematics teachers' opinions about distance education practices were positive. However, it is observed from the table that the number of negative statements used by the mathematics teachers is higher (45%). In contrast to participant mathematics teachers, it was declared that an important part of the participant pre-service teachers' statements related to their opinions about the practices of distance education was positive. They were observed to use positive (59%), negative (32,8%), and neutral (8,2%) statements. The codes determined within the scope of the subthemes related to the participants' positive and negative opinions about distance education practices are explained in detail in the following tables.

First, the pre-service teachers' opinions on the practices of distance education are explained in Table 3.

Table 3. Sub-themes/codes related to pre-service teachers' opinions on distance education

	Pre-service teachers	
	f	%
Positive Thought	398	59,0
Easy Access	154	22,9
Repeatability	73	10,9
Economy	67	9,4
Enriched environment	54	8,1
Organizability	26	3,9
Individuality	18	2,8
Transparency	6	1,0
Negative Thought	222	32,8
Lack of interaction	60	8,9
Access impossibilities	54	8,0
Technological infrastructure	48	7,1
Lesson management disorders	34	5,0
Physical environment disorders	20	2,9
Measurement errors	6	0,9
Neutral	55	8,2
Total	675	100,0

While the participant pre-service teachers explained their statements revealing their positive opinions about the distance education practices, they used statements mostly related to the sub-themes of easy access and repeatability (22,9% and 10,9%, respectively). Moreover, the other positive statements related to the sub-theses of being economic and opportunity for an enriched environment (9,4% and 8,1%, respectively) also indicate that these pre-service teachers had positive opinions about distance education practices. Moreover, while they explained their statements revealing their negative opinions about distance education practices, they used statements mostly related to the sub-themes of lack of interaction, access impossibilities and technological infrastructure (8,9%, 8,0% and 7,1%, respectively). Hence, it is observed that their positive opinions on distance education practices focus on the sub-themes of easy access and repeatability. It is observed that the participant pre-service teachers' negative opinions about distance education practices result from the lack of teacher– student, student–student, and material– student interactions in courses, difficulties experienced during access to distance education courses, and insufficiency resulting from technological infrastructure. It was also observed that approximately 8,2% of them did not state any positive or negative opinions, but used neutral statements.

Below are some examples related to these pre-service teachers' positive opinions on distance education practices.

Starting from the sub-themes of easy access to distance education practices and the repeatability of courses, we can state that the pre-service teachers' positive opinions stated as "we can watch what we have not understood often" and "we can listen to our courses and take notes whenever we like" indicate their favorable opinion about these practices.

Below are some examples related to these pre-service teachers' negative opinions on distance education practices.

It is observed that the negative opinions of their stated as "The students could not experience the collaborative learning environment, peer teaching very much.", "Courses passed as if we listened to conferences." resulted from the lack of communication in relation to the distance education practices. Moreover, it is also observed that their negative opinions stated as "Moreover, we cannot obtain the books every time. We have difficulty in accessing the library" resulted from the difficulties they had in accessing distance education courses. Similarly, it is observed that these pre-service teachers' negative opinions stated as "We had many connection problems", "In distance education, we solved less mathematics problems because we could see less board area", "Not all of us are sufficiently equipped,

so we may fall behind in the class" resulted from the insufficiency of technological infrastructure related to distance education practices.

The codes determined within the scope of the sub-themes related to the participant mathematics teachers' positive and negative opinions about distance education practices are explained in detail in Table 4.

Table 4. Sub-themes/codes related to mathematics teachers' opinions on distance education

	Mathematics teachers	
	f	%
Positive Thought	112	43,4
Easy Access	8	3,1
Repeatability	0	0,0
Economy	27	10,5
Enriched environment	45	17,4
Organizability	5	2,0
Individuality	13	5,0
Transparency	14	5,4
Negative Thought	116	45,0
Lack of interaction	52	20,2
Access impossibilities	8	3,1
Technological infrastructure	10	3,9
Lesson management disorders	15	5,8
Physical environment disorders	18	7,0
Measurement errors	13	5,0
Neutral	30	11,6
Total	258	100,0

While the participant pre-service teachers explained their statements revealing their positive opinions about the distance education practices, they used most statements (17,4%) in relation to the enriched environment sub-theme. The mathematics teachers stated that computer-assisted education was advantageous, they gained experience by integrating technology into mathematics education, and they added visual content to courses via online materials and Z books. In addition, it was understood that they used most statements for the sub-theme of lack of interaction (20,2%). When the teachers' statements related to their negative opinions were examined, it was understood that the teachers could not get in touch with their students, the students' social communications with their peers and teachers weakened, and their lesson motivations and attention spans were at a minimum level during the distance education process.

Below are some statements related to the participant mathematics teachers' positive opinions on distance education practices.

According to this, statements such as "…I think its positive effect is related to performing new generation question solving has become easier via digital applications", "In my math courses, on Google Jamboard, I could take colorful notes, solve plenty of examples, draw figures easily and then share them with my students" and "…since distance education process allows for different practices, I find it useful for mathematics teaching" indicate that distance education provides mathematics teachers with an enriched environment. Moreover, the participant mathematics teachers stated their positive opinions in relation to the sub-theme of transparency via such statements as "I think the courses were taught better with the students participating in the lesson because there was not a problem like dealing with uninterested students in the classroom", and they also stated their positive opinions in relation to the sub-theme of economy via such statements as "In a short time, the acquisitions which need giving were taught. Since there are no out-of-lesson talks in distance education, the teacher could teach the courses more easily" and "Doing the courses by sitting at the computer was positive for those who are both mothers and teachers like me because we did not have to go out of our homes."

Below are some statements related to the participant mathematics teachers' negative opinions on distance education practices.

The mathematics teachers expressed their negative opinions about the sub-theme of lack of interaction via such statements as "Especially in subjects like geometry, which requires the use of tangible materials, the fact that the materials were shown on the screen and the students were not able to examine these materials personally made their learning difficult." , "What's worse, I had some students who did not give any reaction when I called their names (most likely, the ones who were not at the screen / the ones who were concerning themselves with things other than the lesson even if they were sitting at the computer /the ones who started the lesson and slept just over there / the ones who turned the volume of the lesson down and went on playing games)" and "It fell short of making an eye-contact and providing instant feedback". They expressed their negative opinions about the sub-theme of access impossibility via such statements as "the negative aspect of distance education was that the students without a computer, tablet, or smartphone could not join the courses" and "Since especially students living in rural areas had Internet problems, it was difficult for them to join the courses". They expressed their negative opinions about the sub-theme of physical environment disorders via such statements as "The problems of attention deficit and adaptation in the comfortable environment at home are, too, among their negative sides." It was observed that 11,6% of the mathematics teachers remained neutral to the distance education process of mathematics education by not expressing any positive or negative opinions.

Participants' Opinions related to Students' and Their Parents' Worries about the Functionality of Distance Education Practices

37 participant mathematics teachers answered the research problem stated as "What are the students' parents and the students' worries about the functionality of the distance education practices in mathematics education?" with 100 statements. The sub-themes created by using the statements in relation to how the teachers perceived and explained the students' parents and their worries in the process in which mathematics education was realized via the distance education practices are shown in Table 5.

Table 5. Distribution of teachers' expressions about students' parents and students' worries about the functionality of distance education practices in mathematics education

	f	%
Worry	91	91,0
General Anxieties	17	17,0
Distrustfulness	22	22,0
Domestic unrest	14	14,0
Financial difficulties	2	2,0
Fruitlessness	30	30,0
Lack of knowledge	6	6,0
Those who expressed having no worries	9	9,0

In this study, when the distribution of the statements of the mathematics teachers in relation to the kinds of worries that the students' parents and the students had about the functionality of the distance education practices in mathematics education was examined, it was found that while 91% of the students' parents and the students had some worries, 9% of them did not have any worries. The students' parents and their worries focused mostly on the distance education practicesbeing fruitless (30%) and distrustful (22%) in mathematics education.

Below are some examples related to the participant mathematics teachers' opinions about the students' parents and the students' worries related to the functionality of distance education practices in mathematics education.

The participant mathematics teachers stated that the distance education practices were fruitless in mathematics education by referring to the students' parents and the students' worries about the functionality of the distance education practices in mathematics education by expressing opinions stated as "The students' parents and the students think that they cannot benefit from distance education, they cannot get education as good as face-to-face education", "The students' parents' worries because the students' attention are continuously distracted and they cannot learn the topics well have increased" and

"The students already have difficulty in understanding the subject of mathematics, they do not understand it at all in the distance education process." Under the sub-theme of distrustfulness, they gave utterances to the students' parents and the students' worries by expressing opinions stated as "There are worries about the reliability of distance measurement and evaluation works" and "Since mathematics is generally perceived as a difficult subject, they worried that distance education might negatively affect their performance levels negatively."

Participant 90 mathematics pre-service teachers answered the research problem addressed to themselves and stated as "What are the students' parents and the students' worries about the functionality of the distance education practices in mathematics education?" by using 350 statements. The distribution of the statements related to how these participants perceived and explained the students' parents and their worries about the functionality of distance education practices in mathematics education for the sub-themes of the study is given in the following table.

Table 6. Distribution of pre-service teachers' expressions about students' parents and students' worries about the functionality of distance education practices in mathematics education

	f	%
Worry	311	88,9
General Anxieties	101	28,9
Distrustfulness	70	20,1
Domestic unrest	52	15,0
Financial difficulties	42	12,1
Fruitlessness	33	9,5
Lack of knowledge	11	3,3
Those who expressed having no worries	39	11,1

In the analyses, it was observed that an important part of the statements related to the participant pre-service teachers' opinions about the students' parents and the students' worries about the functionality of the distance education practices were worry-indexed. According to the pre-service teachers' opinions, it was determined that 88,9% of the students' parents and the students had opinions including worries about the functionality of the distance education practices in mathematics education and 11,1% of them shared opinions not including any worries. However, it was observed that the participant pre-service teachers' opinions, including worries about the functionality of distance education practices in mathematics education, concentrated on the sub-themes of general anxieties and distrustfulness. Some examples related to these participant pre-service teachers' opinions about the students' parents and their worries in relation to the functionality of distance education practices in mathematics education are given below.

The participant mathematics pre-service teachers' opinions stated as "The students' attitudes toward mathematics due to its difficulty have worried the students' parents" and "Finishing the courses in time; they were worried about that the student can even hardly understand in face-to-face education, how can they understand in distance education" in relation to the students' parents and the students' worries about the functionality of the distance education practices, indicate, starting from the sub-themes, that they had general anxieties about the distance education practices. Consequently, the subtheme in which these states of worry had the highest frequency was explained as general anxieties in which the students' and parents' distrust in distance education and domestic unrest occurred during the process of distance education. Moreover, the opinions stated in relation to the sub-theme of distrustfulness, which is another frequently observed sub-theme, are as follows: "According to the students' parents, the students were detached from the courses; they pretended to be at the computer, but they were interested in different things." These opinions indicate that the pre-service teachers thought that the students' parents and their worries created distrust in relation to the functionality of distance education practices in mathematics education.

Discussion and Results

According to the findings of the study, it was determined that an important part (59%) of the statements related to the pre-service teachers' opinions about distance education practices were positive. In contrast, some pre-service teachers (8%) were indecisive about expressing opinions in relation to distance education practices. It was observed that the pre-service teachers' positive opinions on distance education practices concentrated on the sub-themes of easy access and repeatability. The participant pre-service teachers were observed to think that their negative opinions about the distance education practices resulted from the lack of teacher– student, student– student, and material– student interactions in the courses, impossibilities encountered in the access to distance education, and insufficiency resulting from technological infrastructure.

When the findings were examined, it was observed that the mathematics teachers' positive and negative statements related to their opinions about distance education practices were close to each other (43,4% and 45%, respectively). When these statements were compared with those of the pre-service teachers' statements, it was determined that the number of positive statements did not decrease significantly, but there was a rather high increase in the number of negative statements. In other words, compared to mathematics pre-service teachers, mathematics teachers think more negatively about distance education practices. The theme in which the mathematics teachers thought that the effect of distance education practices on mathematics education was positive was the theme of "It provides an enriched environment". The mathematics teachers were observed to state that computer-assisted education was advantageous; they gained experience by integrating technology into mathematics education and added visuality to courses via online materials. However, the sub-themes of transparency and economy were the other statements that were dwelled upon. Moreover, when the statements of the answers given by the mathematics teachers indicated that the effect of the distance education practices on mathematics education was negative, it is eye-catching that they used most statements for the sub-theme of lack of interaction. When the statements belonging to the negative opinions were examined, it was observed that the teachers could not get in touch with their students during the distance education process, the students' social communications with their peers and teachers weakened, and their motivations and attention spans were at minimum level. According to Kanuka (2011), rather than the way education is performed in a face-to-face or online manner, the level of interaction determines the quality of a student's education experience. The main reason for the opinions stated in this study in the direction that distance education created a lack of interaction might be the participants' having a low level of distance education experience. In distance education, lack of communication between a student and a teacher, insufficient feedback, and insufficient support are seen as the most important disadvantages (Wacker, Unger, & Rey, 2020). In this respect, gaining experience and teachers' showing development in this direction might contribute to the decrease in the number of negative opinions.

One of the positive points upon which both the teachers and the pre-service teachers dwelled was the advantages of the possibility of easily accessing the distance education practices, economy, and enriched environment. These opinions show similarities to the results of the study by Katane, Kristovska, and Katans (2015), which stated that distance education provides opportunities for individualization and accessibility in education. According to Moore (1990), together with the popularization of new technologies, if individual differences are respected and knowledge about characteristics specific to learning style is included in the teaching design of distance learning, it will undoubtedly enhance a learning activity.

Some fears are occurring in relation to the possibility that social inequalities will increase between students who have a better socio-cultural status (those who have their own rooms and required digital infrastructure) and those who do not (Hurrelmann & Dohmen, 2020). The pre-service teachers expressing opinionssimilar to this idea mentioned the impossibilities encountered in accessing distance education courses and the insufficiency resulting from the technological infrastructures. This situation is an indication of the fact that the students who do not have their own rooms and required digital infrastructure are not on the same terms as the ones who have their own rooms and required digital infrastructure, and this situation causes them to express negative opinions about the distance education practices.

The findings of the study indicated that according to the mathematics teachers, while 91% of the students' parents and students felt worry about the functionality of the distance education practices in mathematics education, 9% of them did not feel worry. According to the mathematics teachers, the students' parents and their worries concentrated on the thought that the distance education practices were fruitless and distrustful in mathematics education.

It was observed that an important part of the statements of the pre-service teachers in relation to the students' parents and the students' worries about the functionality of the distance education practices education were worry-indexed. According to the opinions of the pre-service teachers, it was determined that about the functionality of the distance education practices in mathematics education, 88,9% of the students' parents and the students had opinions including worry and 11,1% shared opinions not including worry. However, it is observed that the participants' worry-including opinions about the functionality of distance education practices in mathematics education concentrated on the sub-themes of general anxiety and distrustfulness.

Mathematics teachers and pre-service teachers shared the worry that distance education practices were not confident. Another shared point was that the students' parents and the students had a rather high level of worry related to distance education practices. The generally stated worries were briefly explained as the students' parents' distrust in relation to distance education practices and domestic unrest occurring during distance education.

When distance education practices are considered, due to the difficulty of explaining mathematical concepts, they should focus on mathematics in which distance education is challenging (Frid, 2002). However, it was determined that the participants considered the effect of the difficulties raised by the mathematics curriculum to be less important than that of the difficulties caused by students. It is known that there is a strong correlation between a student's level and the curriculum level (Mailizar et al., 2020), and this strong correlation and, to a certain extent, the commonly known strong correlation between school culture and student success, might account for the fact that a student's level creates the biggest obstacle before the ICT integration in the class (Demirtas, 2010).

In conclusion, it indicates that schools, one of the most important stakeholders of education, are required to play an important role in overcoming the difficulties that students have in using e-learning during difficult periods such as pandemics. In this study, it was found that teachers and pre-service teachers had different positive and negative opinions on distance education practices.

Limitations and recommendations

It has become a known fact that technological change will continue and, probably, its speed will increase, and distance learning will become more prevalent, especially in the field of education. In this context, to follow the latest novelties in place of determining our own direction, it will be more appropriate to focus on "what is the latest technology" in place of "what is worth investigating". In today's rapidly changing technological view, Romberg (1989: 254) put forward the idea that it is important that studies in mathematics education should determine the current status and developments should be future-oriented.

In traditional instruction in Turkey, students complete their courses and homework assignments and receive education in classrooms and at home. The change that online learning has brought to the forms of space and time surrounding (mathematics) education is encouraging quantitative change so much that it might dialectically turn into a qualitative change. In relation to this matter, the mathematics teachers and the mathematics pre-service teachers' positive and negative opinions were inquired. In general, it was observed that the teachers' and the pre-service teachers' opinions on distance education practices showed differences. Although it was observed to facilitate life in general, it was determined that it was thought to change some dynamics of education.

Students' access to mobile technologies might create a student– mathematics relationship, which has not been commonly adopted by mathematics educators, breaks up the traditional flow of mathematics

knowledge from teacher to student and is not understood well from the research perspective. The potential of distance education practices in ruining the institutional and hierarchical nature of traditional education, providing students with opportunities for accessing courses without any requirements, and affecting the quality of courses should be investigated. Mathematics education, as the participants stated, also provides a large accumulation in terms of practice area. In this respect, how this accumulation affects the quality of courses should be investigated. This situation will bring how distance education practices are required to design pedagogically along to the agenda again. The collaborative and social network possibilities of the current technologies and personal learning environments have accelerated the development of distance education practices. However, these new developments are calling forth new questions about the design and use of distance education practices in mathematics education.

In this study, although both mathematics teachers and mathematics pre-service teachers' opinions about distance education practices have different priorities, they are not completely independent from each other. There are great intersections and relationships between the themes realized in this analysis and bringing the intersecting aspects to the agenda. First, problems related to the nature of new mobile/digital technological tools supporting access to mathematics and mathematics education knowledge/information and changing the nature of student-information-teacher-context interaction were realized. This field needs to be investigated in more detail. When the targets are related to mathematics and mathematics education, there is a need to elaborate the pedagogical design of mathematics education using new technological tools. The students' parents and the students' worries about the functionality of the distance education practices in mathematics education, which is another theme, are toward the impossibility of mathematics education via distance education. Although this prejudice about this matter can be considered as required by the applied nature of mathematics education, how this is overcome via various designs and pedagogical supports should be investigated.

Implications

This study was a qualitative study, whose evaluation was made via qualitative analysis methods. In future studies, quantitative methods will be used. Within the scope of the study, only a limited number of teachers could be reached. More comprehensive studies can be conducted with the participation of more teachers. This study, which was conducted in the field of mathematics education, can be repeated in different fields such as science and social studies.

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