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Mathematics teachers' perspectives on distance education in Turkey

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ABSTRACT

The aim of the study is to examine in detail the perspectives of mathematics teachers towards distance education, their positive, and negative experiences in the process and their views on the development of the process. Phenomenological design, one of the qualitative research methods, was used in the study. The sample of the study consisted of 32 mathematics teachers working in different parts of Turkey who were selected through convenience sampling method. A semi-structured interview form was used as a data collection tool. Descriptive analysis and content analysis methods were used to analyze the data. It was found that mathematics teachers mostly used Education Information Network (EBA) live lesson and Zoom platforms in distance education, more than half of the teachers considered themselves technologically competent for distance education, and they generally did not have any problems in accessing and using web-based teaching materials. In addition, teachers rated distance education positively in terms of access to information and ease of time and space, and negatively for reasons such as lack of face-to-face communication.

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1. INTRODUCTION

Distance education started in the 18th century and has shown a positive dynamic development until today as a structural component of form, method, educational resources, and content [1]. Therefore, distance education is not new in the educational system and is used in various fields. Distance education is planned learning and teaching carried out through communication technologies, including private institutional organizations, from places where formal education takes place [2]. In their study, Simonson et al. found that distance education is an effective method for teaching and learning [3]. Accessibility and convenience important advantages of this mode of education [3]. Bobyliev and Vihrova [1] argue that there are three basic keys to the enacting of distance education, and in the absence of at least one of these three features, the implementation of distance education is not possible. The first of these features is that distance education is a learning process and in this educational process there is a bilateral interaction as teaching-learning, the development of students is important and the process can be supported by a special systematic organizational training. Secondly, the educational process can take place between certain distances in practice and thirdly, there is an interaction between the teacher and the student, which includes the systematic application of feedback.

During the COVID-19 pandemic, distance learning was rapidly adopted as an alternative to classroom education due to quarantines, and educational guidelines used online platforms as an emergency solution [4]. The COVID 19 pandemic has led to the compulsory interruption of education in schools in all

countries of the world, regardless of discrimination, and in many countries, it has revealed the obligation to switch to partial or complete distance education, which is still ongoing. In addition, this situation has caused many unforeseen disruptions in the education system, the realization of deficiencies in different areas and the need to adapt to the new situation as quickly as possible and to improve the existing situation. In addition to its advantages, such as facilitating access to education, distance education has created new challenges for all educators. These challenges have affected teaching methods, learning strategies, curricula and many skills and techniques that are very important in face-to-face education environments have become inapplicable in distance education [5].

Distance education provides a different learning environment and requires new responsibilities and additional efforts from educators [6]. Therefore, educational researchers have carried out many studies in this process, such as identifying the existing problems, eliminating these problems, and making distance education more effective. These publications contribute to the development of distance education. A review of distance education studies in the literature shows that interaction is at the center of most studies [7]–[10]. Much of the research is devoted to two-way interpersonal interaction, such as learner-learner and learner-instructor interaction [11]. The use of interaction between the teacher and the student at a high level in the educational process will be efficient in increasing the quality of the learning-teaching process. In their study, König *et al.* [12] found that the ability of new teachers to maintain social contact with students during the COVID-19 period depends on professional competence, and that professional competence lends positive contributions to the planning, implementation, and evaluation of online courses. Therefore, the importance of developing skills related to information and communication technologies is emphasized in both initial teacher education and in-service teacher training. In addition to studies analyzing the views of teachers and trainers, there are also studies analyzing the views of students [13]–[16].

Distance education in mathematics has many problems in common with other fields, but it also has field-specific differences. There is a need for studies to identify the problems specific to the field of distance mathematics education, to help eliminate these problems and to increase the effectiveness of distance education. Although there has been a considerable amount of research on distance education, especially during and after the COVID-19 era, there should also be domain-specific considerations, which are important because distance education is highly technology-oriented and technological limitations directly affect the process. It is well known that there are not only large differences between countries in terms of technological advances, but also similar differences within each country. For this reason, it was thought that taking into account the opinions of mathematics teachers in Turkey and revealing region-specific differences would shed light on the improvements to be made.

Distance learning can be divided into three basic components: the teacher, the student and the technology that brings them together and enables the flow of education. These components can be characterized as the indispensable requirements of distance education. A failure in any of these three components affects the whole system and is equally important for the effectiveness of the education. In this study, the teacher component, which is one of these three components, was addressed and with the help of teachers' opinions, an attempt was made to identify problems and issues related to distance education, as well as possible causes and suggestions for improvement. The fact that teachers in distance education are competent enough to use technology in learning and teaching methods brings especially mathematics teachers to the fore in this respect. From this point of view, this study discussed in detail the mathematics teachers' perspectives on distance education, positive and negative experiences in the process, and their views on the development of the process.

It is believed that revealing teachers' views on distance education will contribute to education and training practices, and filling the gap in the literature in terms of teachers' experiences will give direction to this method of education. The research sought to answer the following questions:

- Q1. What learning management systems (Microsoft Teams, Zoom, EBA Live Lesson, TeamLinks, Google Classroom, and Edmodo) do you use in teaching?
- Q2. Explain your opinion about the learning management systems you use in distance learning.
- Q3. Apart from the learning management system you use in the teaching process, is there any other website/software/application you use in the course, for assignments or evaluation? If so, give an example of how you use them in your teaching.
- Q4. Do you consider yourself to be technologically competent for distance learning?
- Q5. Are the mathematics textbooks suitable for distance learning? If the textbooks are renewed, what are your suggestions regarding their suitability for distance learning?
- Q6. Which mathematical topics do you think are suitable for distance learning and which are not? Explain.
- Q7. In your opinion, what are the positive and negative aspects of distance learning from the teacher's/student's point of view?
- Q8. Do you have any suggestions to make distance learning more effective?

2. METHOD

2.1. Research design

Phenomenological design, one of the qualitative research methods, was used in the study. Phenomenology aims to give a broader meaning to lived experiences [17] and to examine the participants' experiences of a phenomenon or situation from a broader perspective. Phenomenology generally involves the process of identifying themes or patterns in qualitative data. Since this study aims to explore teachers' distance mathematics education experiences and the positive and negative aspects of distance education, phenomenological design was selected as the most appropriate research method.

2.2. Participants

Teachers with differing years of experience teaching in different cities of Turkey in the 2021-2022 academic year were selected using convenience and purposive sampling methods. Thus, the sample group consists of easily accessible, voluntary participants. Sixteen of the participating teachers work in secondary schools and 16 in high schools. When analyzing the distribution of the participants according to their years of experience, 12 (37.5%) have 1-5 years of experience, 11 (34.4%) 6-10 years, 1 (3.1%) 11-15 years, 4 (12.5%) 16-20 years, and 3 (12.5%) 20 years and more.

2.3. Data collection

As a data collection tool, a semi-structured interview form prepared by the researchers was presented to the participants via an online environment. Prior to the data collection process, ethical permission was obtained to interview the participants. Without face-to-face interviews with the participants, they were given access to the questions via the link sent to them by telephone. The interview form consists of open-ended questions that aim to elicit the participants' experiences of distance mathematics education. In formulating the questions, the opinions of an educational expert who is continuing his doctoral studies were taken into account. Before starting the data collection, a pilot study was conducted with two participants to finalize the interview form. As a result of the pilot study, questions that were not clear and unambiguous in the interview form were edited and questions that were considered incompatible with the purpose of the research were removed from the interview form. The final version of the interview form consists of two parts. The questions in the first part aim to identify the demographic characteristics of the participants. The second part is made up of 8 questions. The questions in the second part explore the participants' use of technology, experience of distance learning, classroom communication and the suitability of the mathematics course for distance learning.

2.4. Data analysis

Descriptive analysis and content analysis methods were used to analyze the data obtained in this study. As the data collection tool aims to reveal the experiences of the participants with detailed answers, the data obtained were analyzed separately. In the first stage, the answers to each question were transferred to a spreadsheet. After detailed analysis of these spreadsheets, the participants' responses were grouped and categorized. In the next stage, participants' long answers were shortened, and similar expressions were coded in the same category. Codes and categories were shaped by the findings based on the research questions.

2.5. Validity reliability

In order to ensure the validity of the research, expert opinion was taken while developing the data collection tool and pilot interviews were conducted with two people. Thus, it was aimed to increase the content validity of the research. In order to ensure the reliability of the research, the participant responses were read and coded separately by two researchers at the coding stage. To ensure inter-coder reliability, Miles and Huberman's [18], inter-coder reliability calculation formula "consensus/(consensus+disagreement)×100" was used. According to the calculation, the agreement between the two researchers was calculated as 0.82. This figure is greater than the value that ensures reliability. The interviews continued until the two researchers compared their coding and reached consensus on the questions where they disagreed. In addition, direct quotations were used to allow the reader to easily analyze and interpret the findings [18]. The third researcher finalized the tables of codes and categories. With the final checks made by the three researchers, the tables in the findings section were finalized. It can be said that these stages increased the reliability of the study. In addition, participants were identified on a voluntary basis. In this way, participants provided detailed data without feeling obliged to answer the research questions.

3. RESULTS

Sixteen secondary school and sixteen high school mathematics teachers participated in the study. Approximately 75% of the teachers had 1-10 years of service. Tables of the responses to the questions and

some notable example answers are given below. The frequency distributions, themes and codes of the learning management systems used by the teachers in the distance education process are given in Table 1.

When the teachers were asked which learning management systems, they used in the distance education, regardless of whether they were secondary or high school teachers, it is seen that they mainly used EBA, which is recommended by the Turkish Ministry of National Education, and Zoom, which is equally widely used. Frequency distributions, themes, sub-themes and codes related to the opinions of teachers about the learning management systems used in the distance education process are given in Table 2. In order to protect the confidentiality of the participants, secondary school teachers were given pseudonyms such as O1, O2, and high school teachers were given pseudonyms such as L1, L2.

When the teachers were asked about their positive and negative opinions about the learning management system they used, the most prevalent positive opinion was that it was efficient. L3 emphasized efficiency as providing the opportunity to solve more questions. Technical problems take the first place in negative opinions. Lack of face-to-face communication and inequality of opportunity were also emphasized. Especially L2 and L15, who have the longest teaching experience, have a very negative view of distance education; while L14, a teacher of 25 years, although not negative to the same extent says that they cannot reach enough students.

L15 (26 years of service) "There is no substitute for face-to-face training."
L2 (26 years of service) "No system can replace face-to-face education as much as the core."
L4 (25 years of service) "The applications are very useful but we cannot reach enough students."

Table 1. Learning management systems used by teachers in distance education

Theme	Codes	Secondary school teachers	High school teachers	f
Learning management systems	EBA live lesson	O1, O2, O4, O5, O6, O7, O8, O9, O10, O11, O12, O13, O14, O15, O16	L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, L15, L16	2 9
	Zoom	O1, O2, O3, O4, O5, O6, O7, O8, O9, O10, O12, O13, O14, O15, O16	L1, L3, L4, L6, L7, L8, L9, L10, L11, L12, L13, L14, L15, L16	2 9
	Microsoft Teams	O3	-	1
	Google Meet	O3	-	1
	Discord	O3	-	1
	Google Classroom	O4	L4	2
	Skype	-	L1	1
	TeamLink	O7	L3	2

Table 2. Teachers' opinions about the learning management systems used in the distance education

Theme	Subtheme	Codes	Secondary school teachers	High school teachers	f
Teacher views on distance education	Positive opinions	Efficient	O3, O10, O15, O16	L3, L4, L7, L10, L11, L12	10
		Useful	O4, O7	L14	4
		Time-space independence	O15	-	1
		Effective use of technology	O13	-	1
		Assignment traceability	-	L4	1
	Negative opinions	Technical issues	O1, O5, O7, O9, O10	L4, L5, L9, L16	9
		Inability to participate actively in the lesson	-	L9	1
		Lack of efficiency	O9		1
		Inadequate utilization / lack of prior knowledge	O6	L1	2
		Difficulty in classroom management	O8	-	1
		Difficulty in using foreign languages in management systems	O14	-	1
	Benchmarking	Lack of face-to-face communication	-	L2, L8, L15	3
		Inequality of opportunity	O8, O9	-	2

The frequency distributions, themes, sub-themes and codes related to the websites, software and applications used by the teachers, in assigning and assessing assignments and assessments, other than the learning management systems used in the course during the distance education process are given in Table 3. When the teachers were asked to specify the websites, software, and applications they used for assignment and assessment other than the learning management systems they used in the course during the distance education, it is revealed that more than half of them answered no, regardless of whether they were high school or secondary school teachers.

L3 (6-10 years of service) "I have never heard of any of these."

Table 3. Websites, software and applications used by teachers, in assigning and assessing assignments and assessments, other than the learning management systems used in the course during the distance education

Theme	Subtheme	Codes	Secondary school teachers	High school teachers	f
Homework assignment	Yes	Google Classroom	-	L4	1
		WhatsApp	O8, O12, O13, O16	L16	5
		Pdf files	O9	L11, L16	3
		Z-Kitap	-	L7, L11	2
		Eba	O12, O16	L13, L16	4
Assessment		Kahoot	O3	-	1
		ZipGrade	O7	-	1
Assignment-assessment		Personal website	O4	-	1
		Websites for education and training	-	L4, L11	2
-	No	-	O1, O2, O5, O6, O10, O11, O14, O15	L1, L2, L3, L5, L6, L8, L9, L10, L12, L14, L15	19

WhatsApp and Education Information Network (EBA) system are at the forefront of the ones used; O12 and O13, both from the first 5 years of service, gave the following answers.

O13 (1-5 years of service) "I gave homework assignments through class groups, WhatsApp and then checked them."
O12 (1-5 years of service) "Students sent their homework via WhatsApp; I checked the homework I gave in EBA through the system."

Frequency distributions, themes and codes related to teachers' finding themselves technologically competent in the distance education process are given in Table 4.

Half of the teachers find themselves technologically sufficient for distance education. Some of the responses of the teachers who found themselves partially sufficient and said that they improved in the process:

L16 (6-20 years of experience) "I did not think I was sufficient, but I learnt some things over time."
O14 (1-5 years of experience) "I make a new discovery every day. Let's not say that I find myself sufficient, but our experience of using distance education has directed me more towards professional studies. I find the opportunity to improve myself."

Frequency distributions and themes related to the suitability of mathematics textbooks for distance education process are given in Table 5, and frequency distributions, themes and codes related to recommendations in terms of suitability for distance education in case of renewal of textbooks are given in Table 6.

Table 4. Teachers' finding themselves technologically competent in the distance education

Theme	Codes	Secondary school teachers	High school teachers	f
Technological competence	Yes	O1, O3, O4, O8, O10, O11, O13, O14, O15	L1, L2, L4, L5, L9, L11, L16	16
	Partially	O2, O5, O16	L3, L7, L12	6
	No	O6, O7, O12	L10, L13, L14, L15	7
	Developed in the process	O9	L6, L8	3

Table 5. The suitability of mathematics textbooks for distance education and

Theme	Secondary school teachers	High school teachers	f
Suitable	O11	L4, L5, L13	4
Unsuitable	O2, O4, O5, O6, O7, O8, O9, O10, O12, O13, O14, O15, O16	L1, L2, L6, L7, L8, L10, L11, L12, L16	22

Table 6. Recommendations in terms of suitability for distance education in case of renewal of textbooks

Theme	Codes	Secondary school teachers	High school teachers	f
Book availability in distance education	Few questions	O7, O8	L6, L9, L13	5
	Not suitable for online education	O9, O10, O13, O14, O15, O16	L6, L8, L9, L14, L15	11
	Content not intelligible	O5	-	1
	Curriculum intensive	O6	-	1
	No QR code identification	O2	L11	2
	No content suitable for dynamic software	O3	-	1

In Tables 5 and 6, when teachers were asked about the suitability of mathematics textbooks for distance education, reasons, and suggestions, 22 teachers said that they were not suitable.

> *O16 (1-5 years of service) "Although the textbooks provided by MEB (Ministry of National Education) are already available in the interactive environment, unfortunately they are not fully suitable for online use. However, there are publications and enriched e-books that provide this."*
> *O3 (6-10 years of service) "Mathematics textbooks are also not suitable for face-to-face education (especially for grades 6,7,8). In order for it to be suitable for distance education, teachers should have a good command of dynamic software."*

Frequency distributions, themes and codes related to mathematics topics suitable and unsuitable for distance education (in terms of teachers/students) are given in Table 7.

Table 7. Mathematics topics suitable and unsuitable for distance education (in terms of teacher/student)

Theme	Subtheme	Codes	Secondary school teachers	High school teachers	f
Suitable	Mathematics	Natural numbers	O1, O7	-	2
		Integers	O1, O7	-	2
		Multipliers and multiples	O11	-	1
		Problems	-	L5	1
		Clusters	-	L10	1
		Exponential expressions	-	L12	1
		Logic	-	L12	1
		Permutation, combination, and probability	-	L1	1
		Trigonometry	-	L9	1
		Data analyses	O2, O4, O10, O14, O15	-	5
		Length measurement	O14	-	1
	Geometry	Geometry topics	O12	L9, L13, L14	4
		View of objects from different directions	O10	-	1
		Transformation geometry	O6	-	1
		Geometric objects	O6, O10, O14	-	3
		Analytic geometry	-	L9	1
Unsuitable	Mathematics	Integers	O10, O14	-	2
		Rational numbers	O7, O14	-	2
		GCD-LCM	O2, O4	-	2
		Problems	O14	-	1
		Multipliers and multiples	O6	-	1
		Exponential expressions	O2, O4, O10, O15	-	4
		Square root expressions	O2, O4	-	2
		Algebraic expressions	O11	-	1
		Logic	-	L10, L13	2
		Equations	-	L14	1
		Trigonometry	-	L10	1
		Functions	-	L1, L5	2
		Limit	-	L1, L5	2
		Derivative	-	L1	1
		Integral	-	L1	1
	Geometry	Geometry topics	-	L1, L7, L8, L11	4
		Polygons	O7	-	1
		Circle	O7	-	1
		Geometric objects	O7	-	1

It is observed that positive or negative responses do not cluster in certain topics and show diversity. The responses of middle school and high school teachers differ in their choice of topics. This indicates that suitability is related not only to the topic itself, but also to the level of education. For example, it is noteworthy that teachers who consider geometry topics suitable are middle school teachers, while those who consider them unsuitable are high school teachers. Similarly, while middle school teachers consider exponential numbers unsuitable, a high school teacher has chosen this topic among the suitable ones.

Another noteworthy point is that some teachers identify the same topic as suitable while others consider it unsuitable. For example, a group of teachers, all of whom are middle school teachers, consider 3 topics related to numbers (natural, whole, rational numbers) as suitable, while others consider them unsuitable. This could be attributed to the fact that their opinions change depending on the topics they cover in their classes.

Teachers' opinions show diversity and inconsistency, which does not allow for a generalization.

> *L16 (6-10 years of service) "I think all subjects of mathematics course, which are abstract, are suitable for distance education."*

L5 (6-10 years of service) "Concrete mathematics subjects such as problems and counting rules are suitable."

Frequency distributions, themes, sub-themes, and codes of positive and negative aspects of distance education (in terms of teacher/student) are given in Table 8.

Table 8. Positive and negative aspects of distance education (in terms of teacher/student)

Theme	Subtheme	Codes	Secondary school teachers	High school teachers	f
Positive	Communication-relationship	Student-teacher extracurricular communication	O5, O7	-	2
		Student-teacher development of a new language	O14	-	1
		Student-teacher communication in different environments	O4	-	1
		Getting to know the student better and taking care of him/her	O16	-	1
	Positivity for the student	Efficient use of technology	O2, O10, O14	L5	4
		Possibility to access information	O4, O15, O10	L1, L10, L3, L5, L7, L12	9
		Possibility to improve the learning method and contribution to self-regulation skills	O5, O14	-	2
		Learning different software	-	L9	1
		Always available	O9	-	1
	Accessibility savings	Equal opportunities	O11, O16		2
		Ease of time and convenient location	O1, O8, O13	L9, L10, L11, L13, L14, L16	9
	Classroom management	Discipline, motivation	-	L10, L11, L16	3
		Sustainability of interaction	-	L9	1
Negative	Communication-relationship	No face-to-face contact	O1, O2, O6, O7, O13	L2, L3, L4, L6, L8, L10, L12, L13, L14, L16	15
		No emotional and social bonding	O2, O6, O8, O10	L5	5
		Social distance	O14		1
	Equal opportunity	No equality	O3, O4, O5, O7, O8, O13, O14, O16	L6	9
		Problem in course access	-	L11	1
	Health problems	Negative impact on health	-	L12	1
		Eye strain	O6		1
		Excessive radiation exposure	O9		1
	Technical problems	Lack of infrastructure, connection problem	O1, O12, O16	L6	4
	Negative effects for the student	Limited socialization	O12	L6, L8, L16	4
		Low motivation	-	L7, L16	2
		Attention deficit	O7	-	1
		No competition	-	L6	1
		The process of the student who lacks self-control is inefficient	-	L9	1
		Lack of digital media	O11	-	1
	Negative effects for the teacher	Irregularity of class time	O13	L6, L11, L16	4
		Screen addiction	O9, O14	L6, L8	4
		Excessive workload	O16	-	1
		Declining prestige	-	L15	1
		Inability to adapt to technology	-	L11	1
	Course content	Limited supervision		L14, L15	2
		Classroom management difficulties	O3, O12, O15	-	3
		Lack of communication	O10, O14	L1, L3, L4, L5, L6, L7, L12	9
		Negative classroom climate	O7	-	1
		Difficult to follow lessons	O13	-	1
		Lack of practice in subject learning	O7, O10	-	2
	Quality of teaching	Failure to understand the issues	O14	L5	2
		Inadequate learning	O11	L1, L7, L11	4
		Low participation	O13	L6, L10, L14, L15	5
		Tracking restricted	O8	-	1
		The problem of receiving and giving feedback	O7, O8, O13, O15	-	4

It is illustrated that teachers mainly find distance education unfavorable in terms of teacher-student communication. The most common reasons for this are the lack of face-to-face communication and the lack of emotional bonding. Inequality of opportunity also draws attention among the negative aspects. Lack of student participation and inadequate learning also stand out among the negatives.

L6 (16-20 years of service) "Some of the students enter the class in the last 5 minutes of the lesson just to appear in the roll call. Some of them enter the lesson but do not follow it."
O14 (1-5 years of service) "Inequality of opportunity emerged more. Students with financial difficulties could not benefit from distance education."
O2 (1-5 years of service) "The bond between teacher and student has been broken. The student's access to the teacher and the possibility of asking about he/she does not understand individually decreased."
Students see the ease of access to information and the opportunity to use technology as a positive aspect. Saving time is also seen as one of the positive aspects.
O14 (1-5 years of service) "It encouraged me to learn how to use the internet efficiently in the age of technology."
O13 (1-5 years of service) "We solve more problems. You can benefit from more resources."

Frequency distributions, themes, sub-themes, and codes related to teachers' suggestions for making distance education more effective are given in Table 9.

Table 9. Suggestions for making distance education more effective

Subtheme	Codes	Secondary school teachers	High school teachers	f
Technical	Strengthening infrastructure	-	L4	1
Education	Training to inform teachers about distance education	O7, O12, O16	L9, L15	5
	Good planning	O13	L11	2
	Increasing the number of teachers and decreasing the number of students	-	L3	1
Equipment	Increasing equipment, creating equal opportunities	O2, O4, O5, O7, O8, O9, O12, O16	L5, L6, L8	1 1
	Increasing the number of applications	O7, O15	-	2
	Increasing student participation	-	L7, L10	2
Content	Reducing the content of the curriculum	O7	-	1
	To ensure the efficiency of use by recording	O14	-	1
	Setting up cameras for student follow-up	-	L7	1

Among the suggestions for making distance education more effective, the first place is to improve equipment and to provide equal opportunities.

O8 (6-10 years of service) "Equality of opportunity must be provided, platforms such as EBA, Zoom etc. should be free of charge and it would be much better if mathematics teachers and all students were provided with tablets."
O12 (1-5 years of service) "The problem of internet access must be solved. It should reach every student."

This is followed by the training of teachers.

L11 (6-10 years of service) "I think that planning should be done very well and teachers should be trained on this issue."

4. DISCUSSION

While all individuals around the world are affected differently in the use of distance learning, the inability of students to continue the process face-to-face has revealed factors such as serious symptoms of depression, feelings of loneliness, unhappiness, and reduced physical activity [19]. For this reason, teachers' opinions are very important in order to increase the effectiveness of distance education, to increase the level of usability and to maximize student motivation. In fact, Patricia [20] stated that motivation and self-efficacy levels play an important role in student success.

Regarding the learning management systems used by mathematics teachers in distance learning, it is noteworthy that they mostly use the EBA Live Lesson and Zoom platforms. Apart from these, Microsoft Teams, Google Meet, Discord, Google Classroom, Skype, and TeamLink platforms are also used by teachers in distance learning. Zoom is a platform used for video and audio conferencing and webinars. Video conferencing software such as Zoom provides researchers with an economical and convenient alternative to in-person meetings [21]. Therefore, it can be considered as a more preferred solution. Pitriani and Pratama [22] examined

the views of educators on distance learning during the COVID-19 pandemic, divided the distance learning into two categories as online and offline, and found that educators used WhatsApp first, Zoom second, and Google Classroom applications third while conducting online learning. At the beginning of distance learning, teachers used Zoom software more, but then the Turkish Ministry of Education encouraged the use of EBA in all schools for security reasons.

The opinions of mathematics teachers about the learning management systems used in distance education were divided into three categories as positive opinions, negative opinions, and comparison. Teachers evaluated learning management systems in the distance education positively in terms of being efficient, useful, independent from time and space, effective use of technology, and follow-up of homework. The most predominant of these views was evaluated as being efficient. Technical problems, students not actively participating in the lesson, inability to teach the lessons efficiently, inadequate use/lack of prior knowledge, difficulty in classroom management and difficulty in using foreign language management systems are among the negative opinions. Lack of face-to-face communication and unequal opportunities are also included under the category of comparison. The weightiest of the negative teacher opinions was expressed based on the reasons arising from the technical infrastructure. Lack of face-to-face communication and inequality of opportunity are also emphasized negatively in the process. Teachers especially think that the distance education is not effective and efficient in mathematics lessons. The reason for this is that teachers think that mathematics lessons should be carried out in physical classroom environments. Additionally, teachers often feel that the lack of direct interaction prevents effective communication and feedback, which are important in mathematics education [23], [24].

Apart from the learning management systems used by teachers in distance learning, the applications were divided into three themes: assignment, assessment, assignment-assessment. The most preferred applications are WhatsApp, EBA, pdf files. These are followed by Google Classroom, enriched eBooks, Kahoot, ZipGrade, personal website, and websites for education and training. The majority of teachers do not use any software and applications for assignment and evaluation other than the learning management systems they use in the course during the distance learning. WhatsApp is the most preferred application used by students because it is both free and easy to use. WhatsApp is not only effective for learning but also a tool that can be used to increase students' motivation to learn [25], [26]. In addition, WhatsApp can be a tool for peer assessment [27]. Akar and Erden [28] found in their study that teachers use WhatsApp application to respond to students' questions and problems faster.

The fourth issue relates to whether teachers feel technologically competent in their use of distance learning. Half of both upper secondary and secondary mathematics teachers consider themselves sufficient in distance learning. There are also teachers who consider themselves partially sufficient, who are constantly improving in the process, and who do not consider themselves sufficient in this respect. In their study, Myyry *et al.* [29] found that teachers use digital tools for communication purposes, that is, to interact with students. It was also observed that teachers' technical skills in using digital technology are generally higher than their pedagogical skills [29]. These findings support the limited ability of teachers to use technology.

Most of the teachers stated that the mathematics textbooks are not suitable for distance learning and the reasons for this are the low number of questions in the textbooks, the textbooks are not suitable for online education because they are designed for face-to-face education, the content is not understandable for the students, the curriculum is heavy, there are no QR code definitions for the students to access easily and there is no content suitable for dynamic software which is important for mathematics.

When we look at the teachers' opinions about the mathematics and geometry subjects that are suitable and unsuitable for distance learning, we see that there are clusters and diversity in different subjects. Secondary mathematics teachers identified exponential expressions as an unsuitable subject. This may be because exponential expressions are difficult to relate to everyday life, there are few suitable materials, and there are difficulties with software for base and exponent expressions. On the other hand, secondary mathematics teachers stated that the topic of data analysis was suitable for remote slope. The reason for this may be that there are more visual figures and materials suitable for the topic and that it is easier to express. A few upper secondary mathematics teachers mentioned data analysis as one of the unsuitable topics for distance learning, while a group of upper secondary and middle school teachers mentioned geometry as one of the unsuitable topics. On the other hand, secondary and upper secondary teachers chose between topics that were suitable and unsuitable for their curricula. It can be seen that teachers generally do not agree on whether the subjects are suitable for distance learning or not. The fact that the teachers gave answers during the interviews about the subject they teach can be seen as a result of this. In addition, the fact that distance learning is new and that the teachers have not yet gained experience in all mathematics and geometry subjects at the time of the study can also be seen as a reason for this inconsistency.

Mathematics teachers stated that the positive aspects of distance education, especially for students, are access to information, flexibility of time and space, equality of opportunity and efficient use of technology. Mupinga [30] stated that the benefits of distance education include time and space flexibility for

students. Among the benefits of efficient use of technology, there are studies in the literature that distance education captures students' attention with text, video and audio formats and helps in understanding complex information [31]–[33]. Distance learning has advantages such as unlimited access to information, flexibility, adaptability to individual differences and the ability to progress at one's own pace [34]. This is in line with the findings of this study. In addition, Delen *et al.* [35] mentioned in their study that online learning environments are useful for individual learning. Moreover, the benefits of distance learning such as reviewing lessons, providing flexibility, easy access to notes and easier communication with the teacher are in line with many studies [36]–[38]. Mathematics teachers mentioned several shortcomings regarding the negative aspects of distance learning. Both high school and secondary school mathematics teachers stated that the most important problems in the distance learning are based on the limitation of face-to-face communication and the lack of communication. This finding is consistent with many studies in the literature, [13], [39]–[41]. In addition, problems such as inequality of opportunities, technical infrastructure problems, lack of emotional and social ties, difficulty in maintaining discipline and motivation, limited socialization, dependence on the screen, irregularity of teaching hours are among the disadvantages expressed by teachers. Many students and educators faced issues with reliable internet access and digital inequalities. This lack of access hindered the ability to participate effectively in online learning environments. According to Ndibalema [42], appropriate online mentorship programmers should be part of online learning pedagogy of care for students who feel isolated due to closure of face-to-face sessions. In the literature, it has been reported that teachers experience occupational stress due to increased workload and inadequate technological pedagogical skills [33], [43]. In the literature, there are also many studies that encountered problems due to infrastructure problems such as poor sound and image quality, inability to access the course [15], [44], [45]. These findings parallel those of the study.

The final research question asked teachers to suggest what could be done to make distance learning more effective, and teachers commented on improving equipment and creating equality of opportunity. Teachers stated that there was no equality of opportunity due to shortcomings such as the lack of tablets, computer facilities and limited access to internet resources for all students. They also stated that they did not have much information about the new emergence of distance learning in our lives and that they should receive information training on this subject. They also stated that shortcomings such as planning of training and increasing the number of applications should be eliminated. Similarly, Kocoglu and Tekdal [46] suggested that Internet and material support should be provided to teachers and students. It is important to consider teachers' suggestions and expectations, as adequate training and equipment directly affect the quality and effectiveness of teaching [47]. In their review, Achuthan et al. highlighted the need for continued research and innovation in this area to continually improve the quality and accessibility of online learning [48].

4. CONCLUSION

This study revealed in detail the perspectives of mathematics teachers towards the distance education process, positive and negative experiences in the process and their views on the development of the process. The teacher component, which is the foundation of distance education, has been addressed and with the help of teacher opinions, problems and issues related to distance education have been identified, and we have attempted to reveal the possible reasons for those problems, and also given suggestions for improvement. The results of this study may be useful in terms of directing teacher experiences to the distance education process and contributing to educational practices.

Considering the results of the research, experimental studies can be increased to make distance education activities more efficient. Teachers can be given in-service training to make distance learning more effective. Students and teachers can be provided with resources and materials suitable for the mathematics course in distance education. Further studies can be carried out to minimize technical problems.

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