



Was Emergency Remote Education Enough to Save The Day? Mathematics Teachers' Difficulties and Ways to Cope with These Difficulties

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Abstract: This case study aims to examine the difficulties, and the ways to cope with these difficulties or the solution proposals for coping faced by middle school mathematics teachers during the Emergency Remote Education (ERE). The participants consisted of four online focus groups with eighteen mathematics teachers working in middle schools in Turkey. The data was collected semi-structured interviews. The data was analyzed the thematic approach. According to the findings, the teachers faced difficulties caused by students, teachers, infrastructure, schedule and curriculum, parents, and nature of mathematics. The difficulties were virtual classroom management, participation, and interest/motivation (caused by student), communication/interaction, measurement and evaluation, ICT competencies, and privacy (caused by teacher), device and internet deficiencies (caused by Infrastructure), supporting roles and supervising roles (caused by parents), Schedule and curriculum, and Nature of mathematics. Teachers were able to cope with difficulties by banning/restricting, contacting parents, paying attention to the arrangement of scheduled hours, making additional courses, sending additional lesson documents, and organizing different learning activities, rules, face-to-face homework checks, and face-to-face exams, adhering to the lesson time in the schedule determined by the school administration. The limitations of the study and implications for future research were discussed.

Keywords: *emergency remote education; mathematics teachers; difficulties; cope with difficulties*

Introduction

CoViD-19 is an epidemic that causes serious effects in Turkey as well as in other countries in the World and changes the lives of societies in almost every sector rapidly and suddenly. In order to minimize the impact of this epidemic on societies and to minimize human-to-human contact by maintaining social distance, public areas, including schools were closed quickly (Bozkurt et al., 2020; Bozkurt & Sharma, 2020; Doghonadze et al., 2020). Education administrators decided to stop face-to-face education (Daniel, 2020) and to switch to online and distance education to solve this emerging crisis. The transition to distance education took place very quickly, out of necessity, without the necessary preparations. Since distance education in this case had to be implemented in an unplanned, it was named Emergency Distance Education (ERE) (Bozkurt et al., 2020; Hodges et al., 2020). ERE was the most convenient way to save the day in order to continue education and training activities. ERE, which was implemented to save the day, was experienced all over the world and its educational effects were felt by all stakeholders from kindergarten to higher education (Green, Burlow, & Carvalho, 2020). Undoubtedly, ERE, which had to be implemented in an unplanned manner, caused anxiety among teachers (Demir & Özdaş, 2020; Saadati et al., 2021; Ünal, & Buluz, 2020) as well as students (Kara, 2020; Serçemeli, & Kurnaz, 2020). In order to minimize this concern and not to interrupt education, the Republic of Turkey Ministry of National Education (MoNE) has started to work for ERE quickly and effectively.

First, with the cooperation of the Turkish Radio and Television Corporation and TURKSAT, educational broadcasts that provide education and training services through the Education and Information Network (EIN) channel of television started to be made (MEB, 2020). Immediately afterwards, the infrastructure of the EIN, which was used

before this process, was strengthened and made ready for the use of teachers and students (Arkan, 2020; MEB, 2020). In the early days of the transition to ERE, education administrators and teachers made an effort to offer live lessons through a number of online platforms. In this context, the MoNE decided to integrate the EIN platform with the technology that can provide live lessons in a short time. On April 15, 2020, the MoNE opened the EIN live lesson application for 8th grade, high school preparatory and 12th-grade students to the service of teachers and students. In addition, it was stated by the Innovation and Educational Technologies General Directorate (YEGITEK) that by taking the necessary security and privacy measures, virtual classroom applications can be made with free platforms such as Zoom, Microsoft Teams, Google Meet, Skype and similar platforms for other class levels (YEGITEK, 2020). With the EIN live lesson application, teachers continued their lessons by accessing the Zoom platform via EIN (Arslan, & Şumuer, 2020). In addition, MoNE published a Digital Literacy Teacher's Guide and published a study on the need to use digital technologies correctly, which has become the center of daily life for people of all ages, including teachers, students and parents, with the distance education process. For 5th, 6th, 7th and 8th grade students, 60 study fascicules (a separately published installment of a book or other printed work.) were published on October 5, 2020, where they will reinforce the topics they will cover and gain experience on different types of questions, and 42 study fascicules were published on November 26, 2020. During the pandemic process, distance in-service training activities were carried out for administrators and teachers by experts in the field in order to increase the competencies of administrators and teachers. On December 11, 2020, it launched the "covid19.meb.gov.tr" website, which aims to provide students, parents and teachers with information about the MoNE's work in a short time during the epidemic process and to easily access the inventories that users want about the epidemic (MEB, 2020).

These struggles of education administrators and policymakers to minimize the concerns of education stakeholders during the transition to ERE could not prevent some situations. The most notable of these situations is that the majorities of teachers have completed higher education with face-to-face education, become teachers, and are familiar with face-to-face education in their professional lives. Although these teachers, who were familiar with face-to-face education, had to change their habits as soon as possible with ERE, a large number of teachers applied the teacher-centered teaching method in face-to-face education as well as distance education (Bozkurt, 2020; Rianasar, Julie, & Apriani, 2020). Because teachers were forced into distance education (Borba, 2021) without understanding that being effective in distance education requires different pedagogy, communication and pace of progress (Davis, & Rose, 2007). However, teachers were not ready to switch to distance education, and the preparation, planning and practices related to the lesson were not familiar to them (Hurst, 2021). Thus, teachers had to cope with some barriers and difficulties in order to adapt to this unfamiliar process faster (Schleicher, 2020). In particular, mathematics teachers (MTs), who ensured that students had effective pedagogical strategies to develop their high-level cognitive skills, had more difficulty than other teachers in creating instructional strategies in the transition to ERE (Keebler, & Huffman, 2020). MTs reported that mathematics discipline is more difficult to conduct with ERE than other disciplines (Ní-Fhloinn, & Fitzmaurice, 2021). Even in an online mathematics-teaching plan in accordance with the nature of online learning, teachers have difficulties in monitoring student activities and designing online scenarios. In addition, it is difficult for teachers to determine the accuracy of the test results and to understand the students. Moreover, students

have low-level motivation (Satrianingrum, & Prasetyo, 2021). In addition to the studies that reveal the difficulty of processing mathematics with ERE, there are also various studies that show that students have difficulties when using the unique language of mathematics (Thompson, & Rubenstein, 2000; Rubenstein & Thompson, 2002). In this context, Usiskin (1996) emphasized that when students do not know how to read mathematics, it becomes difficult for them to understand mathematics, and it is important to know the symbols specific to the structure of mathematics and the meanings of these symbols in understanding mathematics. It is seen that mathematics achievement is lower than in other fields in international exams such as PISA for the use of such features (MEB, 2019).

In the literature, there were studies focusing on the difficulties experienced by MTs during the ERE process (Sukma, & Priatna, 2021; Yohannes, Juandi, Diana & Sukma, 2021). The difficulties experienced by MTs in the ERE process affect the effectiveness and quality of ERE in teaching mathematics. In Sukma and Priatna's (2021) study, MTs stated that users who did not have the necessary facilities for online learning encounter obstacles. Teachers, on the other hand, stated that they had difficulties due to unstable internet access and the high price of internet packages, the platforms used were not suitable for mathematical writing, the students were not aware of the assignments and they did not submit their assignments. In the study of Yohannes, Juandi, Diana, and Sukma (2021), it was determined that the difficulties experienced by teachers in applying online learning were caused by various factors such as students, teachers, schools, curriculum, and parents. According to the teachers' opinions, in online learning, students had more difficulties in understanding the subject, increasing internet and electricity costs, and teachers had difficulties in interacting with students and providing feedback. In addition, schools lacked clear guidelines for the technical application of online learning. While curricula did not include evaluating student performance during online learning, parents were insufficient in supervising their children in online learning. Apart from these studies, there are also studies that did not directly focus on the difficulties experienced by MTs in the ERE process, but showed that MTs had difficulties. Related studies reported that MTs faced some difficulties caused by "students" (Barlovits et al., 2021; Batdal-Karaduman, Akşak-Ertaş & Duran-Baytar, 2021; Briones et al., 2021; Matić, 2021; Ní-Fhloinn, & Fitzmaurice, 2021; Tay, Lee, & Ramachandran, 2021), "teachers" (Ata-Baran & Baran, 2021; Batdal-Karaduman, Akşak-Ertaş & Duran-Baytar, 2021; Chirinda, Ndlovu & Spangenberg, 2021; Hurst, 2021; Matić, 2021; Ní-Fhloinn, & Fitzmaurice, 2021; Rodriguez-Muñiz et al., 2021; Russo et al., 2021; Tay, Lee & Ramachandran, 2021), "infrastructure" (Marpa, 2021; Saadati et al., 2021), "parents" (Batdal-Karaduman, Akşak-Ertaş & Duran-Baytar, 2021; Matić, 2021; Panaoura, 2020), and "nature of mathematics" (Batdal-Karaduman, Akşak-Ertaş, & Duran-Baytar, 2021). In an interview conducted by the Ní-Fhloinn and Fitzmaurice (2021), a mathematics teacher mentioned difficulties caused by students "The students mostly do not attend the online classes we offer and then we cannot see what they are doing, we need to wait for them to ask for help." A participating teacher said about the problem caused by teachers (Matić, 2021): "feedback...it's time-consuming. They send me photos of their work. And then I sit at my computer the whole afternoon, till midnight, I think..." In Barlovits et al.'s study (2021), teachers stated that it is a problem for parents to sit behind the computer and tell their children what to do. A teacher who expressed a view in the study of Marpa (2021) mentioned the lack of infrastructure with the expression "We always have difficulties with internet connectivity. Sometimes connectivity suddenly stops along the way of the online discussions. ". In the study of Batdal-

Karaduman and friends (2021), a teacher drew attention to the problem related to the nature of mathematics by saying "There are subjects that need to be applied, such as measurement units, fractions, etc." Considering that these studies are carried out with MTs in different countries, it is seen that the difficulties experienced in mathematics teaching in the ERE process are at a global level.

When these studies on MTs in the ERE process are examined, it has been determined that there are few studies focusing on the difficulties experienced by MTs. Although, in addition to the anxiety caused by the epidemic, MTs who had to give up their teaching habits abruptly and where students failed in international mathematics exams faced difficulties, no study has been found that in-depth reveal the difficulties faced by MTs in Turkey. It is important to know and clarify the difficulties encountered in distance mathematics applications based on MTs' experiences and what precautions should be taken regarding these difficulties, in order to take the necessary precautions in the next crisis processes. In addition, revealing the difficulties encountered in mathematics teaching in the ERE process will provide important implications for education politicians, program developers, instructional designers, education experts, and practice MTs in order to learn from the experiences and develop new policies. The contributions of the study can be made not only at the national level but also at the global level.

Purpose of the Research

Therefore, in this case study, we aimed to determine the difficulties, and the ways to cope with these difficulties or the solution proposals for coping faced by Turkish middle school MTs, who are faced with many negative situations (Covid fear, abandonment of habits, mathematics anxiety, etc.), and conceptual confusion (distance education-ERE) during the ERE process. For this purpose, answers were sought to the following questions:

1. Which difficulties did Turkish middle schools MTs faced in their teaching process during ERE?
 2. How did Turkish middle schools MTs cope with the difficulties?
- (If they couldn't cope,) what suggestions did Turkish middle schools MTs' offer for difficulties?

Methods

Research Design

In this study, a case study is used as one of the qualitative research methods. The case studies are detailed examination of a specific phenomenon in real-life context, and used when the boundaries between the phenomenon and the context are not clear (Yin, 2017). The case in this study is "MTs' difficulties faced on the distance education during Covid-19 process".

Participants

The participants of this study consist of four online focus groups with eighteen MTs working in middle schools in Turkey. When the participants are selected, two different sampling methods are used. First method is the criterion

sampling method. The criterion sampling includes identifying important criterion, articulating these criteria, and conducting a systematic evaluation and study of examples that meet the criterion (Cohen & Crabtree, 2006). The criterion in this study is to MTs' experiences distance education for at least one semester during Covid-19 pandemic process. Second method is the maximum variation sampling method. By dealing with a wide range of differences connected to the circumstance, this strategy allows for the identification of common patterns from the differences (Patton, 2014). MTs are chosen to work in four different regions in order to acquire more specific information about the phenomenon. Table 1 shows the demographic characteristics of the participants.

Table 1

Demographic Characteristics Of The Participants

Focus Group Number	Gender	Teaching experience	Educational level	
1	Female	16 years	Bachelor degree	FG1MT1F
	Female	11 years	Master (Continue)	FG1MT2F
	Female	9 years	Master	FG1MT3F
	Female	6 years	Master	FG1MT4F
	Male	10 years	Bachelor degree	FG1MT5M
2	Female	9 years	Bachelor degree	FG2MT1F
	Male	9 years	Bachelor degree	FG2MT2M
	Male	9 years	PhD (Continue)	FG2MT3M
	Male	14 years	Bachelor degree	FG2MT4M
	Male	24 years	Bachelor degree	FG2MT5M
3	Female	6 years	Master	FG3MT1F
	Female	12 years	Bachelor degree	FG3MT2F
	Female	7 years	Master (Continue)	FG3MT3F
	Male	14 years	Bachelor degree	FG3MT4M
	Female	3	Bachelor degree	FG3MT5F
4	Male	11	PhD (Continue)	FG4MT1M
	Male	21	Bachelor degree	FG4MT2M
	Female	21	Bachelor degree	FG4MT3F

Data Collection Tool

In this study, the data was collected using a semi-structured interview form for the focus groups. Researchers used existing literature to create a semi-structured interview form. The interview form includes questions about participants' demographic profiles as well as two semi-structured questions about MTs' difficulties with distance education during the Covid-19 process and solutions. The opinions of four experts, two of whom are studying distance education, two of whom were studying mathematical education, and a math teacher, were taken on the instrument to ensure the validity of the instrument. The instrument, which had been modified in accordance with expert recommendations, was ready to collect data. The semi-structured interviews form for the focus groups was tested and revised in a pilot focus online group with three MTs.

Procedural Detail and Ethical Issues

Data was collected through semi-structured interviews in four online focus groups discussions with 18 participants run between 17 March and 30 May 2021. A focus group discussion is an interview technique that described as “an interactive discussion with a small group of preselected participants, led by a trained moderator and focusing on a specific set of issues (Hennink, Hutter, & Bailey, 2011; Krueger, 1994).

Focus groups typically consist of 6 to 8 participants, but can be anywhere between 5 and 10 depending on the purpose of the study (Hennink, 2014). To ensure that online discussion was manageable, the other three focus groups were kept to five participants, except for one focus group with three participants. All focus groups were organized and moderated by EK. The participants first discussed the difficulties on distance education faced by MTs pandemic process and then discussed the potential solutions of each topic in the context of difficulties. The questions in the form were asked in the same order to all focus groups’ participants, and the prompt questions were used when necessary. During the discussions, EK attempted to encourage every participant to talk about their ideas at least once. Finally, the EK concluded the discussed themes.

Researchers assumed ethical issues into account throughout the data collection process for the study. Participation in this study was voluntary before the data were collected. Respondents were notified that the information they provided would only be utilized for this study. Participants were also given information on the study aims, as well as how their data would be handled and how their personal information would be maintained. Participants did not allow the Zoom meeting, images and audio files to be shared with third parties. For this reason, raw data for dataset are not publicly available to preserve individuals’ privacy under the European General Data Protection Regulation. However, if desired, the written version of the raw data can be translated into English and shared via e-mail. Following the supplying of study information to the participants, online discussion periods were scheduled. For 50 to 65 minutes, each group engaged virtually via a web videoconferencing system (Zoom). Participants were able to attend via video and audio and provided their informed consent. The online discussions were recorded with the approval of the participants by EK and VDK. The recording was initiated prior to the beginning of each discussion.

Data Analysis

The data were analyzed with a thematic approach being used to extract themes and concepts according to the first and second research questions. MaxQDA was used for data analysis. Thematic approach, the other words, thematic analysis is a method for analyzing qualitative data that includes exploring a data set for repeating patterns, understanding them, reporting them (Braun, & Clarke 2006). It's a method for representing data that's been processed in a pragmatic way, but it also involves interpretation in the code selection and theme construction stages (Coffey, & Atkinson, 1996). The versatility of thematic analysis to be employed within a wide range of theoretical and epistemological frameworks and to be applied to a wide range of study questions, designs, and sample sizes is one of its distinctive characteristics (Braun, & Clarke 2006). The phases of the study were as follows: familiarizing yourself with the data; generating initial codes; searching for themes; reviewing themes; defining and identifying categories;

and last, preparing the report, which included a variety of illustrative data and quotations. The substance of the focus group discussions was verbatim transcribed. After every focus group discussion, two researchers independently coded the transcripts and then checked for agreement on the open coding. They then discussed the open codes and emerging concepts, developed themes, and reached a consensus by recoding or redefining concepts and themes when there were disagreements. The data collection and analysis were done in a step-by-step manner. To reach theoretical saturation, the data collection via focus group discussion was continued until no new conceptions appeared. Continuous comparisons of codes and themes led to the final code-theme structure. The findings were organized into figures with codes and themes that corresponded to the research questions. Direct quotes from the participants were also used to corroborate these figures.

Findings

This section provides the findings regarding difficulties faced by MTs during ERE and ways of coping with these difficulties. The findings are organized based on difficulties faced by MTs during ERE and ways of coping with these difficulties.

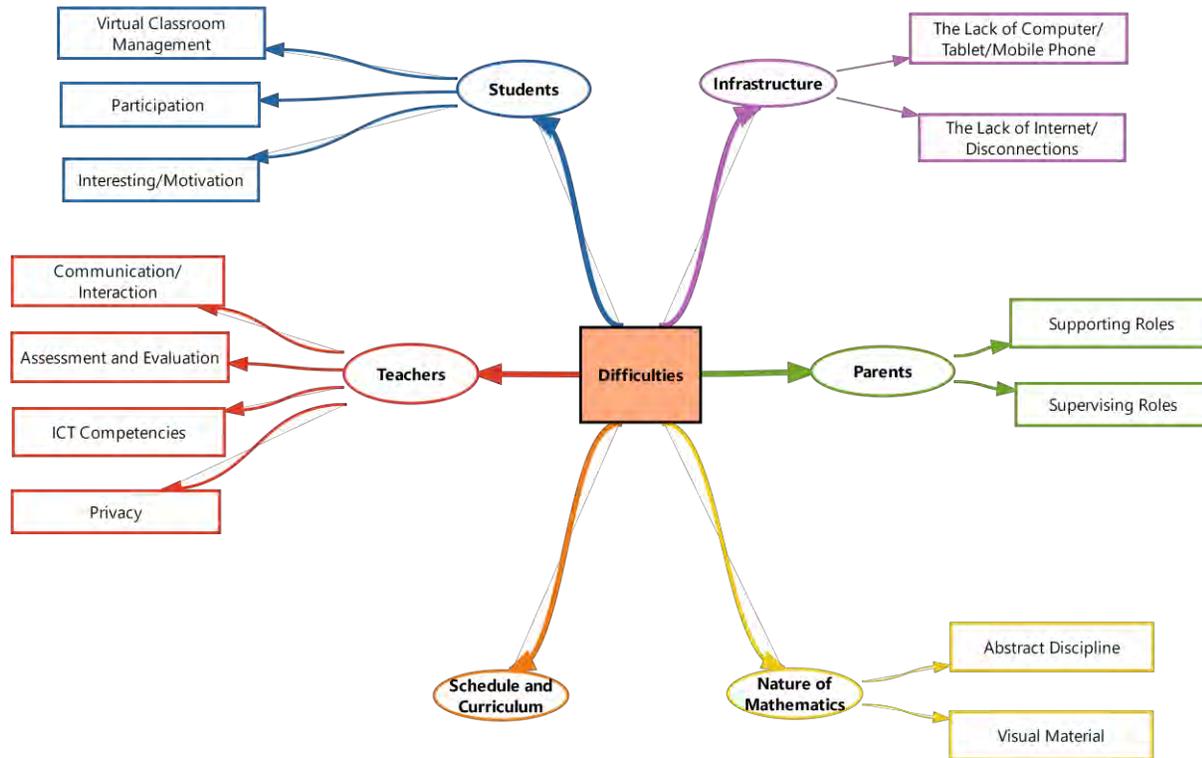
Difficulties Faced By MTs During ERE

In line with the research question, the first findings are related to difficulties faced by MTs during ERE. According to the findings, five themes were identified; student, teacher, infrastructure, schedule and curriculum, parent, and nature of mathematics. The themes and codes are showed in Figure 1.

Difficulties Caused by the Students

The difficulties caused by the students's theme consist of three categories related to virtual classroom management, participation, and interest/motivation.

MTs reported that the technology used during ERE, the implementation of distance education at home, and the difficulties related to the functioning of the lessons cause virtual classroom management difficulties. Regarding the technology used during ERE, MTs stated that students use the screen without permission, use the chat panel outside the lesson, and do not turn off their microphones. MTs also reported that the application of distance education at home causes students to lie down or listen to the lesson more comfortably. According to the MTs, not turning off the microphones during the lesson and dividing the lessons with music cause difficulties with virtual classroom management. One of the MTs (interviewee # FG2MT3M) commented as: “... *One student attended the course and its name was Yogo. When the course was continued, Yogo started to play the music...*”

Figure 1*Difficulties Faced by MTs During ERE*

MTs reported that one of the difficulties arising from the students is related to the participation of the students in the lesson. They also emphasized that students' participation in the lesson is low, they can attend the lesson with different names, and their entrance to the lesson is irregular. As interviewee # FG2MT1F commented, “...*I had difficulties such as students not attending the course or attending the course after a while...*”

While MTs reported that distraction of students is one of the important difficulties during ERE regarding interest/motivation, they also stated that students' not doing their homework is among the important difficulties. One of the MTs (interviewee # FG3MT3F) commented as: “...*The fact that there are too many elements to distract students in the course in these environments is an obstacle to students' learning. This is also a big problem...*”

Difficulties Caused by the Teachers

The theme of difficulties caused by the teachers themselves consists of four categories. These were determined as communication/interaction, measurement and evaluation, ICT competencies, and privacy.

MTs stated that they had difficulties in terms of communication/interaction difficulties because they could not see the students directly during ERE. In this context, they emphasized that the inability to make eye contact with the students

negatively affects the course of the lesson. One of the MTs (interviewee # FG3MT1F) expressed this situation as follows: *"...Since there is no school environment, we do not have face-to-face communication with students. This situation causes us to experience disconnection in communication with students..."*

One of the difficulties arising from MTs is the difficulties experienced in measurement and evaluation. MTs stated that they had difficulties in preparing and evaluating homework for students. In this context, one of the MTs (interviewer # FG4MT3M) stated the following. *"I continued to learn how to prepare a paper-pencil measurement tool that I was familiar with online. I had a hard time giving one-on-one feedback to students because there were so many homework files..."*

Another category was determined as the difficulties experienced at the privacy. Here, MTs stated that their intra-family communication was disrupted during ERE. In addition, MTs emphasized that their private lives were violated and that having housework forced them. In this context, one of the MTs' views (interviewee # FG4MT1M) is as follows: *"...We talked to parents until midnight. This disrupted our family situation..."*

Another category based on difficulties arising from MTs was determined as difficulties with ICT competencies. MTs stated that they experienced technical difficulties during ERE. In this direction, they emphasized that they need support at the point of using technology. In this context, a teacher's opinion (interviewee # FG1MT3F) is as follows: *"...Older teachers had constant difficulties. Most have retired. Young teachers also tried to make better use of technological opportunities..."*

Difficulties Caused by Infrastructure

MTs stated that both they and their students had infrastructure difficulties during ERE. In this context, they emphasized that there are device and internet deficiencies. Regarding this, one of the MTs (interviewer #FG1MT3F) stated the following. *"...There are students who do not have a smartphone or internet at home. This situation is more common; especially in villages..."* They also stated that they had connection difficulties as well as having internet. One of the MTs (interviewee # FG4MT2M) expressed this situation as follows. *"...Our biggest problem is the internet. There were interruptions in the classroom environment. Children could not enter. As the number increased, we began to experience difficulties..."*

Difficulties Caused by Schedule and Curriculum

MTs stated that the difficulties arising from schedule and curriculum are generally related to the lessons. In this context, MTs emphasized that teaching lessons too early or too late negatively affects students' participation in the lesson. In addition, they stated that organizing and changing the weekly lesson programs by the MTs also poses a problem. On the other hand, it was reported by the MTs that the short courses made it difficult to focus on the course flow. At the same time, they emphasized that informing MTs about changes in curriculum and other subjects at the last minute causes difficulties in terms of necessary arrangements. A teacher's opinion regarding these situations is as

follows. One of the teacher's opinions (interviewee # FG2MT1F) regarding these situations is as follows. “...*There was little lesson participation in the early morning and evening hours. Participation was higher in the middle of the day. This situation affected us as a family, too. The fact that the course hours are variable and they coincide with breakfast and meal times adversely affected the lessons...*” The other teacher (interviewee # FG3MT5F) expressed this situation as follows “...*We need to do more activities to improve students' metacognitive skills in the current mathematics curriculum. However, distance education has made it very difficult...*”

Difficulties Caused by Parents

The theme of difficulties caused by parents consists of two categories. These are supporting roles and supervising roles.

Within the scope of supporting roles difficulties, MTs stated that the participation of families along with students negatively affects the course of the lesson. In addition, they emphasized that there are situations such as the reflection of family conversations in the lesson. In this context, the opinion of one of the MTs (interviewee # FG2MT1F) is as follows: “...*We have witnessed mothers raising their voices to their children. The events in the family have directly reflected us. The shouting of families to their children was heard by their friends, causing the students to be offended...*” Another teacher (interviewee # FG1MT5M) stated the following. “...*There were too many mistakes in the students' homework. Because the parents did not support the students enough in mathematics lessons...*”

Another situation that creates difficulties during ERE is examined under the category of supervising roles. MTs stated that the problem here is that parents do not care about students. They emphasized that this situation caused the students to break away from the lessons and not be able to adapt to the lessons. Regarding this, one of the MTs' views (interviewee # FG4MT1M) is as follows: “...*The fact that the parents were not sensitive to the lesson hours caused difficulties for us...*”

Difficulties Caused by Nature of Mathematics

MTs stated that they had difficulties during ERE due to the abstract nature of mathematics. They stated that they had difficulties in subjects such as algebraic expressions in particular. One of the MTs (interviewer # FG2MT1F) commented as follows. “...*I had difficulty with equations and equation-building difficulties that required students to think abstractly...*”

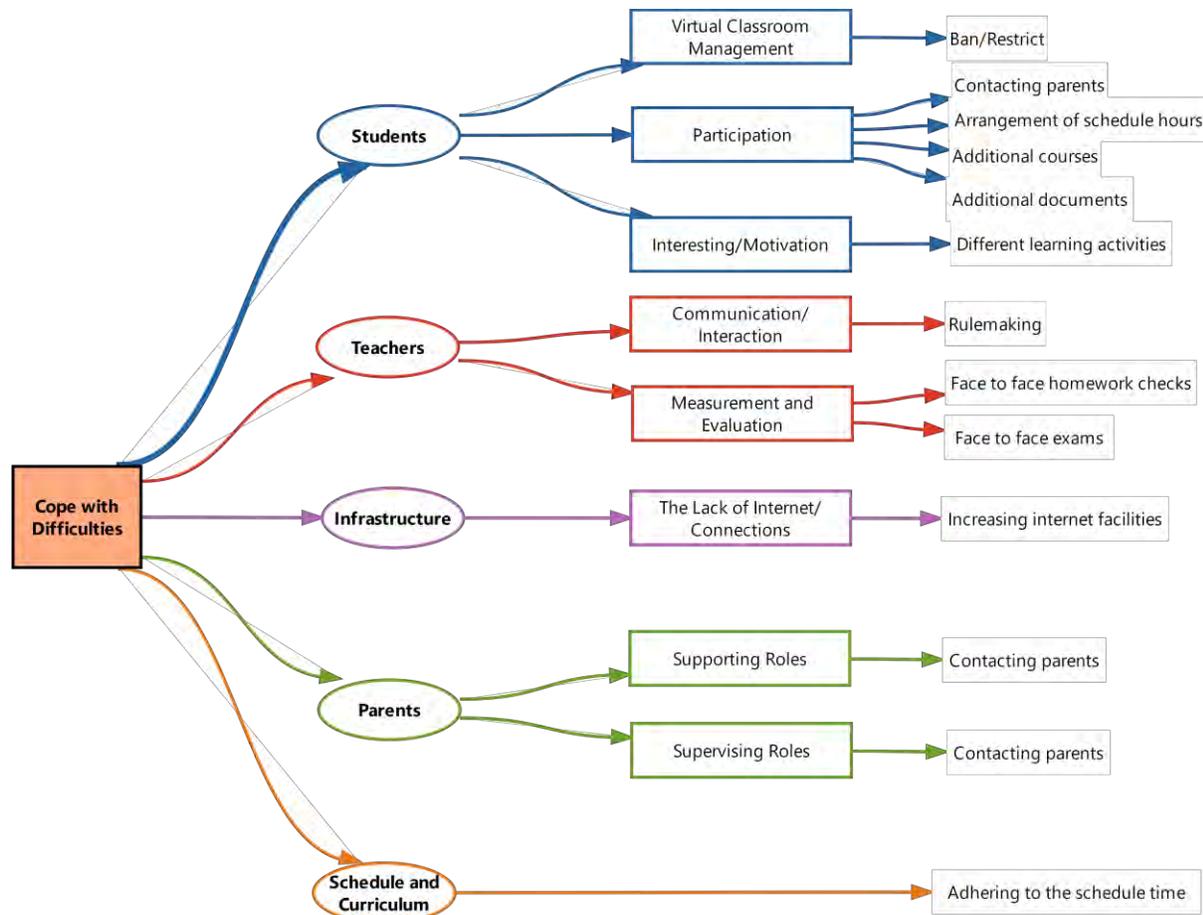
MTs stated that they had difficulties in using materials in the lessons. They emphasized that they had difficulties because they could not use materials one-on-one with students during ERE. They reported that such difficulties were more common, especially in subjects such as geometry. Regarding this, one of the MTs (interviewer # FG2MT3M) thought as follows: “...*Subjects in the field of geometry in distance education are a little more challenging. For example, when we explain the subject of angles in the classroom, it is easier. We can easily use the protractor in the classroom. We've processed the protractor using some programs, but I don't think it's effective...*”

Findings Coping with the Difficulties Faced By MTs During ERE

In line with the research question, the second findings are related to ways of coping with difficulties faced by MTs during ERE. According to the findings, five themes were identified; student, teacher, infrastructure, parent, and schedule and curriculum. The themes and codes are provided in Figure 2.

Figure 2

Ways of Coping with the Difficulties Faced By MTs During ERE



Ways MTs Cope with Difficulties Caused by Students

The ways MTs cope with the difficulties caused by students were examined under three categories. These categories consist of virtual classroom management, participation, and interest/motivation.

MTs explained how they coped with the difficulties experienced in virtual classroom management. In this context, they emphasized that it would be beneficial to turn off the sound, image, screen drawing, and chat section from a technological point of view. In addition to these, they stated that use the student waiting room can also be effective. At the same time, they emphasized that it is necessary to give warnings to the students in this context. Based on these,

the opinion of one of the MTs (interviewee # FG3MT1F) is as follows. “...*There are sections on the system, such as blocking or dismissal. By identifying the students who disrupt the course of the lesson, we tried to identify students who disrupt the course flow and warn them with positive motivating speeches...*”

MTs emphasized that it is important to communicate with parents regarding participation difficulties. They also stated that doing additional courses and sending additional documents would be effective for students who could not attend the classes. They stated that in the difficulties based on the schedule, teaching according to the scheduled hours would increase participation. A teacher's (interviewee # FG1MT4F) view on this is as follows. “...*Children see the assignments we send to WhatsApp student groups. We can do something like this we can send the documents about what we explained during the lesson and the questions we solved to the students on WhatsApp...*”

The MTs emphasized that it would be effective to carry out different learning activities that motivate students to prevent situations, such as distraction during the lesson. One of the MTs (interviewee # FG3MT5F) expressed this situation as follows. “...*We had learning conversations that motivate students and guide the class to school. In this way, we aimed to keep students in the lesson more effectively...*”

Ways MTs Cope with Difficulties Caused by MTs

Ways MTs cope with the difficulties caused by the teacher consist of two categories as communication/interaction and measurement and evaluation.

The MTs stated that they asked the students to open the camera to overcome the difficulties they experienced related to communication/interaction during ERE. They emphasized that they saw the students more comfortably in this way. One of the MTs (interviewee # FG4MT3F) stated this as follows. “...*I insist that they open their images. In this way, I try to check what everyone is doing, whether they are interested in the lesson or if they are interested in other things...*”

MTs made various suggestions within the scope of measurement and evaluation. They emphasized that face-to-face education should be done instead of the distance education process for the difficulties encountered in the measurement and evaluation. They stated that the learning process is more effective in this way. In this context, they said that lectures and exams should be face-to-face. Similarly, they emphasized that it would be beneficial to check the homework during the face-to-face education process. A teacher's (interviewee # FG1MT4F) view on this issue is as follows. “...*For the learning process to be carried out more effectively, the explanation of the subjects should be done at school. I think that there should be no lectures in online lessons. Only problem solving will be more effective in online lessons...*”

Ways MTs Cope with Difficulties Caused by Infrastructure

MTs made various suggestions for the difficulties arising from infrastructure. MTs stated that for infrastructure difficulties, internet packages limits should be increased. In addition, they emphasized that increasing the support of the state and operators and the creation of municipal wifi points would be effective. Similarly, MTs stated that it would be beneficial to have an upper limit on the internet package fee. In this context, the views of one of the MTs (interviewee # FG2MT2M) are as follows. “...*We upgraded our internet package due to the difficulties experienced in wifi. I kept my phone ready in case of any mishap. I also brought unlimited internet to the home environment. I try to use it from there...*”

Ways MTs Cope with Difficulties Caused by Schedule and Curriculum

MTs stated that they generally have difficulties with schedule and curriculum based on the scheduled hours. For this reason, they emphasized that it would be beneficial to conduct the distance education process by adhering to the scheduled hours. One of the MTs (interviewee # FG2MT1F) expressed this situation as follows: “...*Due to the difficulties experienced in the program, it would be more beneficial to take the process by adhering to the scheduled hours. Thus, it is clear who will teach at what time. There is no confusion...*”

Ways MTs Cope with Difficulties Caused by Parents

MTs' ways of coping with difficulties caused by parents consist of two categories: supporting roles and supervising roles. Teachers stated that they communicate with parents within the scope of supporting roles. Based on this, a teacher's (interviewee # FG1MT1F) opinion is as follows. “...*We can deal with our difficulties by contacting parents. Now we have each other's phone numbers. That's why we contact and solve our difficulties about supporting their children's learning...*”

MTs stated that for the distance education process to be carried out successfully, parents should be more active in supervising. They emphasized that in this way, it would be easier for students to adapt to this process. One of the MTs (interviewee # FG3MT3F) expressed it as follows. “...*I think parents should have been more active. At the very least, they should check to see if the kids have done their homework, are listening to the lecture, or doing something else. I think parents should have been much more careful at this point...*”

Discussion and Conclusion

This case study aims to examine in depth, which difficulties Turkish middle school MTs faced in their teaching process in the context of the Covid-19 pandemic, copes with these difficulties, and suggestions about the difficulties. For this purpose, the findings obtained from the thematic analyses are interpreted and discusses along with the literature. Although this present study only focused on the difficulties experienced by a group of middle school MTs during the ERE process, the findings may apply to other disciplines as well. In this section, we discuss the study's limitations, summarize the main findings, and offer recommendations for both policy and practice.

Limitations

This present study has some main limitations. The first of these limitations concerns the participants. Limitations about the participants have two sub-limitations related to the type of school the participants work in and the diversity of the participant group. This study is limited to secondary school MTs and cannot be generalized to other education levels (e.g. primary school, secondary education). In order to increase the generalizability of the results obtained from the research, studies should be conducted in which MTs from different education levels are also participants. In addition, a limitation is that the participants of this present study, which focused on the difficulties encountered in teaching mathematics in the ERE process, were only MTs. In this context, a more holistic approach to the difficulties encountered in mathematics teaching in the ERE process should be ensured by conducting studies in which the participant group, in which students and parents are participants, is diversified. The second limitation of the study is related to the research method used. Based on the qualitative results of this research, quantitative studies should be conducted to reveal the difficulties faced by MTs during ERE. The other limitation of the study is related to the data collection tool used. Future studies should reveal the situation by using different data collection tools (observation, questionnaire, rubric etc.) to reveal the difficulties experienced by MTs in distance education. The last limitation of the research is related to the focus of the research. This current study focused only on the difficulties faced by MTs. Since this process is a very difficult process for MTs, we also did not find it appropriate to increase their stress levels by observing their lessons.

Discussions

The current case study results showed that MTs encounter six key findings during ERE, arising from students, teachers, infrastructure, parents, schedule and curriculum, and the nature of mathematics.

Difficulties Caused by the Students and Ways MTs Cope with These Difficulties

Our analysis indicated that students who abused the features of the platform used for mathematics teaching and distance learning opportunities in the ERE process created virtual classroom management difficulties, and students' low motivation and lack of infrastructure created participation and motivation difficulties. In other words, when the students who suddenly found themselves in ERE faced a different learning environment from the physical learning environments they were accustomed to, they abused these environments and created a virtual classroom management problem. The fact that their low motivation and lack of infrastructure created difficulties for both their participation in classes and their low motivation was falling down much. In relevant studies, the difficulty of virtual classroom management (Barlovits et al., 2021; Ní-Fhloinn, & Fitzmaurice, 2021), low student participation (Briones et al., 2021; Eroğlu & Şenol, 2021; Matić, 2021; Ní-Fhloinn, & Fitzmaurice, 2021; Tay, Lee & Ramachandran, 2021) and students' low interest/motivation (Batdal-Karaduman, Akşak-Ertaş & Duran-Baytar, 2021; Briones et al., 2021; Ní-Fhloinn, & Fitzmaurice, 2021; Tay, Lee & Ramachandran, 2021; Yohannes, Juandi, Diana, & Sukma, 2021) reported that there were the difficulties MTs faced. There is more than one reason for these difficulties arising from students. By deducing from the data that the MTs stated that the students' mathematics achievement decreased and that the students had

difficulty in learning mathematics subjects, we can say that the students could not regulate their own learning skills in the mathematics lesson at ERE. The ability of students to take responsibility for their own learning or to regulate their own learning skills is expressed as a self-directed learning approach (Knowles, 1975). It is emphasized that self-directed learning skills are very important for distance education and online learning carried out in the ERE process to be effective and problem-free (Bozkurt, 2020; Matić, 2021). Another reason is that students had to share their learning time with their responsibilities at home. Because during ERE, learning environment was at home and students spent the remaining time learning after fulfilling their responsibilities at home (Naidoo, 2020). In addition, if we consider that the most important condition for the problem-free progress of online learning is infrastructure, it is possible to encounter difficulties with students having a lack of infrastructure. The MTs mentioned that cope with the classroom management difficulties to be encountered by imposing a ban on students in platforms issues or by restricting students from the possibilities of distance education. MTs underlined that they increased student participation by contacting parents, paying attention to the arrangement of schedule hours, making additional courses, and sending additional lesson documents from many platforms. In this context, good cooperation and communication between teachers and other stakeholders can be effective in controlling students' participation in online learning (Yohannes, Juandi, Diana & Sukma, 2021). In additionally MTs emphasized that they were able to cope with the low student interest/motivation problem they experienced in the teaching-learning process, by taking care to organize different learning activities to increase the motivation of the students. The recommendations of Yohannes, Juandi, Diana, and Sukma (2021) and the results of Bıyıklı and Ozgur's (2021) study confirmed the precaution taken by the participating teachers in this present study. Additionally, these studies are suggested that various and interactive alternative methods and learning environments should be provided to attract students' attention.

Difficulties Caused by the MTs and Ways MTs Cope with These Difficulties

Another key finding of our study is related to the difficulties arising from the teacher. MTs' inability to make physical eye contact with students and students' failure to turn on their cameras caused communication and interaction difficulties, while the difficulty of giving feedback on a large number of assignments caused them to have difficulties with assessment and evaluation. In addition, low ICT competencies of MTs and violation of their privacy are also important difficulties. The other studies in online learning during ERE reported that student-teacher communication (Ata-Baran & Baran, 2021; Batdal-Karaduman, Akşak-Ertaş & Duran-Baytar, 2021; Ní-Fhloinn, & Fitzmaurice, 2021; Russo et al., 2021; Yohannes, Juandi, Diana, & Sukma, 2021), measurement and evaluation (Chirinda, Ndlovu & Spangenberg, 2021; Hurst, 2021; Russo et al., 2021; Matić, 2021; Ní-Fhloinn, & Fitzmaurice, 2021; Tay, Lee & Ramachandran, 2021; Yohannes, Juandi, Diana, & Sukma, 2021), low ICT competencies (Ata-Baran & Baran, 2021; Batdal-Karaduman, Akşak-Ertaş & Duran-Baytar, 2021; Chirinda, Ndlovu & Spangenberg, 2021; Hurst, 2021; Eroğlu & Şenol, 2021; Matić, 2021; Yohannes, Juandi, Diana, & Sukma, 2021) and breach of privacy (Barlovit et al., 2021; Rodriguez-Muñiz et al., 2021) were difficulties. We think that the main reasons for these difficulties arising from MTs during ERE are low ICT competencies, the paper-based assessment and evaluation method that MTs are familiar with, and MTs' inability to effectively design distance education. In addition, MTs, especially female MTs, stated that it was difficult to teach at ERE with their responsibilities at home, while most of the MTs pointed out that their

communication within the family deteriorated. We think this is due to the greater increase in workloads (home and home-based schooling) of female MTs compared to males during the COVID-19 pandemic (Rodriguez-Muñiz et al., 2021). MTs' mention of the increase in the time spent on teaching in the ERE process (Barlovits et al., 2021) are the reason why MTs stated the deterioration of family communication as a problem. MTs coped with the communication difficulties they encountered with the rule of keeping the cameras on. Since they could not find a solution to the measurement-evaluation difficulties they encountered in the teaching-learning process, they stated that this problem could be solved by face-to-face homework checks and exams if given the opportunity in the future. It is noteworthy that MTs did not take any precautions and give suggestions regarding privacy and lack of ICT competencies difficulties.

Difficulties Caused by the Infrastructure and Ways MTs Cope with These Difficulties

The third key finding of the current study was that during the ERE, even in the 21st century, both students and MTs still had infrastructure difficulties caused by the lack of computers/tablets/mobile phones and the lack of internet /disconnections. It is possible to come across many studies results showing that ERE has some limitations. During ERE, the lack of computers/tablets/mobile phones (Yohannes, Juandi, Diana, & Sukma, 2021) and the lack of internet /connections (Marpa, 2021; Saadati et al., 2021; Yohannes, Juandi, Diana, & Sukma, 2021) difficulties were among the most repeated limitations in the studies. In these studies, lack of internet speed, and lack of tools such as computer tablets and mobile phones were the difficulties for both MTs and students during the ERE. The fact that remote teaching opportunities during the ERE in Turkey were below the OECD average also supports these results (Yılmaz et al., 2020). MTs suggested that they could not find a solution to cope with the infrastructure difficulties of MTs and students, but that internet facility should be increased. Previous studies' findings also emphasize the solution to difficulties related to infrastructure (Bıyıklı & Ozgur, 2021). Because it is important to provide sufficient facilities for users, especially the internet, in support of online learning (Tay, Lee & Ramachandran, 2021; Yohannes, Juandi, Diana, & Sukma, 2021).

Difficulties Caused by Parents and Ways MTs Cope with These Difficulties

The analysis also provided evidence that relates to difficulties caused by parents. Parents, who have important roles in their children's learning, had to experience these roles at the highest level during ERE (Bozkurt, 2020; Greenhow, Lewin & Staudt-Willet, 2021). Parents of K12-level students had to take on both educational and social roles (supporting roles), and directly related to learning and teaching processes roles (Bozkurt, 2020). But parents did not adopt supporting roles that having to undertake and this situation created difficulties for the MTs. The results of other studies confirm that the expected support from parents in mathematics teaching was not received (Batdal-Karaduman, Akşak-Ertaş & Duran-Baytar, 2021; Matić, 2021; Panaoura, 2020; Yohannes, Juandi, Diana, & Sukma, 2021). It is thought that the negative attitudes of parents towards struggle while learning mathematics (Russo et al., 2021) cause the students not to be supported by their parents during the ERE. Parents assume the role of not only supporting their children in learning but also supervising their children's learnings in both synchronous and asynchronous parts of online learning. Because the supervision and control of their children (learners) development in online learning is very

dependent on the role of parents (Cai, & Wang, 2020; Hasmiwarni & Elihami, 2021). While Yohannes, Juandi, Diana, and Sukma (2021) concluded that parents do not provide the necessary supervision for students' online learning, in our study, it is seen that parents attend the lesson with their children because they over-accept the supervising role (either answering the questions asked by the teacher in the lesson or interfering with their children's answers). In Barlovits et al.'s study (2021), MTs stated that it is a problem for parents to sit behind the computer and tell their children what to do. The reason for all these parent-related difficulties stems from the fact that parents cannot keep up with the difficulty (Azubuike, & Aina, 2020) that they are faced with being both parents and MTs at the same time during ERE. Although the difficulties caused by the parents showed that the parents did not take on their educational role, it can be claimed that the intervention of the children in the synchronous lessons related to their adopting the role of the substitute mathematics teacher. While the MTs found solutions to the supervision difficulties caused by the parents by communicating with the parents, it was seen that they suggested that the parents be more involved in the process of supporting children's learning. Other study findings also offer suggestions for enabling parents to perform tasks related to their children's education (Biyıklı & Ozgur, 2021; Tay, Lee & Ramachandran, 2021).

Difficulties Caused by Schedule and Curriculum and Ways MTs Cope with These Difficulties

The fifth key finding of the current study was that during ERE were the schedule and curriculum difficulties. The very early / very late hours of the lessons and the constantly changing lesson hours cause the students not to participate in the lesson. In addition, the short duration of the online course is also a problem for the mathematics course. In different studies that concluded that there were difficulties with the curriculum during ERE, were emphasized that the course duration was insufficient (Eroğlu, & Şenol, 2021; Yohannes, Juandi, Diana & Sukma, 2021). During ERE, teachers' imitation of face-to-face learning in online lessons (Bozkurt, 2020) caused time difficulties. In addition, the fact that MTs emphasized lesson times as a problem in teaching mathematics can be associated with the nature of mathematics. It takes a long time to make maths-teaching modules and write math equations for online learning (Yohannes, Juandi, Diana, & Sukma, 2021). Another problem that the MTs mentioned about the schedule is that the schedule hours are intense. The MTs' schedule hours' intensities were the same in face-to-face education. However, the intensity of the lessons hours is a problem because MTs try to keep up with an approach they are not familiar with during ERE, their low ICT competencies, and both home and school works to be run together. MTs stated that they coped with the problem of schedule hours by adhering to the lesson time in the schedule determined by the school administration.

Difficulties Caused by the Nature of Mathematics and Ways MTs Cope with These Difficulties

The last key finding of the current study was that MTs faced challenges related to the nature of mathematics during ERE. MTs' views emphasize that the discipline of mathematics is more abstract than other disciplines. The fact that mathematics is an abstract discipline (Egodawatte, 2011; Lawrance, 2007; Swanson & Williams, 2014) caused MTs to have more difficulties in the ERE process. The difficulty in understanding and teaching mathematics subjects in online learning (Yohannes, Juandi, Diana & Sukma, 2021) can be related to the fact that mathematics is an abstract discipline. In addition, in online learning, the MTs mentioned that had difficulties in using the visual materials using to embody the mathematics lesson subjects in face-to-face learning. Results of studies revealed were supported the

results of this study that it was difficult to use learning materials during ERE in teaching mathematics (Batdal-Karaduman, Akşak-Ertaş & Duran-Baytar, 2021; Yohannes, Juandi, Diana, & Sukma, 2021), and was defined as "visual art" (Ní-Fhloinn, & Fitzmaurice, 2021). Another reason why MTs have difficulties with the nature of mathematics is the difficulty of creating mathematics teaching modules for online learning and writing mathematical equations/drawing shapes (Yohannes, Juandi, Diana, & Sukma, 2021).

Conclusion

In conclusion, the ERE, which is the only solution to "save the day" in the sustainability of the learning-teaching process during the COVID-19 process, is a process where MTs faced difficulties (Ata-Baran & Baran, 2021; Barlovit et al., 2021; Batdal-Karaduman, Akşak-Ertaş & Duran-Baytar, 2021; Briones et al., 2021; Chirinda, Ndlovu & Spangenberg, 2021; Hurst, 2021; Marpa, 2021; Matić, 2021; Ní-Fhloinn, & Fitzmaurice, 2021; Panaoura, 2020; Rodríguez -Muñiz et al., 2021; Russo et al., 2021; Tay, Lee & Ramachandran, 2021; Yohannes, Juandi, Diana & Sukma, 2021). This case study also confirmed with qualitative results that MTs faced difficulties, and cope with these difficulties. This present study is also an indication that the effectiveness of ERE has not reached the expected level due to the difficulties faced by MTs. In other words, ERE was the only way to save the day, but it was not effective enough to save the day. During the ERE process, MTs had difficulties with the nature of mathematics, but more so with the nature of distance education. In addition, when the difficulties experienced by MTs were examined in general, it was seen that there was no sharp boundary between the difficulties; moreover, the difficulties had a "domino effect" on each other. The primary problem of ERE ineffectiveness is the lack of infrastructure. The lack of infrastructure is the root cause of many student-related difficulties. Over and above, low ICT competencies of MTs and their inability to understand the nature of distance education prevented them from designing courses suitable for distance education. These inabilities fueled the difficulties experienced with students, teachers, parents and the nature of mathematics. Another important problem is that students with low self-regulation skills and motivation in distance education have inappropriate behaviors in the management of virtual lessons, the lack of participation, a decrease in their interest and motivation in the lesson, and not doing their homework. In addition, the ERE process revealed causes difficulties that the current mathematics curriculum was not suitable for distance education, and that parents' not adopting or over-adopting their roles.

The practical recommendations of this study are geared toward for MTs and policy makers. In order to eliminate connection/internet difficulties, the system (EIN and internet) should be strengthened by performing infrastructure and maintenance works. Devices should be supplied to MTs and students in need in cases such as ERE, as was done in the FATIH project, for device shortages. Mathematics lessons should be recorded, and re-watched, as a precaution in case of inadequacy of access opportunities and student's inability to attend. Mathematics curriculum studies that are suitable for distance education or adaptable to be used in emergencies should be carried out. In-service trainings, seminars, additional resources and workshops should be organized to improve MTs' ICT competencies and their ability to design mathematics courses suitable for distance education. In order to eliminate many difficulties caused by the student and the teacher, MTs should design courses for distance mathematics teaching. For this reason, MTs should

design activities that allow students to individualize and adapt the online learning process, to be mentally (cognitive presence) in addition to their physical presence, to create a sense of belonging, to enable interaction and to connect with real life. MTs should design mathematics lessons short hours simultaneously, and extracurricular activities intensively. MTs must give feedback on student assignments and assignments. In order to prevent some of the difficulties caused by students and parents, MTs should prepare course behavior guidelines about distance education to students and parents' (the time, the behaviors to be avoided, the time required to complete the homework or activities, which assignments the child-the parent will work on together etc). In addition, it should organize a regular, extracurricular, online face-to-face meeting with both students and parents to talk about difficulties or improving distance education engagement.

Future research could be conducted to reveal the relationship between students' participation in the ERE process and their self-directed learning. In addition, research could be conducted to determine the factors affecting students' learning motivation in the ERE process. In addition to research that will reveal the relationship between MTs' ICT competencies and their assessment and evaluation competencies in ERE, research that will reveal the effects of MTs' instructional design at distance education on students' transactional distance could be conducted.

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