Mathematics Teachers' Experiences Teaching of the Online Distance Education During the COVID-19 Pandemic: Concerns and Adaptations

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Abstract– The purpose of this study was to investigate how mathematics teachers make sense of their experiences teaching in distance education settings during Covid-19 pandemic in 2020-2022. Interpretative phenomenological analysis was used to design this study which is based on the phenomenological pattern. Eight teachers with at least seven years of professional experience participated in the study. Data were collected through semi-structured interviews and interpreted by interpretative phenomenological analysis. As a result, the following four main themes were identified: struggle adaptation & reflection, lack of interaction, tension between authority and autonomy, and concerns about professional competence. According to the themes identified, teachers underwent a search and struggle process as they attempted to adapt themselves and their students to the new situation from the beginning of the period.

Keywords: COVID-19 pandemic, online-distance mathematics education, emergency remote teaching, mathematics teachers' experiences.

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Introduction

The occupational experiences of teachers have been the subject of numerous studies for several years (Gellert et al., 2013; Hodgen & Askew, 2007). The rapid technological advancements and replacements in teaching materials have opened the doors to varying new experiences for mathematics teachers (Trouche et al., 2012). Although many mathematics teachers lean towards employing technology in education (Önal & Çakır, 2016), only some are capable of using information and communication technologies for mathematics teaching (Yazlık, 2019). However, after the COVID-19 outbreak in December 2019, over 91% of students switched from face-to-face to online distance education (ODE) worldwide (Miks & McIlwaine, 2020). As a result, technology use in education has become a necessity rather than a choice. Both educational institutions and teachers naturally embarked on a quest for how to practice distance education and what to do in this process (Tarkar, 2020). It is necessary to reveal how mathematics teachers interpret these experiences to comprehend their online distance education (ODE) experiences during the pandemic.

The COVID-19 outbreak was declared a 'Pandemic' by the World Health Organization (WHO) on March 11 (WHO, 2020). After the COVID hit, it has been rapidly understood that this is not just a health crisis but has economic, social, and educational aspects (Chan, et al., 2021). People started to meet, shop, and educate online (Borba, 2021) there have been some transformations in education and health, economy, and social fields in the world. In Turkey – where the data was collected- all kind of schools were closed from March 16, 2020, to March 30, 2020, and the Ministry of National Education decided to undertake distance education activities in primary and secondary education via three television channels and Education Information Network (EBA). Some teachers also began to conduct distance education activities voluntarily within this period. However, as of the 2020-2021 school year, a planned and compulsory distance education program has been initiated. Although some education levels (8th and 12th grades) received face-to-face education at certain times during this school year, ODE was implemented for most of the year. In this sense, this study focused on mathematics teachers' online distance education experiences.

In the literature, during the pandemic, education was defined as unplanned, sudden, and temporary practices. Hence, the concepts of distance education, such as; online education, remote teaching, etc. were unable to explain the educations that took place during the pandemic, and the use of the 'Emergency Remote Teaching' (ERT) term was recommended instead (Bozkurt & Sharma, 2020). Unlike distance education, which is scheduled to be

conducted online from the beginning and designed for online, ERT refers to the transition to a non-permanent alternate environment where the learner is provided education in an emergency or crisis (Hodges et al., 2020). Thus, it is plausible for the researchers to classify this period as ERT in the first place because the distance education practices in the second semester of the 2019-2020 school year were not within the scope of any plan and program, and teachers lessoned voluntarily. Yet, this study covers approximately one-and-a-half-year period. In the last year of this one-and-a-half-year process, the relevant ministry has tried to provide a robust education ecosystem with distance education. In this context, rather than giving temporary access to education and training support, the courses were planned at the beginning of the semester and conducted within a specific program with EBA. As a result, it is not appropriate to refer to an entire period of time as an unplanned and temporary process. However, the fact that there is no change specific to distance education in the teaching materials and curriculum makes it difficult to say that this process is not entirely ERT. Whether or not it is suitable to refer to a scheduled educational process as online education within this period; or whether it meets other standards are not within the scope of this research. In other words, the conceptual debate about whether or not the education scheduled in this process is ERT is beyond the focus of this study. Therefore, the term ODE will be used as a principal concept in the study.

The meaning of being a mathematics teacher may only be comprehended when the contexts influencing the teaching practices of the mathematics teacher are envisioned (Desforges & Cockburn, 1987). Some of these elements, such as pedagogical content knowledge (Shulman 1986), mathematical knowledge for teaching (Hill et al., 2005), content knowledge (Ball et al., 2008), and technology knowledge (Niess, 2005), are related to teacher's knowledge and the quality of teaching. Nevertheless, other contexts are linked to social and personal elements such as attitude, emotion, belief, value, and ethics (Bishop et al., 2003; Boylan, 2016; Kuntze 2012; Lee, 2005; Schoenfeld, 2011). Such factors affecting the mathematics teacher's teaching-related variables emphasize occupational knowledge and personal and social variables. Along with these teacher-related variables, the demanding requests of colleagues and school administrations may also be effective in decision-making about mathematics education (Santagata & Yeh, 2016). In addition to the other stakeholders, parents were identified as one of the primary variables in teachers' decisions in the school (Shapira-Lishchinsky, 2011).

Being a mathematics teacher in ODE is not discussed in this study within the teacher identities but with teacher experiences of struggles that they had to overcome. This study used the interpretative phenomenological analysis (IPA) method, a sort of phenomenological research, focused on teachers' experiences with ODE, the essence of those experiences, and how teachers interpreted the process. Therefore, the data in our research were interpreted by considering these factors impacting the actions of mathematics teachers in the literature. Despite that, the unique context of the pandemic requires new perspectives.

All teachers began working from home since online distance education became available during the pandemic. Working from home may cause alterations in knowledge and skills required by professions and their attitudes and perceptions about their profession (Bloom et al., 2015). In this context, earlier studies may not precisely assess the experiences of mathematics teachers to the pandemic. Several studies in many countries revealed how this pandemic affected mathematics teachers and mathematics education (Baki & Çelik, 2021; Drijvers et al., 2021; Krause et al., 2021). Despite the change in the use of digital and physical materials, the studies carried out in this area show that different countries offer different opportunities and limitations (Drijvers, et al. 2021). This difference leads to different experiences of ODE by mathematics teachers. Therefore, this study aimed to investigate the making sense of mathematics teachers' experiences in teaching in ODE settings during the pandemic some studies have been conducted in Türkiye (e.g., Baki & Çelik, 2021). However, there are some limitations to these studies. For instance, the scope is limited to challenges and remediations, or the participants are from primary schools. On the other hand, we aimed to describe the essence of the mathematics teachers' experiences. Thus, this study provides both deeper and broader findings.

The findings of this study are likely to contribute to the literature in two ways. Firstly, this process could be considered an opportunity to improve preparedness for future comparable situations. Orasanu and Conolly (1993) emphasized that experience plays a significant role in deciding accomplishments. As a personal experience, therefore, this process influence teachers' education practices after outbreak (Engelbrecht, et al., 2023). Such shared human experiences are also envisaged to serve as a mentor for their actions in future crises. During the pre-reading phase of this study, the authors reviewed the previous crises and educational challenges in those periods. These readings helped researchers specify appropriate research questions and issues on which to focus. This curiosity is not exclusive to the authors of this article; many authors also have detailed experiences of humanity in prior crises in their

publications (Gosztonyi, 2021). Secondly, knowing how teachers experienced this process throughout the pandemic has the potential to provide insight into how the process may reflect on teaching practices in the future and what the long-term consequences will be. In this context the analysis of the qualitative data will help to find uncover the following question:

– How do mathematics teachers make sense of their experiences of the online distance education during the COVID-19 pandemic?

Method

The study was designed as phenomenological research. Phenomenology defines the real nature of a shared experience (phenomenon) or the shared meaning of experiences (Patton, 2014). The purpose of this study was to investigate how mathematics teachers make sense of their experiences teaching in distance education settings during COVID-19 in the 2019-2020 and 2020-2021 school years. In particular, the IPA approach was adopted, emphasizing the essence of teachers' experiences and how they perceived this process. In IPA, the analytical process is defined as the dual interpretation process. First, the participants make meaning of their world, and then the researchers attempt to decode that meaning to make sense of their meaning-making (Smith & Osborn, 2008). Accordingly, incorporating both interpretations into IPA studies allows for profound and more comprehensive analysis (Pietkiewicz & Smith, 2014). With these opportunities provided by IPA's analytical procedures, it is possible to thoroughly analyze mathematics teachers' experiences in distance education and their interpretations.

Participants

Participants are selected homogeneously in IPA, and the number of participants is usually between one and fifteen (Pietkiewicz & Smith, 2014). In this study, purposive sampling has been carried out by paying attention to similar characteristics of the participants. As this study investigated teachers' experiences in a crisis, the researchers did not predetermine the number of participants. Instead, analysis and data collection took place simultaneously. Data collection was terminated when data satisfaction was achieved. At this stage, the number of participants has reached eight. 8 participants are enough and appropriate to identify similar situations in teachers' experiences accurately and to examine them in depth.

Eight mathematics teachers from different secondary participated in this study. The participants' professional experiences ranged from 6 to 17 years (not a deliberate limit but an emergent situation). Since novice teachers had no prior expertise in face-to-face education,

they (novice teachers) were presumed to be inadequate at interpreting their previous mathematics teaching experiences in distance education. Consequently, the study was conducted among experienced teachers with the idea that it would be better to interpret the essence of their experiences in distance education. None of the participants had undergone any training in distance education programs. They experienced this process for the first time. The socioeconomic statuses of schools where the participants worked were also similar. Regarding academic standings, no differentiation was made between schools with low, middle, and high rankings, but priority was given to all public schools. Detailed information about the participants is given in Table 1.

Table 1 Information about the Participants

Participant's:				The school where he/she employed:	
Name	Gender	Experience (year)	Career	Type	Academic achievement
T1	Male	6	Bachelor	Secondary school	Low
T2	Male	17	Master	Science and Art Centre	High
T3	Female	8	Bachelor	Secondary school	Low
T4	Male	11	Bachelor	Secondary school	High
T5	Male	14	Master	Secondary school	Middle
T6	Female	9	Bachelor	Secondary school	Middle
T7	Female	7	Bachelor	Secondary school	Low
T8	Female	9	Bachelor	Secondary school	Low

The findings were not analyzed within the framework of these characteristics of the teachers. however, these characteristics are important for the richness, similarities and differences of the findings. the similarities in the findings were revealed by selecting the schools at the public school and secondary school level and paying attention to the teacher experience between 6-17 years. the selection of both male and female teachers and the diversity in the achievement level of the schools provided the differences and richness in the findings.

Data Collection and Analysis

Data were collected through semi-structured interviews. Since IPA allows more study flexibility, data collection was mostly executed through semi-structured interviews (Pietkiewicz & Smith, 2014; Smith & Osborn, 2008). The question styles proposed in the IPA research were considered while setting the framework for the interview questions (Smith & Osborn, 2008, pp. 61-63). After asking questions about demographic information, participants

were briefed about the distance education applications in Türkiye. Afterward, the participants were asked to state how they experienced this process in general and share their experiences. Because in an IPA study, the interview begins with a generic inquiry, the participant is expected to discuss the subject before asking specific questions (Smith & Osborn, 2008, p. 62). While some teachers elaborated on this process in detail, others limited themselves to a more cursory explanation. Therefore, questions were posed to deepen the interview, but no guidance was given to the participants. The questions and scope used in the interview are shown in Table 2.

Table 2 The Questions and Their Scope

Questions	Scope of the question
Can you summarize the whole process? How did you experience the COVID 19 pandemic as a mathematics teacher?	The way the distance education was practiced, and issues encountered in this process, Difficulties experienced in this period, emotional issues, feelings, changing conditions, and things in which teachers gain or lose within the process
Can you narrate your typical online lesson?	Comparison between face-to-face and distance education processes
Can you narrate your typical face-to-face lesson?	Comparison between face-to-face and distance education processes
What is "online education" in your view?	Things changed for a teacher, such as responsibilities, relations with parents, students, and administration
What is it like to be a mathematics teacher in online education?	Pedagogical practices, changing structures, the way how teachers experienced the process, their thoughts, feelings, attitudes, etc.

With the assistance of carefully crafted questions, experiences and interpretations of teachers in the process were acquired comprehensively. Two academics who are experts in mathematics education also provided feedback on the interview questions. Before interviewing the participants, three secondary school mathematics teachers (outside the participants) were pilot interviewed to ensure that the interview questions were clear, comprehensible, and target-oriented. Therefore, there was no need for a second interview since data was saturated successfully in the first interviews with participants. The data analysis for the IPA study was executed according to Smith et al. (2009) by taking into account the hermeneutic circle, which allows the opportunity to reciprocate among the cases. The transcripts of the interviews are generated first, and then the researchers repeat the readings according to this approach (Smith et al., 2009). Each reading generates unique perspectives, and researchers take initial notes on observations and add remarks during this process (Pietkiewicz & Smith, 2014). Three researchers reviewed the transcripts of the

interviews and took their initial notes in this study. Later, they discussed these notes and reached a consensus. The essence of the participants' statements and the inferences they conveyed were the focus of these initial notes. "*Feeling helpless and detached from the social world and business life* (T8'; "*Feeling of a virtual wall between herself and her students* (T3)"; and "*Feeling of unable to touch the hearts of students* (T3)" were just a few of these initial notes. The initial notes were quite specific and mainly about the statements made by teachers. Later, the researchers shared the additional transcripts, and the initial noting stage was executed separately. Finally, notes were discussed to reach a consensus by holding a meeting for each transcript.

After the first stage was completed researchers moved to the second stage, which refers to a process of transforming notes into themes (emergent themes). The researchers repeatedly studied their notes rather than the transcript while *transforming them into emergent themes* (Pietkiewicz & Smith, 2014). At this point, the three researchers studied separately on the documents and combined the initial notes from the first stage. Ideas were occasionally exchanged, and, eventually, the structures of themes were developed through a meeting during this process. The common issues stressed by the participants' expressions were considered while choosing the themes. For instance, the notes such as "*Unable to touch lives of children; unable to make eye-to-eye contact; unable to cognize students; and a cold communication process*, etc." indicated emotional connection rather than general communication in the *initial coding* phase. Such statements were clustered under the theme 'unable to establish an emotional connection'. In this way, the themes such as *"The feeling of being lost, feeling inadequate as a teacher, and feeling a loss of authority*, etc." were identified via focusing on the teachers' perceptions of their experiences.

The relations between themes and theme clusters were studied in the final stage (Pietkiewicz & Smith, 2014; Smith et al., 2009; Smith & Osborn, 2008) The themes identified at this stage are categorized based on conceptual similarities, and some of them may be eliminated if they do not entirely fit the emerging structure or provide insufficient evidence. Accordingly, the final list may include several major (super) and minor (sub) themes (Pietkiewicz & Smith, 2014). Thus, weak themes were excluded from the list throughout this procedure, which is the final stage of the analysis, by considering the advice of returning to the scripts and rechecking before concluding the themes (Pietkiewicz & Smith, 2014). Those themes clustered according to their conceptual similarities were categorized in four main themes: Struggle, adaptation & reflection, absence of interaction, authority & autonomy, and

concerns about professional competence. The main themes and sub-themes were provided with quotations in the results.

Interpretations of both the participants and the researchers are emphasized during the IPA analysis. The researchers in the IPA process are aware of the significance of interpreting people's mental and emotional states, especially when they may have difficulties expressing themselves (Smith & Osborn, 2008, p. 54). Thus, three researchers working together at each stage carried out the interpretation process in this study. The researchers also worked individually on each participant's analysis before the meetings to evaluate the interpretations. Meetings were recorded so that they could revisit them when needed. Thus, authors tried to prevent interpretations of the data not to being influenced by a single researcher's prejudices.

Findings

According to the analyses results, the following four main themes were identified: Struggle, adaptation & reflection, absence of interaction, authority & autonomy, and concerns about professional competence. The themes and sub-themes are listed in Table 3 to provide a holistic perspective. Each theme is then presented in detail.

Table 3 Emerged Themes and Sub-themes.

No	Theme	Sub-themes
1	Struggle, Adaptation & Reflection	Feeling the absence of materials and methods, used in face-to-face mathematics education
		Seeking online mathematics education more effective
		Recognizing the advantages
		Comparing the new with the old and criticizing the old
		Re-determining the role of technology
		Adaptation
2	Lack of Interaction	The lack of emotional attachment
		The loss of non-verbal communication
		The inability to communicate effectively
		Unable to observe students while studying
		The inability to assess the psycho-social states of the students
3	Authority & Autonomy	Feeling greater responsibilities
		Feeling lesser responsibilities
		Excessive interaction with student's parents
		Tension induced by institutional demands
4	Concerns about Professional Competence	Dissatisfaction with the occupation
		Feeling inadequacy as a teacher
		Concern for their students
		Feeling of being lost

As can be seen in Table 3, there are six sub-themes for Theme 1, five for Theme 2 and four for both Themes 3 and 4. Each theme is explained and elaborated on in the quotes in the following section.

Theme 1. Struggle, Adaptation & Reflection

It appears that, at the beginning of online mathematics education, participants struggled to adjust to new conditions and educational environments, attempting to adapt to this situation and realizing the advantages of online education within the process. Following this stage, it seemed that the participants tended to compare the new and old states and generally recognize the shortcomings of face-to-face education; they attempted to make online education more effective by adapting the new conditions, and accordingly, their perceptions and attitudes towards online education changed. Some participants conceded to online education and defined it as a genuine opportunity to adopt. Others, however, appeared to reject the entire process and perceive it as a temporary state.

Feeling the absence of materials and methods, used in face-to-face mathematics education

Participants were observed to opine that they would not be able to use the materials they were accustomed to in face-to-face education. Hence, they felt deprived. For instance, when T5 adverted his experience in face-to-face education, he wishfully stated, "While I was lecturing geometry, for instance, there were geometric strips and similar materials…, and students liked them, too". It is clear that T5 spoke longingly about the materials he utilized in face-to-face education and that the students were also satisfied with them. The participants also stated that they attempted to address these inadequacies in various ways. Those statements confirmed that the participants yearned for face-to-face education resources and approaches.

Seeking online mathematics education more effective

Participants were deemed to search for a more effective communication channel with students and uncover more productive tools. T6 stated that she made various attempts to invent the best suitable method in the process.

"Usually, I was pointing the camera towards my paper or notebook so that students were able to see what I had prepared beforehand. Because it was evident that understanding something that had already been written was more challenging for them. So, I was pretending as if I was writing on the board newly; I was turning the paper in my hand to make sure they could see it at that moment"

T2 also claimed that he attempted to find new strategies to communicate with his students by his following words. *"We have also made several trial-and-error attempts like writing on board, finding ourselves there, figuring out the best suitable environment and strategy".* When combined with all participant statements on the subject, one could infer that the process directed the teachers to search for solutions. Furthermore, participants who found more effective tools and communication channels by these searches were observed to recognize the advantages of online education.

Recognizing the advantages

After the initial bewilderment, teachers exposed to online education seemed to become aware of *the* valuable aspects of this education. Initially, the participants recognized the benefits of attending classes in the comfort of their own homes, and the participants also realized the more significant values of online education as the process continued. The statements of T1 show that the online education process resulted in a noteworthy change in teachers' perceptions.

"I think everyone calls it before and after the pandemic, and something like that will continue in education. I believe this face-to-face education will take a different format. So, as I said, this online education has to be integrated into somewhere in education. Or, even if the national education system no longer prefers this, the teachers themselves may keep using it." (T1)

These opportunities (online classes, meeting programs, etc.) had already existed before; however, T2, who indicated that he discovered them through online education, showed his excitement in the following way.

"The existence of such a thing is fantastic. This program (online classes) provided us with valuable insight, allowing us access to an area we were previously unaware of. We just realized it, and this practice is becoming increasingly prominent in my style. The thing about which I am furious with myself is why we have waited until the epidemic to act, although we had known about it since Khan Academy?"

T2 intended that his online education experience opened the doors of an era he was unfamiliar with, demonstrating the enormous impact that his experience has had on him. Teachers' required use of online education played a primary role in acquiring these benefits. Teachers who had recognized the advantages and had partially acclimated to the new situation began to criticize the previous education programs by comparing the new with the old.

Therefore, teachers who had to lecture in distance education took the opportunity to assess benefits through experiencing a new teaching approach.

Comparing the new with the old and criticizing the old

It was noteworthy that the participants began to question face-to-face education after getting used to online education. It was noticed that participants reassessed their education profile as they had never considered it before, and they assumed it as imperative. T2 said that "*Actually, there is no point in going and gathering at school, and staying there until 7 PM*". T2 also questioned whether many people must come together and spend a significant portion of the day at school in face-to-face education. Similarly, T1 stated as follows:

"Maybe you will not go to school, but you will not have to pay for transportation. From the Government's perspective, it does not have to construct huge buildings, and no need to hire a cleaning company and have that building cleaned. So you will get rid of all these costs."

Re-determining the role of technology

Soon after the online education started, the participants interiorized to the new circumstances and even adopted their instruction techniques into the new settings. Significant changes were observed in the participants' perspectives on the role of technology during this process. For instance, T2 remarked that "*We initially thought that we should perceive the problem at the micro level such as using paper and pencil and then move on to technology itself. But my faith in the technology increased once I moved straight into it*". It seemed that T2 positioned technology from a supporting element to the center of education.

Adaptation

There seemed to be a struggle and adaptation process based on the participants' experiences. Initially, the participants were observed to face a circumstance where they faltered and did not know what to do. However, their perceptions of online education changed as they worked through the issues over time. For instance, regarding experience and success in online education, T2 expressed his opinion as follows:

"Things are moving slowly. I feel that online education will become more prevalent at the end of this process. In my opinion, it is a bit ambitious, but I believe that online education is the way of the future. Online education is a must. Is it necessary to have so many buildings, schools, classrooms, and time to spend on them? It is a fantastic thing that something like

online education exists. In terms of both time and space, I began to believe that face-to-face education is a waste."

When generally assessed, there were some critical states where the participants changed their minds in the process. Teachers who had the opportunity to evaluate their teaching results somehow, for instance, had a positive impact on their perceptions of online education. T4 noted that he was unable to follow what the introverted students were doing during this period, and he was only able to get some insight into their circumstances after the exam results.

"It was the one that altered my mind about online education for the better. I was concerned about exam results and wondered how my students, namely my introverted students, were doing. Once they scored above a certain threshold, I felt a little better."

T4's perceptions of online education changed positively after the exam results. Teachers who had no chance to perform assessment-evaluation somehow, however, had concerns about the process. T6 emphasized her concern as follows; "*Easier, yes, it is definitely easier to evaluate during online education; however, I do not believe it offers accurate results. I mean, I do not think that the evaluations in online education are 100% reliable*". Therefore, the exam evaluation process emerged as a factor influencing teachers' views on online education.

Another point raised by the participants was that they saw the new conditions afforded by online education as liberating, and they were delighted with the situation. T3 explained, "*You are free of restraints, so you save time and do not have to shuttle between home and school*." T4 said, "Online education is much better for students if they know their responsibilities because attending school is a loss of time for children, " adding that online education was better suited to children who were aware of their responsibilities.

When evaluating the abovementioned examples and other statements in the process, it could broadly be divided into four stages, or they still have gone through some of these stages. These stages are: (1) estrangement/alienation, (2) seeking/struggle, (3) adaptation, and (4) adoption. Initially, the participants felt left alone in an unfamiliar environment with tools they could not utilize. However, they later embarked on a quest to overcome and lectured a preferable education, struggling with the difficulties they encountered in the process. Furthermore, teachers mastered to use of online education tools more effectively when students became accustomed to the teaching environment throughout the process, and they gradually began to recognize the advantages of online education. At this point, by

acknowledging that teachers updated their habits and roles, they also attempted to adapt themselves to the process. In the last stage, however, teachers were found to be separated into two perspectives. While more teachers adopted online education with the expectation of it continuing in the future, others believed it should be phased out and thus developed a negative attitude towards it. For instance, T4 said, "I definitely don't think there is a transition or anything like that, zero chance." He thought of the process, as not a shift or development but as a temporary situation.

Theme 2. Lack of Interaction

The lack of interaction emerged as the main theme expressed by almost all participants. The principal features of the lack of interaction were enlisted as follows:

The lack of emotional attachment

The participants stated that when they were unable to touch (metaphorically) or make eye contact with their students, they felt they failed to establish bonds with their students, resulting in estrangement. T7 described her feelings as "*Since I do not see them, I cannot touch them (influence them metaphorically). I cannot make them feel anything*". Other participants expressed similar statements as well. In conclusion, teachers could not establish an emotional attachment with their students in online education. Once teachers failed to achieve this, they either lost their enthusiasm or struggled to motivate their students. Similarly, T6 stated that:

"Of course, being face to face with students and having that emotion is more crucial… There is no such sensation in online education. It is more of an abstract concept. You're alone in a room, and you do not get that particular feeling no matter how students seem to be present there."

Other participants described the same situation similarly, but with different words. Participants complained that using feelings, emotional dialogues, and having eye contact in face-to-face education could have no match in distance education. This sub-theme indicated that, according to the participants, being a mathematics teacher in distance education entailed losing the emotional bond.

The loss of non-verbal communication

Elements such as body language, gestures, facial expressions, intonation, and emphasis in the education process refer to as non-verbal communication. According to the participants'

interviews, the inability to employ gestures, facial expressions, and body language in distance education caused teachers to feel incomplete. For instance, T2 stated that:

"Students on Zoom do not see your hands or arms; they only see your face. Since they cannot visualize your arms, legs, or hands, you seem to act as if you do not exist. Communication without hands, arms, or body parts is a significant impediment in education. At the very least, I believe that I failed to lecture without them."

Being unable to use his body limbs as a communication tool caused the participant to act as if he had none. Thus, the teacher was considered to feel dramatically constrained. Although he believed his face was visible through the camera, he seemed unable to use his body limits.

The inability to communicate effectively

Even if the participants did not fully lose their interaction with their students during distance education, they claimed they failed to communicate effectively. As stated by the participants, the limited communication and loss of control over the student due to this confinement, inability to receive feedback, and no assessment on whether or not the student grasped the teaching were signs of failure to communicate effectively. They were all identified as variables that prevent teachers from delivering a successful education in ODE. For instance, T8blamed the limits of the new communication channels as the reason to fail communication with her students.

"...there are resources and receivers, but an issue exists in the communication channel in between. There is no way to send a message and receive feedback. As a result, I think we could not establish constructive communication."

The difficulty in the communication channel also hampered receiving feedback and making healthy communication. Therefore, she referred that, despite the general disadvantages of online education, such as lack of student participation and loss of motivation, she considered that communication was a problem.

Unable to observe students while studying

One of the reasons why teachers dissatisfied with the way of communication they established and deemed it insufficient was the inability to monitor their students while they were studying. Unequivocally, teachers claimed they could neither assess the process (lost the

opportunity of monitoring) nor receive feedback and provide input accordingly. T2 expressed this situation as follows.

"I do not have the opportunity to monitor my students when studying. I mean, I do not know whether or not they write it down. You only rely on assumptions. You get feedback from students, but that feedback does not come to you as alive and immediate. They send you a photograph of something or a piece of work generated within a few minutes. So, you cannot see the process; you only see the final picture."

Other participants also indicated that the inability to observe student work during distance education was a limitation and a concern for them.

The inability to assess the psycho-social states of the students

Participants stated that a lack of interaction with students prevented them from observing their improvements in mathematics and their psycho-social situations. T5 expressed this issue as a failure to satisfy in meeting and supporting the humanitarian needs of students.

"Are the students in a good mood that day, are they unhappy, or are they sick? These are all significant aspects of the learning process. So, if the students need assistance, you can observe them at school and touch them emotionally. At least you motivate them."

Based on the expressions on interaction, participants perceived this process as losing the emotional connection with students, missing the opportunity to observe the students while they were working, and failing to provide feedback.

Theme 3. Authority & Autonomy

Another main theme that emerged from the interviews was the authority relationships of the teachers. The participants considered authority relations from two perspectives. They are themselves the source of authority over the autonomy of students, and the school administration is the source of authority over the autonomy of teachers. The sub-themes reflecting the tension between authority and autonomy were as follows:

Feeling greater responsibilities

Different reasons underlined the participants' increased sense of responsibility in online education. T7 felt a sense of new obligations due to the difficulties she experienced in reaching her students, receiving feedback, and her concerns about student progress.

"Our responsibilities have grown significantly, and our students have constantly been sending questions. We answer their questions ... I continuously try to download new resources ... Teaching used to be within the school boundaries, now it turned out to be something unlimited ... I mean, I seriously think that our responsibility has increased. I got tired more and more. Well, it is not important to get tired. I often believe that I am tired of nothing. In that sense, I feel that I am wasting my time."

T7 stated that she was exhausted by wasting her time rather than increasing responsibilities and workload. In addition, expressing that her teaching responsibilities reached beyond the school boundaries and turned into something unlimited was an indication of how exhausted she felt. T6, however, compared her online training to giving seminars and stated that she felt obligated to plan for this reason.

"...As I said, it had to be more prepared and planned since I could not establish such a connection. Or I felt as if I was giving a seminar. Normally, students in courses would interact with each other. They were asking questions, and I was answering them, etc. Now, I am giving more of a seminar, so I need to prepare ahead of time. I believe that my level of responsibility increased."

T6 referred to her work as a seminar rather than a lecture. What lay beneath T6's feeling to plan more could be the decrease in her self-confidence. In the statements in the following part of the interview, it was evident that the teachers had lost their self-confidence.

"Frankly, I did not want to teach the 8th grade this year because it is a burden of conscience. For the children, it is important to take the lyceum exam. And, I think I could not pass on the information this way. In my opinion, I failed to convey the information from here to the children, even to my best student."

Feeling lesser responsibilities

The participants considered that their obligations had increased on several topics. However, they believed that their obligations on other matters decreased. This issue was demonstrated by T3's following words: "*I feel eased like a bird, I have no responsibilities".* It was noteworthy that while the responsibilities of the participants elevated due to their intrinsic motivations, they thought that their responsibilities (obligations) to the authority lessened.

Being uncomfortable with student autonomy: Issues such as students and teachers not being present in the same settings, students accessing and terminating online classes at their own will, and students' having camera and microphone control during online teaching all

caused a sense of loss of authority among the teachers; hence, they were observed to be disturbed by such matters in online education. T6 sensed that the students' ability to set communication boundaries or their freedom to shut themselves off from communication compromised the teachers' authority in online education.

"... there is also this issue. You are in complete control of face-to-face education. So, you may go and check if students have books and notebooks or control what they are doing. But this is not the case in online education. A student may say my camera is off, my microphone is off, or my internet is down, and you cannot confirm it at that moment. I mean, online education was too difficult in terms of teachers' control."

In her following statement, T8also stated that the loss of authority over the students caused emotional stress in her:

"They are there. Students are right in front of me and have audio equipment. But they do not respond to me in any way. So, I feel like students periodically test their teacher's patience. For me, this situation became emotionally and psychologically abrasive and draining."

T8believed that she had lost her control over the students and that the students were deliberately provoking her because they were aware of it. Such an aggressive circumstance demonstrated that the teachers lost their authority over the students within the process."

Excessive interaction with student's parents

Although not every participant mentioned it, excessive contact with student's parents was identified as a sub-theme that should be regarded as an issue. Because this issue evolved as a factor arising from distance education, it put pressure on the teachers in the process. According to T2 and T5, parents' involvement in the teaching process and excessive contact with them put teachers under pressure. T5 expressed his feelings as follows:

"Regarding the student's parents, I think we interacted with them too much. I have to send messages to parent groups and share links with them. Because I feel that I cannot reach my students directly. So, parents became highly visible between the student and me. I was not addressing my students but rather their parents. I wanted the parents to convey my messages to the students. That makes me very uncomfortable. I never want to deal with the parent excessively, but I have to. This issue was something that affected me negatively."

According to T5's claims, the teaching process shifted from a confidential dialogue between the student and the teacher to a procedure that included the parents, which he found extremely disturbing.

Tension induced by institutional demands

Another stressful issue raised by the participants was teachers' discomfort with the school administration's increased requests, directives, and their ability to reach them by phone at any hour of the day. While calling the students at any time was beneficial, T2 expressed the followings:

"To me, the idea that we are somehow out of their control causes them (the school administration) to message (frequent texting) us. I am unsure if the administrators (school administration) cannot fulfil their roles, but there is a constant barrage of irrigative messaging. Even a message saying good morning, if nothing else, begin to irritate me now. The school administration and parents' roles have grown, while the student and teacher's roles have reduced."

It was clearly inferred that the participants experienced this process as a dilemma between authority and autonomy within the context of shifting power and control relations.

Theme 4. Concerns about Professional Competence

Participants began to assume that they could not benefit from their previous teaching experiences and acted as novice teachers upon the start of online education. The following sub-themes revealed this main theme:

Dissatisfaction with the occupation

One of the principal affections experienced by the participants in this process was their dissatisfaction with the education they lectured. This feeling, which seemed to be shared by all participants, was a common theme by several factors such as communication issues, difficulty to make an assessment, poor student participation, and the influence of negative consequences such as stress and burnout. All factors contributed to the participants' assessments of their teaching as ineffective. While T7 stated that she had no indulgence with her profession, T4 indicated that online education was not adequately productive and noted...*much as things were tested in online education, this process let the students fall behind. So, what happened? Of course, it was not quite zero over 100; it was closer to 20 or 30.* T8 also expressed her feeling as *...while I was lecturing, I occasionally felt like I was*

teaching on a blank wall. With the analogy of a blank wall, T8 seemed to believe that the teaching she provided was in vain. While T2 described his teaching style in online education as "*it is getting towards expository teaching approach*", T1 expressed that "*online education is getting more and more expository teaching approach*", implying that teachers in online education adopted a strategy that required them to be more active. Teachers also indicated that such practices were imperative rather than optional because they would otherwise fail to interact with their students. Teachers lecturing approaches in distance education appeared to lean toward traditional education, but they eventually gave up since such procedures were very time-consuming. T4 remarked that he quit trying after a while and switched to making presentations to keep up with the curriculum.

"*As teachers, there is not much we can do. You hit the wall once and hit the wall twice. But you do not want to strike that wall anymore. You say that teaching it this way is the best because you have a schedule to set. I shifted to making presentations. Perhaps it was also easier for us.*"

It was also seemed that the majority of the participants were dissatisfied occupationally, felt limited, and were under stress; thus, they chose to compensate for online education by loading excessive homework to students.

Feeling inadequacy as a teacher

The participants seemed to develop a sense of inadequacy by their discontent with their occupations. For instance, T2 addressed this issue as "*There is a deficiency somehow, and we* failed *to overcome it*" While T1 stated that "*Of course, you feel an inadequacy, of course, that was also an effect on that issue*", T5 expressed this situation with the following statement:

"*...We also have certain shortcomings considering the use of different applications. Such things are all limiting factors. I mean, we tried to adapt to a new process and a new system. There are difficulties that we experienced. We suddenly found ourselves in this process. There are many factors. It seems that we felt inadequate at this point.*"

T5 felt inadequate in using the newly required communication tools, especially in online education. He further noted that the rapid changing procedure prevented teachers from improving in this sense. The lack of opportunities for teachers to evaluate their teaching approaches possibly caused a detrimental impact and made them feel this way. T5 drew attention to this issue with his following words: "*How productive I was, and how beneficial I was*". Other participants also believed they could no longer express themselves adequately for

classroom control, reaching out to students, and receiving feedback. T6 also remarked that "*teaching experience lost its meaning with online education*". Based on similar statements of other participants, the teachers appeared to feel inexperienced in this new setting and believed that their previous experiences could no longer mentor them. It was also evident that such a situation caused teachers to be concerned for their students and put them under pressure.

Concern for their students

There were different reasons behind the participants' concerns for their students. These were students' poor learning, poor adaption to the new educational environment, failure to use new resources, and low participation in online education. Therefore, teachers seemed to be worried about losing some or all of their students. For instance, T7 expressed these concerns as follows:

"The problem in this process was that many students seriously atrophied and evanished. Unfortunately, we caused this. So, I don't think teachers are that powerful in the process. If more powerful people than teachers did things right, would teachers be more involved? I do not know."

T7 used the term 'evanished' for many of her students. Those students T7 mentioned might be considered the successful group because the expressions 'atrophied' and 'evanished' seemed to refer to this context. T7 also blamed policymakers rather than teachers. As a result, it would be plausible to say she had serious concerns for her students. Finally, it was determined among the teachers that a lack of job satisfaction, feelings of inadequacy, and concern for students also established a ground for the sense of being lost.

Feeling of being lost

While the participants described the problems contended, they defined their feelings as being cut off from professional life and becoming senseless to the world, being incomplete, solitary and alone, disturbed by uncertainty, losing control, and not knowing what to do. These sensations seemed to convey the feeling of being lost. T8 said that '*It was a kind of feeling of desperation. We had already cut off from the social world at certain points, and the same happened in professional life*', stating that she felt detached from the world and felt alone. Furthermore, it was noted that the participants considered themselves in a strange environment and did not know what to do, as evidenced by the statements such as '*It was difficult to adapt*' and '*There was a situation where no one knew what to do*'.

Conclusions and Discussion

This study aimed to investigate the making sense of mathematics teachers' experiences in teaching in ODE settings during the pandemic. The participants stated that they found themselves in an educational setting in which they were unfamiliar and didn't know what to do in the early stages of distance education. With the management of initial chaos, the teachers attempted to make the existing tools and communication channels more effective while also searching for new equipment and ways of communication. This process might be characterized as a struggle and search. Participants in this procedure seemed to prefer to employ the tools (graphic tablet, webcam, etc.) that they considered the most efficient among the equipment they practiced during the online education. As NíFhloinn and Fitzmaurice (2022) stated that, usage of such tools was rising, based on their technical advantages. Teachers realized the potential and limitations of these instruments, which they used compulsorily at the beginning of this process, and improved the instruments' utility as they experienced. This process is described as the adaptation procedure through which teachers modify the tools as suitable for them. Finally, teachers adopted new modes of communication and tools by making decisions through their experiences throughout the process. The literature highlighted that teachers made their own decisions based on their experiences (e.g. Bishop, 2008; Huang et al., 2022). Furthermore, some of the participants appeared to take a negative stance towards online education and adopted resistance, developing a perception through rejecting the effectiveness of online education. Therefore, these mathematics teachers described this process as a general struggle, search, adaptation, and adoption/rejection process.

As anticipated, teachers coped with the challenges originating from the change in communication channels and the limited communication throughout ODE. As in other professions, teachers also considered themselves to feel constrained by the new circumstances generated by work from home and the unorthodox communication style (Ipsen et al., 2021). The lack of non-verbal communication and the inability to observe students while studying were the key elements that directed participants to believe their communication with students was ineffective. Non-verbal communication encompasses individuals' conscious or unconscious behaviors in the presence of others; thus, it is a crucial aspect that directly impacts the quality of teaching (Bambaeeroo & Shokrpour, 2017). As a result, teachers believed they lost the principal components determining the teaching quality besides their rudimentary roles. There seemed to be verbal communication between the teacher and the

student; however, non-verbal communication was restricted severely during online education. The fact that the participants rated their communication with students as "poor" indicated that mathematics teaching should be approached in a broader framework covering non-verbal and emotional communication beyond employing mathematical/symbolic language. In the literature, mathematical communication is emphasized mostly by its mathematical communication skills (Cai et al., 1996; Chen et al., 2021; National Council of Teachers of Mathematics (NCTM), 2000). Such skills include the individuals' correct use of mathematical language, expressing their thoughts clearly, and interpreting the opinions of others (NCTM, 2000). However, the findings of this study revealed clues that non-verbal communication was a significant component of mathematical communication for teachers. In parallel with these findings, spontaneous mathematical discourse in mathematics learning and teaching environments should include activities such as employing the body language of teacher and student and pointing out mathematical objects in addition to verbal expressions (Barwell, 2003). In this regard, the inexistence of non-verbal communication means the teachers lose one of their natural components of the mathematical discourse or, as one of the participants stated, 'a limb he/she uses in teaching mathematics'. The lack of communication additionally caused teachers to weaken and alienate their emotional bonds with their students. Sakiz (2017) stated that one of the most significant components of a learning environment was teachers' constructive emotional support, which he defined as dignifying, empathizing, valuing, and providing the need for safety. The participants also stated that they could not perceive their students' requirements and hence failed them to support. The participants also thought that the responsibility and roles of the teachers, for instance, observing students during studying, mentoring, and acting as a facilitator in education, disappeared during online education. According to Lester et al. (1989) these are fundamental aspects of a teacher's profession.

Teachers mediated themselves as authorities in the classroom and believed their role weakened in distance education. However, they assessed that the school administration's power over them diminished and that, as a result, their autonomy elevated. These findings align with the results obtained by Meisner and McKenzie (2022), thereby corroborating and reinforcing the scholarly work on the matter. According to Piaget (2013), autonomy refers to the ability to self-behave without being influenced by external pressure. As a result, the idea that participants believed their authority-dictated obligations diminished while their sense of responsibilities increased (e.g. T8) could be justified by autonomy. While working from

home, the participants experienced a sense of being out of control (Ipsen et al., 2021), and they were pleased with such a situation for themselves. However, they were uncomfortable instead when their students acted uncontrolled. In addition, they opined that they lost classroom privacy due to the unnecessary involvement of parents in the teaching process. Teachers recognizing the erosion of school administration's control over them felt a greater sense of professional responsibility. Therefore, distance education entailed redefining the roles in terms of more responsibility versus less control for the teachers and assigning obligations to students and teachers.

Teachers had concerns about their professional skills since they could not use their previous teaching experiences in the new settings. The most obvious explanation for teachers to have such an opinion was that they neither received feedback nor had the opportunity to evaluate students. This result is in accordance with Flack et.al. (2020) findings that teachers feels being like a beginner teacher, even one of our participant used the exact same sentence to express her feelings. Yohannes et al. (2021) stated that one of the obstacles experienced in distance mathematics education was the lack of proper interaction and feedback. They further emphasized that the unidirectional media tool (only the teacher activities were visible) was the root of the problem since teachers were accustomed to evaluating their students solely on a paper-based. However, Assareh and Bidokht (2011) stated that the major constraint in online education was the assessment and evaluation process. Such feelings seemed to shift positively among teachers (T2 and T4) when they had the opportunity to receive feedback or execute objective evaluation.

Suggestions

As a result, we can say, the entire process turned into a practice in which teachers' previous experiences became obsolete, leaving them as felt being inexperienced, isolated, lost, and alone but paradoxically liberalized. The essence of this feelings is the lack of interaction during ODE. It is safe to conclude that being a mathematics teacher during the pandemic had a traumatic aspect. Life generally includes a continuum that ties the past with the future. Trauma disrupts this continuum by severing the link between the past and the future, generating a gap in the lifeline (Garland, 2018). The participants' thinking that their teaching experience became obsolete and their great confusion might have caused them to perceive the process as a traumatic situation. As Engelbrecht et al. (2023) stated, many things have changed with the school closures during the pandemic in terms of education. Our findings indicate that not all of these changes are positive. In this sense, we suggest investigating

teachers after the pandemic process to find out post-traumatic effect on teachers. In future studies, differences and similarities in teacher responses according to variables such as gender and professional experience can be investigated.

The results of this study showed that teachers often tried to find solutions on their own during the crisis. This process of struggle led them to become exhausted or, on the contrary, to discover new ways. Those who were able to manage the process realized the benefits of distance learning, while those who weren't developed prejudices. Therefore, in times of crisis, scheduling should be centralized and the process clearly defined. If teachers are both decision-makers and implementers, yet not authorized, crises can cause new crises..

Compliance with Ethical Standards

Disclosure of potential conflicts of interest

The authors declare that this study and no processes involved in conducting the study have the potential for conflicts of interest.

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Research involving Human Participants and/or Animals

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Matematik Öğretmenlerinin COVID-19 Salgını Sırasında Çevrimiçi Uzaktan Eğitimle Öğretme Deneyimleri: Kaygılar ve Uyarlamalar

Özet:

Bu çalışmanın amacı, matematik öğretmenlerinin 2020-2022 yılları arasında Kovid-19 salgını sırasında uzaktan eğitim ortamlarında öğretmenlik deneyimlerini nasıl anlamlandırdıklarını araştırmaktır. Fenomenolojik deseni temel alan bu çalışmanın tasarımında yorumlayıcı fenomenolojik analiz kullanılmıştır. Araştırmaya en az yedi yıllık mesleki tecrübeye sahip sekiz öğretmen katılmıştır. Veriler yarı yapılandırılmış görüşmeler yoluyla toplanmış ve yorumlayıcı fenomenolojik analizle yorumlanmıştır. Sonuç olarak, dört ana tema belirlenmiştir: uyum sağlama ve yansıtma mücadelesi, etkileşim eksikliği, otorite ve özerklik arasındaki gerilim ve mesleki yeterliliğe ilişkin endişeler. Belirlenen temalara göre öğretmenler dönemin başından itibaren kendilerini ve öğrencilerini yeni duruma adapte etmeye çalışırken bir arayış ve mücadele sürecinden geçmişlerdir.

Anahtar kelimeler: COVID-19 salgını, çevrimiçi uzaktan matematik eğitimi, acil durum uzaktan öğretimi, matematik öğretmenlerinin deneyimleri.

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