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Teachers in Math Lessons in the Digital Age: The Real Face of Distance Education[1]

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ABSTRACT

The COVID-19 pandemic has made distance education compulsory for all students in primary, secondary, and higher education in Türkiye. This situation has brought about many changes in teaching methods, material use, assessment and evaluation processes, and course durations. This study investigates the effects of these changes on secondary school mathematics teachers and their experiences and difficulties adaptation processes. This study conducted using a qualitative approach as a case study, included 75 secondary school mathematics teachers working in Türkiye in the 2020–2021 academic year. The data collection process was conducted online with a semi-structured interview form via Google Form. The obtained data were evaluated by content analysis. According to the findings of the research, teachers tend to provide skill-based questions as homework during the distance education process, rather than the lesson. Teachers who have negative judgments about assessment-evaluation processes find the course durations in distance education insufficient. Teachers who use different motivation tools in the distance education process, on the one hand, think that the process improves them; on the other hand, they expressed their concerns in terms of professional development. Teachers need more support and training to cope with the difficulties they face in the distance education process. In addition, they should be supported to improve themselves in online assessment and evaluation strategies and increase student participation.

Dijital Çağın Matematik Dersinde Öğretmenler: Uzaktan Eğitimin Gerçek Yüzü

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ÖZ

COVID-19 salgını, Türkiye'de okulöncesinden yüksek öğretime kadar tüm öğrencilere uzaktan eğitim yapılmasını zorunlu kılmıştır. Bu durum öğretim metotlarında, materyal kullanımında, ölçme-değerlendirme süreçlerinde ve ders sürelerinde birçok değişikliği beraberinde getirmiştir. Bu çalışma, bu değişikliklerin ortaokul matematik öğretmenleri üzerindeki etkilerini ve öğretmenlerin adaptasyon sürecindeki deneyimlerini ve yaşadıkları zorlukları araştırmak için yapılmıştır. Durum çalışması olarak nitel bir yaklaşımla yürütülen bu çalışmanın katılımcıları, 2020-2021 eğitim-öğretim yılında ortaokul düzeyinde farklı kurumlarda öğretim yapan 75 matematik öğretmenidir. Veri toplama işlemi, yarı yapılandırılmış görüşme formu ile çevrimiçi olarak Google Form üzerinden yapılmıştır. Elde edilen veriler içerik analizi ile değerlendirilmiştir. Araştırma sonuçlarına göre öğretmenler, uzaktan eğitimde ders sırasında beceri temelli soruları kullanmaktansa ödev olarak vermeyi tercih etmiştir. Ölçme-değerlendirme süreçleri konusunda olumsuz yargılara sahip olan öğretmenler, uzaktan eğitimde ders sürelerini yetersiz bulmaktadırlar. Uzaktan eğitim sürecinde farklı motivasyon araçları kullanan öğretmenler, bir yandan sürecin kendilerini geliştirdiğini düşünürken öte yandan da mesleki gelişim anlamında kaygılarını dile getirmişlerdir. Öğretmenler, uzaktan eğitim sürecinde karşılaştıkları zorluklarla başa çıkmak için daha fazla destek ve eğitime ihtiyaç duymaktadır. Ayrıca online ölçme ve değerlendirme stratejileri, öğrenci katılımını artırma gibi konularda kendilerini geliştirmeleri için desteklenmeleri gerekmektedir.

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INTRODUCTION

In the final months of 2019, Türkiye, like the rest of the world, was challenged to deal with the coronavirus outbreak that originated in Wuhan, China. One of the areas significantly impacted by the COVID-19 pandemic was education, where specific measures and restrictions necessitated radical change and transformation (Bozkurt & Sharma, 2020; Can, 2020; Erkut, 2020; OECD, 2020; Özer, 2020). In response to the pandemic, Türkiye, along with many other countries, introduced distance learning to maintain educational continuity during periods when face-to-face instruction was not feasible. This change posed significant challenges for students and teachers alike, prompting a transformation in education systems and the onset of a demanding period, particularly for teachers (Allen, Rowan, & Singh, 2020; Daniel, 2020). The shift to distance learning enforced greater reliance on educational technologies, pushing teachers, who play a pivotal role in the education system, to adapt swiftly.

In the current era, education systems are required to proactively address adverse situations such as natural disasters in line with technological advancements and labor market demands (UNESCO, 2015) because disasters and epidemics can rapidly alter professional competencies, leading to the emergence of new skill areas. The World Economic Forum's Future of Professions Report" predicts that as technological adaptation in professional life escalates, 50 % of all employes will need to acquire new skills by 2025. This highlights the importance of continuous learning and skills development and emphasizes the need for individuals and organizations to embrace lifelong learning and invest in developing the skills needed for the jobs of the future. Within the realm of education, a new competence has emerged for teachers who lack training in DE, specifically, the ability to apply effective pedagogical approaches that align with the demands of distance learning and perpetuate student motivation. Knowledge, skills, and ethical values are some of the competencies expected to enable online teaching, especially in long periods of time such as the pandemic period (Zhu & Liu, 2020).

In transformations necessitated by both natural disasters and technological advancements, it was revealed that teachers, despite having pedagogical competence and domain knowledge, exhibit hesitation and reservation toward distance learning due to their lack of knowledge in using technology (International Labour Organization [ILO], 2020a). Teachers experience the stress of adapting to new technologies and designing pedagogically appropriate use of such technologies, especially given the changes required by the pandemic in our education system (Dong et al., 2019). Other factors exacerbating teachers' anxiety include their lack of experience with distance education, the pedagogical differences inherent in distance learning, students' adaptation issues, and challenges in assessing student achievement.

It is clear that a more flexible approach to teacher education is needed in the wake of the pandemic. The future landscape of teaching and learning and how they will change in the post-pandemic era is currently a topic of debate (Bakker & Wagner 2020). Therefore, it is crucial to identify the necessary changes, understand the challenges teachers faced during the pandemic, and create a roadmap accordingly. It is no longer a choice but a necessity to create a dynamic, flexible educational environment in the post-pandemic period by exploring the limitations, difficulties, advantages, and disadvantages of distance education. The challenges experienced during the COVID-19 pandemic necessitate a transformation in education, with a focus on technology. As such, training for distance learning and digitally supported education is anticipated to become increasingly prevalent. Given that even in the TIMSS 2019 research conducted before the pandemic, the main training need demanded by teachers was the use of digital tools, a need that has been exacerbated by the pandemic. Therefore, it is evident that understanding the issues faced by teachers during distance learning and planning to address their deficiencies is of utmost importance. Teachers' perceptions and opinions of the distance learning process significantly impact its effectiveness (Başar et al., 2019). Teachers' attitudes toward the DE process, their comfort level with technology, and their understanding of the pedagogical strategies needed for effective online teaching can significantly influence the overall quality and success of DE initiatives. Therefore, it is important to consider and address teachers' perspectives and concerns to ensure the efficiency and effectiveness of DE programs. Sharing teachers' experiences, opinions, and attitudes is critical for taking more effective steps to eliminate the above-mentioned problems and improve the quality of DE (Talidong & Toquero, 2020).

Distance Education and Teacher Competence

DE is defined differently across various sources in the literature. Horzum (2003) defines DE as an education model that uses communication technologies to facilitate student-teacher interaction, unrestricted by time and space. This definition emphasizes the use of technology to overcome physical distance barriers and enable distance learning experiences. Similarly, Uşun (2006) considers DE as an application of educational technology in which the source and receiver are situated in separate environments, and communication and interaction are enabled via technical means while emphasizing individuality, flexibility, and independence. Both definitions underline that DE involves technology-enabled communication that transcends time and space constraints. As part of distance education, courses can be conducted either synchronously or asynchronously. Synchronous education entails students and teachers convening at a predetermined time, usually online, for live lessons (Fidalgo et al., 2020). Conversely, asynchronous education involves pre-prepared content such as presentations, videos, or audio recordings, which students can access at any convenient time when synchronous work is not possible (Watts, 2016).

DE has both advantages and disadvantages compared with traditional education. The advantages of DE include minimizing opportunity inequality, facilitating mass education, reducing education costs, providing students with flexibility, enriching the educational environment, promoting individual learning, and assigning learning responsibility to the individual. Conversely, disadvantages include potential hindrance to students' socialization, limited support for students unaccustomed to independent and self-guided learning, and suboptimal use of practical courses (Kaya, 2002). Despite these shortcomings, DE has widened access to information for a large portion of the world 's population during the pandemic, aiding the transmission and conveyance of educational content in digital media (Fidalgo et al.,2020). Furthermore, while DE was perceived as a supplement to face-to-face education pre-pandemic, it has evolved into a viable alternative under pandemic-induced constraints.

The rapid development in technology and the fact that this development is not reflected in educational institutions at the desired level has revealed the problem of technology integration in education. The necessity of the integration of technology into teaching is felt daily, and the inadequacy of teachers to use technology in the classroom environment with appropriate pedagogy stresses teachers (Dong et al., 2019). While there are already problems in this regard in our country as in the whole world, teachers suddenly found themselves in a technology-based education after the pandemic that emerged unexpectedly. According to a systematic review by Kurtoğlu and Seferoğlu (2013), teachers generally have positive attitudes toward new technologies. However, even if they know new technologies, they also express concerns about increased responsibilities, feelings of inadequacy, and the need for professional development in technology and pedagogy. In fact, a study conducted in Türkiye during the pandemic period revealed that teachers' readiness levels, self-efficacy, self-confidence, and attitudes toward e-learning were at a moderate level (Üstün, Karaoğlan-Yılmaz, & Yılmaz, 2020).

Considering that in the near future, certain job groups (50% of all employes) will need to acquire new skills in working life, it seems essential for teachers to receive training to improve their competence and skills in integrating technology into their lessons. The results of the TIMSS 2019 survey revealed that teachers mostly demand training on the integration of technology. Moreover, considering that this research was conducted before the pandemic, it would not be difficult to say that this rate has increased even more worldwide after the pandemic.

Teachers with field knowledge and pedagogical competence may have reservations about DE practices because of their lack of knowledge about technology (International Labour Organization [ILO], 2020b). In this process, presenting the course content used in face-to-face traditional classes in an online environment by converting it directly into digital format has been the most common method used by teachers. This approach of teachers who have no previous experience in DE has often failed (Ko & Rossen, 2017). Although DE with digital learning tools offers an environment where the learner can progress according to the learner's learning speed and learning style, the inability to design an appropriate learning environment has negatively affected the perceptions and thoughts about distance education. Teachers' inexperience in distance education, students' adaptation problems to the new system, and the ambiguity of how to evaluate student achievements have

increased and spread this uneasiness. Considering that teachers' self-development and motivation in online environments will positively affect their thoughts about online learning (Machado, 2007), teachers' perceptions and opinions about this process are thought to be a way to increase the efficiency of DE activities. Accordingly, this research is significant in terms of revealing the opinions of mathematics teachers working in lower secondary schools about DE and the difficulties they experienced in this process during the COVID-19 outbreak and guiding the DE practices to be carried out in the future.

Education in Türkiye during the Pandemic Period

Pneumonia cases of undetermined cause first emerged in Wuhan province, China, on 31 December 2019 and were subsequently identified as COVID-19 by the World Health Organization (World Health Organization [WHO], 2020). It swiftly spread worldwide, prompting the WHO to classify the outbreak as a "public health emergency of international concern" and to declare it a pandemic on March 11, 2020.

The COVID-19 pandemic necessitated broad-scale changes and transformations worldwide due to both the preventive measures taken and the imposed restrictions. Education was a area most rapidly affected by these changes. To prevent further spread of the coronavirus, new arrangements in education policies and practices were implemented. However, these circumstances significantly impacted teachers and students, marking the start of a challenging period for education systems. In this context, measures were taken to prevent and control virus spread, including recommendations for school closures. The timing of school closures varied by country according to individual circumstances. Starting in early 2020, schools worldwide, particularly in China and Hong Kong, began to close. According to a UNESCO report, school closures affected 1.57 billion students and more than 63 million educators in 143 countries (UNESCO, 2020). By April 2020, educational institutions in 194 countries had temporarily closed, affecting 91.3% of learners worldwide (UNESCO, 2020b).

In Türkiye, the first viral case was reported on March 10, 2020. Subsequently, the Ministry of National Education (MoNE) rescheduled the planned break from April 6–10, 2020 to March 16–20, 2020 and suspended educational activities in pre-school, primary, secondary, and higher education institutions for three weeks. From 23 March 2020, MoNE began emergency remote teaching activities (MoNE, 2020a).

With emergency remote teaching necessitated by the COVID-19 pandemic, MoNE made concerted efforts to ensure continuity in education through various digital platforms. The Education Informatics Network (EBA), launched by MoNE in 2012 as part of the FATIH Project initiated in 2010, has played a crucial role. EBA is an online social education platform developed by the General Directorate of Innovation and Educational Technologies [(Yenilik ve Eğitim Teknolojileri Genel Müdürlüğü (YEGİ-TEK)], where teachers, students, and schools can access free course content and additional resources (Aktay & Keskin, 2016). Upon the urgent decision for remote teaching, MoNE enriched the EBA content and swiftly decided to record lecture videos with volunteer teachers. To ensure equal opportunity, given the varying internet access across Türkiye's socioeconomic conditions, TRT EBA television channels were established. These channels broadcasted course content prepared for primary, secondary, and high school students as part of distance education. The three EBA TV channels (EBA TV Primary School, EBA TV Secondary School, and EBA TV High School) were broadcasted on six different frequencies, serving as a DEtool without requiring internet access with the agreement between MoNE and TRT. Lessons on EBA TV channels were planned to last 20 minutes each, with a 10-minute break between lessons. Students could follow the broadcast stream, learn their course schedule, and tune in during their designated time slot. They could connect to the broadcast at a specified time interval and interact with the broadcasted lessons (MoNE, 2020a). This format allowed students to access educational content aligned with their curriculum and participate in distance learning through EBA TV channels. Between 23 March 2020 and 19 June 2020, these channels broadcasted a total of 2,516 hours (MoNE, 2020b). In households with more than one child, access to lesson repetitions was provided at different times to accommodate overlapping lesson schedules. Additionally, an agreement with GSM operators provided up to 8 GB of free internet for EBA platform use for students with insufficient internet infrastructure.

Starting on Monday, 13 April 2020, the EBA Live Classroom application was another opportunity offered to teachers and students. Initially serving 8th and 12th-grade students, the application began providing live lessons at all grade levels on April 23, 2020 (MoNE, 2020a). This feature of the EBA Live Classroom application facilitated

simultaneous distance learning experiences by enabling real-time interaction and engagement between teachers and students. Teachers used the "whiteboard" application to teach their lessons share materials, tests, and documents on the EBA platform, and exchange messages with students. In addition, live classroom practices were recorded so that they could be shared with students later.

Literature Review

In the literature, there are many studies on education during the pandemic period. In the studies where the opinions of teachers and students in different branches were taken, the difficulties experienced by teachers and students in this period and how they overcome these difficulties were examined. When these studies are analyzed, two trends stand out. The first of these studies is the research in which teachers from different educational levels and branches are participants (Adıgüzel & Adıgüzel, 2020; Alper, 2020; Avcı & Akdeniz, 2021; Balaman & Hanbay-Tiryaki, 2021; Dilekçi & Limon, 2020; Ergüç-Şahan & Parlar, 2021; Karaca et al., 2021), and the second is the research conducted on the basis of a single branch. These studies were conducted on special education (Anıl et al., 2022; Kurnaz et al., 2020; Mengi & Alpdoğan, 2020), physical education (Özcan & Saraç, 2020; Çetin et al. ,2021), religious culture and ethics (Çakmak & Uzunpolat, 2021), science (Bakioğlu & Çevik, 2020; Ünal & Bulunuz, 2020), visual arts (Hiçyılmaz, 2020), English (Tümen-Akyıldız, 2020), preschool (Gündoğdu, 2021), classroom (Bakan et al., 2023; Saygı, 2021; Sönmez, Yıldırım & Çetinkaya, 2020), Turkish (Bayburtlu, 2020; Özgül et al., 2020; Karakuş et al., 2021) and social studies (Dere & Akkaya, 2022; Gürel & Er, 2020; Tanta, 2021).

When the studies on mathematics in distance education are analyzed, it is seen that the studies were mostly conducted with pre-service teachers (Karatepe et al., 2020; Kuzu, 2020; Akıncı & Tunç, 2021; Korkmaz, 2021; Özyıldırım &Gümüş, 2023). There are also studies in which classroom teachers (Karaduman et al., 2021) and prospective classroom teachers (Düzgün & Sulak, 2020; Özçakır Sümen, 2021) are participants and how the mathematics course is taught in primary school distance education. However, studies directly related to mathematics teachers are very limited. When these studies are reviewed, Özdemir Baki and Çelik (2021) tried to determine what kind of measures secondary school mathematics teachers took, what methods and techniques they used, and what kind of instructional content they prepared during the pandemic. They determined that teachers in rural and urban centers took different measures for the difficulties they experienced. Some of these measures include following technology, eliminating material deficiencies, using time effectively and using different communication resources. In the study conducted by Coşkun Şimşek et al. (2022), it was found that high school mathematics teachers did not have sufficient preparation for distance education and that they generally acquired information about the distance mathematics education process informally. As a result, especially in secondary school mathematics education, there are no studies addressing the skill-based questions that teachers have difficulty even in face-to-face education and teachers' views on the change in their professional competences.

Based on the reported literature, this study aims to delve into the experiences of mathematics teachers during the DE process, explore the contributions of the process to their development, and gather their suggestions for improving the process. To this end, this study seeks to answer the question, "What are the views of mathematics teachers on the DE process?" In pursuit of this primary question, this study also answers the following sub-questions:

- To what extent were lower secondary school mathematics teachers able to include skill-based questions in DE?
- What are the views of lower secondary school mathematics teachers on the measurement and evaluation approaches in the DE process?
- What are the opinions of secondary school mathematics teachers about the duration of lessons in the DE process?
- How did lower secondary school mathematics teachers ensure student motivation during the DE process?
- How did the DE process change lower secondary school mathematics teachers' views on their professional competence?

METHOD

Research Design

The study employed a case study design, a qualitative research method. A case study is a qualitative research strategy in which the researcher deeply examines one or more time-bound situations through observation, interviews, or documents, and delineates themes and scenarios related to the case (Creswell, 2007). The research used an explanatory case study, a type of case study method, to shed light on a situation, render unfamiliar situations understandable, and clarify links with real-life scenarios. The case under consideration in this study is the exploration of mathematics teachers' perceptions of the DE process. Hence, this study aims to identify the causes of difficulties, advantages, disadvantages, and changes in the professional competences of lower secondary school mathematics teachers experience in the DE process in terms of their views and to offer insights into future research focus areas and policy-making decisions related to DE processes.

Research Participants

The study group consists of 75 lower secondary school mathematics teachers working in public schools, private schools, and Science and Art Centres (BİLSEM) in Türkiye for the 2020-2021 academic year. The teachers participating in the study were determined by the criterion sampling method, one of the purposeful sampling methods. Accordingly, the criterion for participation in the study was being a mathematics teacher who experienced the DE process at the lower secondary school level and volunteering to participate in the study. Information about the demographic characteristics of the lower secondary school mathematics teachers constituting the study group is presented in Table 1.

Table 1. *Demographic Information about the Participants*

Variable	The category of Variables	Frequency	Percentage (%)
Gender	Female	49	65.33
	Male	26	34.66
Education Level	Undergraduate	57	76
	Master's Degree	17	22.66
	PhD	1	1.33
School Type	Public School	57	76
	Private School	13	17.33
	BİLSEM	5	6.66
Seniority	1-5 years	30	40
	6-10 years	15	20
	11-15 years	17	22.66
	16 or more years	13	17.33
	Total	75	100

Research Instruments and Processes

The main instrument used in this research is structured interviews. While preparing the structured interview form research on DE was first analyzed. The second researcher conducted informal interviews with 3 lower secondary school mathematics teachers who had experienced the DE process. The interviews were recorded, and after the necessary corrections, a draft interview form including 8 open-ended questions was prepared. Some questions that were not understood and had very wide boundaries were edited and transformed into more understandable and limited questions. For example, the question "What did you feel during the DE process? Did you have a sense of inadequacy about yourself?" in the draft form has been made more understandable as "What kind of change did the DE process bring about for you in terms of professional competence?". To determine the suitability of the draft form, the opinions of two mathematics teachers and mathematics educators who had experience in the DE process were taken. In addition, a linguistic expert was

consulted to examine its linguistic appropriateness. Finally, an interview form consisting of six questions was created. In the first part of the structured interview form, which consists of two parts, there are questions that determine demographic information. In the second part, there are five questions that are prepared in line with the purpose of the research.

University Ethics Committee approval was obtained for the collection of research data. Then, the research questions were prepared on Google Forms and a link was created. Lower secondary school mathematics teachers were contacted through WhatsApp and Telegram groups, social media accounts, and the link of the research were shared. The questions were answered by the lower secondary school mathematics teachers who voluntarily participated in the research, and the data were obtained.

Data Analysis

The answers received through the Google Form were converted into a Google spreadsheet. The data obtained from the table were divided into different documents according to the sub-problems, and the data obtained were analyzed with the help of the MAXQDA qualitative data analysis program. In the analysis phase, each item was coded. Codes were created from the answers given for each question, and categories were reached from the codes created.

Qualitative researchers are interested in how codes relate to each other rather than the frequency of occurrence of codes (Creswell, 2013). To this end content analysis is used to bring together similar codes and categories and transform them into a meaningful form (Yıldırım & Şimşek, 2005). This approach allows researchers to discover connections and patterns in the data, thus providing a deeper understanding of the situation under study. Content analysis is the categorization of data and systematization of these categories into smaller structures through coding (Büyüköztürk et al., 2019). The teachers participating in the study were coded as T1, T2, T3, ... The categories obtained are presented in tables and figures in the finding section.

The data obtained in the study were coded by two researchers, and the opinion of a third expert was consulted for data that could not be reconciled. The third expert's opinion was used to assign the relevant code. Strauss (1987) stated that the coding process can be completed when the codes are created and the codes reach saturation (when no new codes can be formed) and a patterns formed (As cited in Çelik et al., 2020). The results obtained were then shared with the teachers through e-mail adressses, and they were asked whether they wanted to make additions on a missing or different subject. When the codes created in this study reached the saturation stage and it was understood that no new code could be generated, the coding process was terminated. The qualitative data obtained in the study were transferred to the MAXQDA qualitative data analysis program by the researchers. Data that were similar were brought together within the framework of certain codes and themes and organized in a way that the reader could understand. The codes and themes obtained in the study were visualized with the help of MAXmaps, and the frequency of each code and theme was shown on the visual.

In the research, the percentage of agreement between the experts was calculated using Miles and Huberman's (1994) formula. According to Miles and Huberman (1994), agreement among coders is expected to be at least 80%. In this study, this value was 92.3%.

Ethic

The committee involved in ethics evaluation: Necmettin Erbakan University Social and Human Sciences Ethics Committee.

Date of ethics evaluation: 18/06/2021.

Serial number of the ethics evaluation documents: 2021/371

FINDINGS

The findings obtained by analyzing the data obtained from the interview form in this study, in which the views of lower secondary school mathematics teachers on their perspectives on mathematics teaching and profession in the DE process were examined, are presented, respectively, in line with the sub-questions.

Solving Skill-Based Questions in the DE Process

Lower secondary school mathematics teachers' opinions on the extent to which they could include skill-based questions in the DE process were analyzed under two subcategories as yes and no. Figure 1 demonstrates the codes obtained from teachers' opinions and the subcategories belonging to these codes.

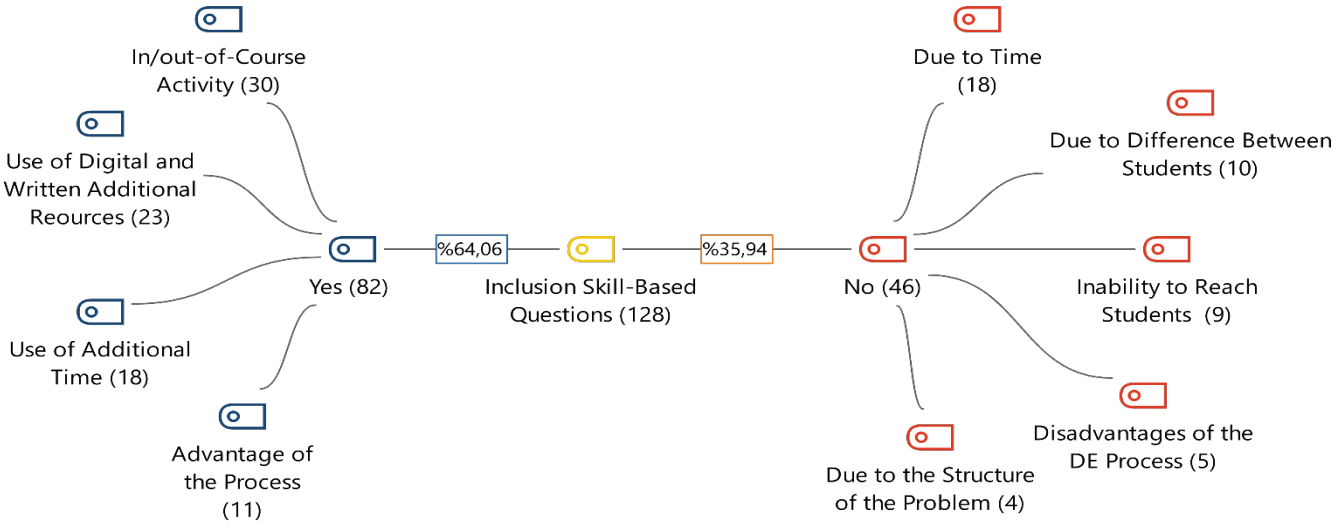

Figure 1. Teachers' ability to include skill-based questions in the DE process

As presented in Figure 1, approximately two -thirds of the participants could include skill-based questions in their lessons during the DE process. When the answers of the teachers who included skill-based questions and how they did it were analyzed, the teachers stated that they mostly included these questions as in-class/out-of-class activities in this process. This was followed by teachers who stated that they could include these questions in their lessons by following digital resources such as Youtube, EBA and additional written resources such as PDF and solving questions from this source book. Teachers who stated that they could only include skill-based questions in the DE process by using additional time are in the third place. Teachers who could not solve adequate skill-based questions because of the inadequacy of technological facilities in face-to-face education managed their time better with screen sharing in the digital environment as well as the availability of the same digital resource to the students. Teachers who saw the process as an advantage tried to include skill-based questions with extra studies, homework assignments before or after the lesson, sharing in WhatsApp groups, sample solutions on Youtube, and video sharing from the EBA network. Teacher quotations regarding the themes and codes are as follows:

T74: While I could easily do this in the eighth grade, it was difficult to realize this in the sixth grade due to the intensity of the curriculum."

S30: Yes. In general, I continued in the form of frequent feedback and video shootings on social platforms. At the same time, I used such questions by sending them as homework on platforms such as WhatsApp. After the lecture was over, we solved them together in some classes.

T5: Yes. We solve study and skill-based questions published by MoNE and provinces in the digital environment. At the same time, I screen-shared the source book available to all my students in the digital environment, and time was managed better. Sometimes we shared questions from their own Z books and solved them with the students. We will discuss the questions in class.

Despite the intensity of the course curriculum, teachers solved questions from various sources in the digital environment, supported students with video recordings and feedback, and sometimes discussed and solved questions from textbooks or their own sources with students.

Measurement Assessment in the DE Process

In the second sub-problem of the study, the lower secondary school mathematics teachers' views on measurement and assessment approaches in the DE process were analyzed. Teachers' views were categorized into two categories: negative and positive. Figure 2 shows the categories and codes that belong to these categories.

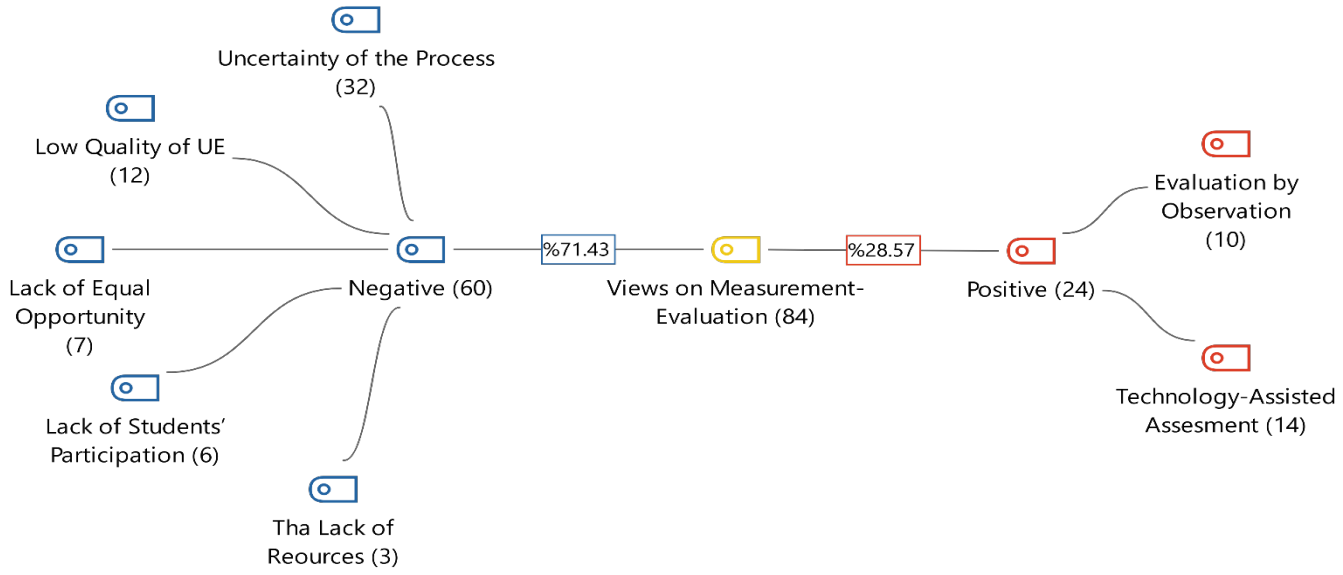

Figure 2. Teachers' measurements and evaluation in the DE process

According to Figure 2, while teachers mostly expressed negative opinions about the assessment and evaluation they carried out in this process, approximately one-fourth of the teachers expressed positive opinions about the assessment and evaluation they carried out. The teachers in the negative category stated that during the pandemic period, they could not perform measurement and evaluation with the desired quality due to the uncertainty of the process, that is, the opening and closing of schools under pandemic conditions. In addition, teachers stated that they could not conduct adequate assessment and evaluation due to the lack of equal opportunities, that is, the thought that not all students could benefit equally from these opportunities. Finally, students' reluctance to participate in the lesson and the lack of sufficient resources were among the obstacles to measurement and evaluation. Teacher quotations regarding the themes and codes are as follows:

T10: I do not think that I conducted an effective assessment and evaluation because I had students who could not attend the course for various reasons during distance education. At the end of the term, we were asked to perform assessment and evaluation for all students, but we were instructed not to give low grades to the students who could not attend the class. Simultaneously, the lack of sufficient information about whether to go to school all the time or to stay or whether the written grade is valid and the lack of the necessary letter to the school about this made the process difficult.

T19: No, I do not think that the measurement and evaluations were as reliable as face-to-face. The reason is that there was less interaction. It was impossible to get a response for measurement from the children when they could not hear and see the children who turned off their voices.

T13: No. We could not perform an effective assessment and evaluation for everyone because not everyone's home environment was suitable for this.

The teachers who stated that they could make assessments and evaluations in the DE process stated that they made technology-supported and mostly observation-based assessments. In addition, mathematics teachers working in BILSEM stated that they did not have problems in terms of measurement and evaluation because they had

different types of education in related schools and there was no graded evaluation. Below are the opinions of the teachers who performed the measurement and evaluation. Teacher quotations regarding the themes and codes are as follows:

T69: Yes. Because there is no graded assessment in BILSEM, I was not using traditional assessment and evaluation methods such as written and oral. I considered my students' active participation in the process, their desire to participate in the process and their effort to reach the result, their completion of the activity, and their ability to put something on it as sufficient.

T6: Measurement and evaluation should be performed according to the conditions and evaluated according to those opportunities. We delivered mock exam booklets to the students, gave them a certain period of time, solved them at home under the supervision of their parents, delivered the optics, and assessed them at school and shared the results with the students. I answered the questions that could not be answered in online lessons. We did homework, and we asked for and checked the video footage of the studies.

T45: Partly yes; I asked them to add their homework to a padlet. This was data like collecting homework. In EBA, we can prepare our own study questions and score them. Web2.0 tools, Teacher-made, Saesaw, and Classkick are the tools I use in measurement and evaluation.

T55: Since there was not a healthy assessment-evaluation environment, I tried to make assessment-evaluation with the participation in the lesson, the questions they solved in the lesson, and homework assignments. It was a type of observation-based evaluation.

According to the data obtained from teacher interviews, teachers used different methods of assessment and evaluation other than traditional assessment methods; this was based on student participation, home-solving mock exams, questions created in digital tools and observation-based assessments.

Mathematics Teachers' Opinions on Course Duration during the DE Process

The opinions of mathematics teachers about whether the lesson time reduced to 30 min in the DE process was sufficient or not were collected in two categories as yes and no. The categories for the answers given by the participants and the codes related to the categories are shown in Figure 3.

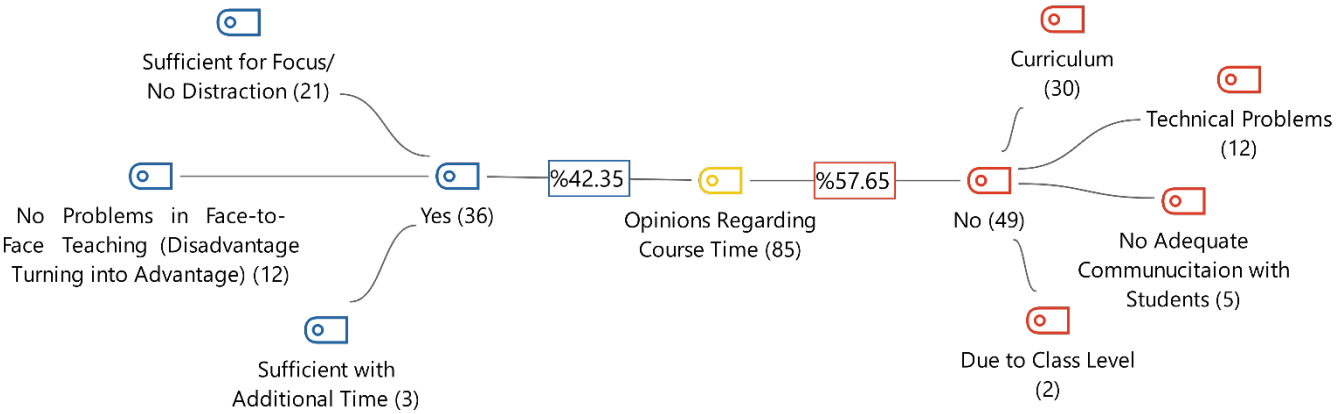

Figure 3. Regarding the opinions of mathematics teachers on the 30-minute course duration in the DE process

According to Figure 3, 42,35% of the participant teachers consider it sufficient to reduce the lesson duration to thirty minutes in the DE process. In particular, they think that the duration is sufficient for the students not to be distracted and that it is an ideal duration because there were no in-class management problems like in face-to-face education. Some teachers also stated that the duration was sufficient if additional time was used. The opinions of the teachers regarding this finding are as follows:

T13: Yes. Because in a face-to-face education of 40 minutes, students could get bored and distracted. It was enough because there were no problems that could arise in the school environment.

T38: When the participation rate was low, it was effective because I got feedback more quickly and I spent less time on classroom management. However, when the participation rate was high, most of the time was spent on classroom management and solving students' attendance problems.

T41: Yes, it was enough. Since there was no problem in writing questions, I could spend more time lecturing. I think it is sufficient time to emphasize the essential parts of the subject without distracting the students.

T51: I can say that 30 min in DE was more than 40 min in face-to-face education. Because too many extra factors in face-to-face education reduce productive lesson time. However, I can say that 30 min in DE (the fact that there are few students may be a factor) was very productive and full.

T13: Time was not enough, but I could solve this problem with additional time.

According to Table 4, 57,65% of the participant teachers did not find the 30-minute lesson time limit in the DE process sufficient. Teachers find the lesson time insufficient, especially because of the intensity of the curriculum, technical problems experienced in the DE process, and inability to communicate with the students. The explanations of some teachers who found the duration insufficient are given below.

T17: The duration was not enough. It was not sufficient for a learning outcome. There was only enough time to explain the subject. In addition, there was a loss of ten minutes of time due to technical problems that students could not connect at the same time.

T26: The duration was not enough. The duration of the lesson decreased, but the intensity of the learning outcomes remained the same. We were spending a lot of time, especially to explain basic concepts. I also had time problems when I tried to answer questions. The curriculum should have been diluted in the DE process.

*T42: The duration was not enough. because there was an indirect rather than a direct communication environment. You could not make eye contact with the student. When you called the student, sometimes he/s*he was not in front of the screen.

According to the data obtained from the teachers' opinions, the opinions of the teachers about the duration of the course in distance education varied; while some of them found this duration more efficient and sufficient than face-to-face education, others stated that the duration was insufficient due to technical problems, communication barriers and curriculum density.

Motivating Students in the DE Course

The views of mathematics teachers on how they motivate students in the DE process were collected under three categories: at the beginning of the lesson, during the lesson, and after the lesson. Figure 4 shows the codes and categories belonging to these codes.

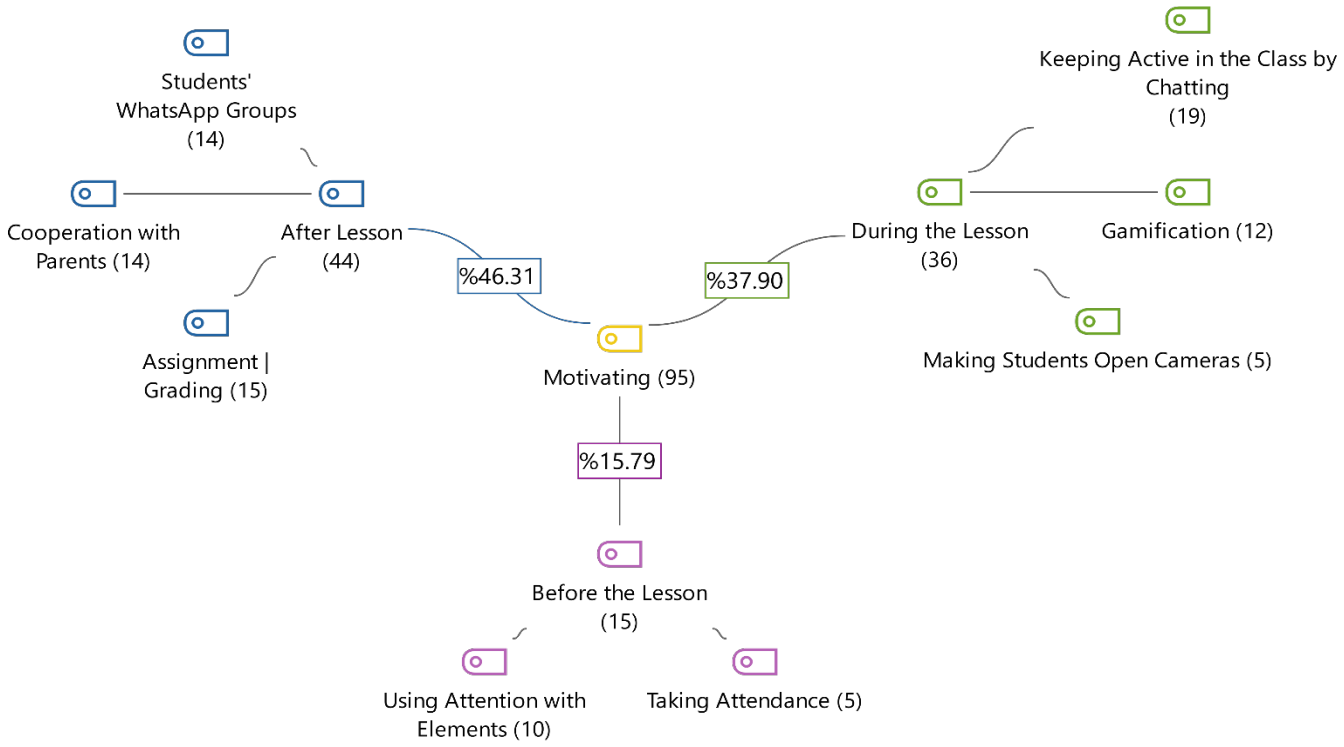

Figure 4. Participants' views on how they motivate students in the distance education process.

When Figure 4 is analyzed, the teachers within the scope of the research tried to keep the motivation of the students alive mostly after the lesson. They tried to ensure the students' motivation by assigning homework and grading the homework and staying in contact with the students and parents through WhatsApp groups. The opinions of some teachers regarding this finding are as follows:

T43: I tried to tell the students that I was with them and that the education continued by sending them homework and study notes that I had prepared myself. Taking notes was a source of motivation for the students. I tried to evaluate each activity using a grade.

T66: "I tried to provide motivation by constantly informing the students about the lesson from WhatsApp groups, having students solve different types of questions, and being in instant communication.

T35: "First of all, I contacted the parents before the start of the course period and explained how important attendance was in terms of subject integrity. At the same time, I informed the families of the students who did not attend the class by being in constant communication throughout the DE process. In this way, I attempted to create discipline at home by cooperating with the parents.

Teachers who expressed opinions on increasing students' motivation during the lesson in the DE process mostly chatted with students and encouraged them to take actions that would make them active. Teachers tried to ensure students' motivation during the lesson by ramification and making them turn on their cameras. The opinions of some teachers regarding this finding are as follows:

T34: I tried to engage in one-to-one dialog with the students. In this process, I saw that children needed to be listened to and mathematics teachers. I tried to create a learning environment that was mixed with conversation.

T44: We made the lessons fun with online games. In addition, from time to time, my directing students to competitions and activities such as the Bilge Kunduz website, code.org created excitement and curiosity in students. I motivated them by saying that I would give prizes (puzzles, and storybooks) to the first five students with high participation in the lesson.

T12: I think it motivates my students by opening the cameras to the lesson and asking them one by one how

they are and expressing that seeing them makes me happy.

To increase the motivation of the students before the lesson, the teachers used elements such as videos, stories, and tales and tried to motivate the students to participate in the lesson by taking attendance at the beginning of the lesson. The opinions of some teachers regarding this finding are as follows:

T51: I sent videos to arouse curiosity before the lesson. Sometimes we started the lessons with a song, and sometimes with a fairy tale. At the end of the lesson, we made fun endings by giving them exit tickets, and this curiosity motivated them.

T11: I tried to increase the participation and motivation of the students, especially by taking attendance before the lesson. Sometimes I gave small rewards to those who were in that lesson.

The teachers interviewed in the study used various strategies to keep students' motivation alive. They assigned homework to students, graded these homework assignments and kept in touch with students and parents through WhatsApp groups to ensure motivation after the lesson. These strategies included sending original notes to students, having them solve different types of questions, and being in constant communication with parents. During the lesson, making students active, making them turn on their cameras and establishing one-to-one dialogue with them were used as methods to increase motivation. Prior to the lesson, methods such as taking attendance at the beginning of the lesson and attracting students' attention with videos and fairy tales were used.

Effect of DE on Professional Development of Teachers

Within the scope of the last research problem of the study, the opinions of the teachers about their professional development and concerns in the DE process were collected in two categories: it improved them professionally and it made them anxious. Figure 5 shows the codes related to the teachers' opinions and the categories belonging to these codes.

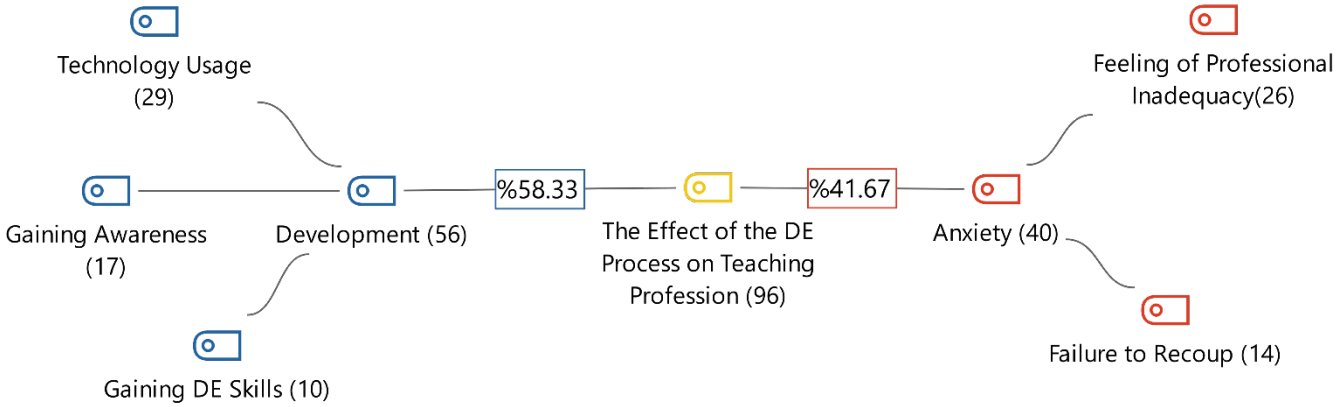

Figure 5. Effect of the DE process on teachers' professions

Figure 5 shows that more than half of the mathematics teachers think that they improved their professional education during the DE process. In particular, the use of different technologies, gaining awareness of their professional inadequacies, and gaining DE pedagogy stand out as the areas where they have improved themselves in the process. The opinions of some teachers who think that the DE process contributes to teacher development are as follows:

T41: It provided me with digital experience and made me aware of new applications and tools in this field. I do not think that I will have problems with digital teaching materials if DE is continued in the future. I think that my pedagogic skills regarding DE have improved.

T63: When we look at it as professional development, we can say that it helped us realise our deficiencies. At the same time, I think it was a good process in this respect as we realized that we needed to be open to innovations.

The situations that make teachers anxious during the process include the thought that they cannot compensate

for the learning losses experienced during the process in face-to-face education and the anxiety of professional inadequacy they experience in this process. The opinions of some teachers who stated that they were anxious during the DE process are as follows:

T2: I realized that we lack a lot in digital education. By conducting more research, more effective resources or materials can be found.

T32: It caused me to feel inadequate in my profession. I was concerned about the students' inability to achieve the learning outcomes.

T44: When face-to-face education is switched to face-to-face education, we have concerns both as parents and teachers about adapting our students to the lessons and overcoming their deficiencies.

According to the views of the teachers above, more than half of the mathematics teachers think that they have improved their professional training during the DE process. Especially the use of different technologies, the realisation of their professional inadequacies and the acquisition of DE pedagogy stand out as the areas where they improved themselves in the process. Among the situations that worried the teachers during the process were the thought that the learning losses experienced in the process could not be compensated in face-to-face education and the concern of professional inadequacy they experienced in this process.

DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

In this study, the views of lower secondary school mathematics teachers on the DE process were investigated. To this end, answers five subproblems were sought.

The first sub-problem focused on the extent to which mathematics teachers could include skill-based questions in the DE process. The study revealed that while the majority of lower secondary school mathematics teachers included skill-based questions in the DE process, approximately one-third of them could not They stated that while skill-based questions could be included during the lesson in face-to-face education, in the DE process, due to the limited time and the structure of the questions, they were given to the students as homework, additional time was used, and the lectures were supported by videos. They also stated that they could not include them adequately due to the level difference between the students, the difficulty of solving skill-based questions in DE the students not attending the lesson regularly, the long explanation of these questions, and the limited time. It is also among the findings of the study that it was not as easy to focus students' attention on the question as in face-to-face education. It is noteworthy that the limited time given was the common opinion of the participants who answered both yes and no. In addition to the participants who argued that they could not include skill-based questions in a thirty- minute period, there were also participants who had the same opinion and gave skill-based questions to students with in/out-of-class activities. From this, it can be concluded that live lesson time was not an appropriate time to include skill-based questions in mathematics teaching. In addition, since 8th grade students are in the LGS (central examination for passing to high schools) process, it has been determined that teachers who taught at this grade level paid more attention to include skill-based questions. In the intermediate grades, it was aimed to teach the learning outcomes first. Considering that the quality of the questions increases students' motivation toward the lesson (Belcastro, 2017), they also stated that they had difficulty in including skill-based questions in DE because they were more performance-based, more related to real life, and led to interpretation and analytical thinking (Kuzu, 2020). In fact, teachers made negative evaluations about the process in that students did not answer the questions posed during live lessons (Baki & Çelik, 2021) and therefore could not interact sufficiently while solving these questions. Similarly, teachers stated that mathematics teachers had difficulty in including these questions in DE because mathematics has a procedural aspect and it is difficult to transfer both operations and drawings to the screen with a phone or computer mouse (Kilit & Güner, 2021).

When the findings related to the second problem of the study, which is to what extent lower secondary school mathematics teachers are able to perform measurement and evaluation in DE seven out of every ten participants gave a negative answer. In this process, since the opening and closing of schools constantly changed, the exam dates also changed accordingly. The uncertainty of the process had a negative impact on the measurement and evaluation. In addition, the announcement by MoNE (2020) that there would be no written exams in this period

may have caused both the inability to make measurements and evaluations and the formation of a code for by observation. Measurement and evaluation mean distinguishing successful and unsuccessful students, ensuring justice, and giving students the score they deserve (Sarı, 2020). Therefore, in this process, not being able to ensure fairness in measurement and evaluation is one of the biggest concerns of teachers (Kilit & Güner, 2021). The possibility of cheating on online and unsupervised exams is perceived by teachers as an injustice against working students (Erzen & Ceylan, 2020). In addition, the lack of a necessary and sufficient environment for measurement and evaluation made the process more difficult. In addition, the fact that participation in the lesson was not compulsory also reduced the participation rate of the Students. Baki and Çelik (2021) stated that teachers did not conduct any measurement and evaluation due to the low attendance of students in general. Therefore, one of the most difficult stages of the process for mathematics teachers was the lack of participation obligation and the need for teachers to conduct assessment and evaluation independent of grades in order to determine which subjects students understood and which subjects they lacked. It is known in the literature that teachers do not consider themselves sufficient in preparing assessment and evaluation activities in DE (Kear et al., 2012). On the other hand, from the opinions of the mathematics teachers who tried to make assessments and evaluations, we can say that they primarily made assessments by scoring according to their participation in the lesson. In this process, teachers stated that they tried to ensure students' regular participation in the lesson before making assessments and evaluations. Teachers also stated that they mostly used homework assignments and online tests in assessment evaluation. Similarly, they stated that they conducted assessment and evaluation through homework assignments and used tests and exercises in the DE process; (Özgül, Yıldız, & Ceran, 2020; Dere & Cankaya, 2022; Coşkun Şimşek et al., 2022). On the other hand, Adıgüzel and Adıgüzel (2020) stated in his study that the participants applied for open-ended written exams because they were the most appropriate and applicable in the pandemic process. In addition, the teachers also used homework and tests in distance education, which they were used to and used in face-to-face education. Mathematics teachers working in BILSEM emphasized that measurement and evaluation were not carried out in their institution.

Regarding the third problem of the research, whether the 30-minute EBA live lesson duration was sufficient for mathematics teaching, more than half of the mathematics teachers answered no and a smaller number answered yes. Teachers who answered as no had insufficient time due to the curriculum, technical problems, and the class level caused by the lack of time, but they found enough time to communicate with the students. Similarly, the study revealed that science teachers spent between 30 and 60 minutes for a lesson in the DE process, and this time was found to be insufficient by teachers for the science lesson (Bakioğlu & Çevik, 2020; Dere & Cankaya, 2022). Again, it was determined that teachers working at different levels and branches found the course duration short, experienced problems such as not being able to start the lesson on time, technical problems, and lack of communication and interaction (Arslan & Şumuer, 2020). In addition, explaining the topics, solving the questions, making the students comprehend the subject cannot be fulfilled within the live lesson time determined in DE (Özçakır Sümen, 2021). On the other hand, the participants who thought that the duration of the live lesson was sufficient thought that the duration was sufficient for more focus and motivation, and that more time in front of the screen would distract the student 's attention and bore the student. They thought that thirty minutes of class time was sufficient when there were no technical problems, when students entered the lessons on time, and when the lesson was taught in intermediate classes. On the other hand, teachers working in BILSEM stated that they conducted the lessons 40 minutes on different platforms such as Zoom since there was no live lesson assignment in EBA. One of the skills that teachers should have in online learning environments is time management skills (Phelps & Vlachopoulos, 2020), which directly affects learning success (Caplan & Graham, 2008). Therefore, not only the time management skills of the teacher but also the intensity of the curriculum, technical problems, and student readiness are the most important factors affecting the adequacy of the course duration in DE.

Although the DE process positively affects teachers' professional development, it can also cause teachers to realize their professional inadequacies and uncertainties in education, which increases their anxiety. According to the results of the study, more than half of the mathematics teachers believes that the DE process contributed positively to their professional development. In particular, the use of technological tools, pedagogical approaches, and the formation related to DE can be stated to have this positive effect. This finding of the study supports Bakioğlu

and Çevik's (2020) finding that teachers' technology uses and professional development are positively affected in the DE process. It can be said that teachers had the opportunity to realize their professional inadequacies by more actively meeting digital technologies and thus felt the need to improve themselves. Based on the opinions of the teachers, it can be interpreted as DE playing an important role in increasing teachers' digital skills and professional competencies. However, in addition to these positive developments, the DE process also caused anxiety among teachers. Teachers were not only worried about how to compensate for the learning losses experienced by students in face-to-face education but also expressed a sense of professional inadequacy in this process. Similarly, Ünal and Bulunuz (2022) reported that teachers felt inadequate in motivating students. The rapid advancement and integration of technology creates stress and anxiety for teachers in terms of adapting to new technological tools and using these tools within a pedagogical framework (Dong et al., 2019). These concerns may stem from the uncertainties that DE brings with it, technological inadequacies, and a lack of sufficient information on how DE affects the teacher-student relationship.

During the distance education process, students experienced a loss of motivation and lack of motivation. Teachers used different strategies to involve students in the teaching-learning process (Demir & Özdaş, 2020; Özdoğan & Berkant, 2020). Teachers' strategies for increasing student motivation in the DE process are quite diverse. Most teachers focused on maintaining student motivation after the lesson. By actively using homework and grading methods, teachers tried to keep students in a continuous learning environment. They also supported this motivation by communicating with students and parents through messaging platforms such as WhatsApp. These strategies remind students that they are in a continuous learning process. In particular, T43's statement that they are with the students with the homework and grades given to them can be counted among the approaches that can help overcome the sense of isolation brought by the DE process. As for the methods to increase student motivation, it can be stated that teachers adopted interactive and student activation strategies. In this process, teachers' use of gamification methods helped the lesson to have an entertaining structure that can attract students' attention rather than a boring and monotonous structure. In T44's statement, it can be stated that the approach of making the lesson fun with online games and using the reward system are among the strategies that can be effective in increasing student motivation. It can be stated that teachers' strategy of one-to-one communication by having students turn on the camera helps maintain the bond between students and teachers. In terms of pre-lesson strategies, teachers used different elements (videos, stories, tales) to attract student interest. These methods can be interpreted as ensuring that the student's motivation is high at the beginning of the lesson and encouraging active participation in the lesson. Similarly, Alper (2020) supports the result of our research that teachers communicate with their students using various technologies (such as Whatsapp, telephone) during the DE process and provide students with motivation by giving them the right to speak to as many students as possible in the lesson (Özçakır Sümen, 2021).

This research has revealed some important findings and trends. However, the following recommendations can be offered for further research and investigation:

The results of the current study indicate that teachers need more support and training to overcome the challenges they face in the distance learning process. Training programs should be developed to enable teachers to effectively incorporate skills-based questions into their lessons. In addition, teachers need more guidance and support in implementing assessment and evaluation strategies. Such training can help teachers manage DE processes more effectively. Concurrent mentoring and consultancy programs can help teachers cope with the challenges they face in the DE process. This can especially help teachers in the implementation and adaptation process of new technologies and strategies. Mentors or advisors can provide real-time feedback to teachers and help them quickly improve their teaching processes by suggesting strategies and techniques that can be immediately implemented. This can help teachers to better serve students while supporting their own professional development.

Technology use and integration are critical factors for effectiveness in distance education. The ability to use technological tools and programs effectively is important for teachers to manage their educational process effectively. However, teachers often have to distance teaching without adequate training in the use of technology. Therefore, teachers can receive regular training in the use of technology. These trainings can help teachers reach students more effectively using technology. In this sense, platforms can be created where teachers can share their experiences and best practices. This can enable teachers to learn from and receive support from each other,

especially in the DE process. Collaboration among teachers can help develop technological competencies, pedagogical knowledge, and skills. Moreover, teachers observing each other 's teaching strategies and receiving feedback can make them more effective in distance education. In this way, sharing and collaboration among teachers can increase teachers' perceptions of professional self-efficacy in terms of both pedagogy and technology use and help their professional development.

This research shows that live class time is insufficient for teaching mathematics. This indicates the need for more research on how to make the best use of class time and guidance on time management. In addition, teachers must have sufficient knowledge to develop strategies to minimize technical problems in distance education. Teachers need to be trained in different strategies for encouraging student participation, especially given that they spend a large proportion of their time engaging students. For example, teachers can encourage all students to actively participate in lessons by assigning responsibilities to specific students at the beginning and end of the lesson and changing these responsibilities continuously. Teachers can also use short questionnaires or feedback forms at the end of the lessons to obtain feedback from students. This feedback can help teachers improve their lessons and better respond to students' needs.

Technology access in DE is critical to ensure equal learning opportunities. Therefore, policies can be put in place to ensure that all students have access to appropriate technological tools and stable internet connectivity. Access to technology can be a major challenge, especially for students living in rural areas or in low-income families. To overcome such problems, governments and educational institutions should support students by providing them with the necessary tools, such as tablets, computers, and internet connections.

Transferring assessment and evaluation strategies to online settings has been a major challenge for teachers. This suggests that more guidance and training is needed for teachers in developing online assessment and evaluation strategies. In-service training for teachers on reliable and fair assessment and evaluation strategies in the online environment can help them overcome this challenge. However, in a distance learning environment, traditional exam formats may not always work. Therefore, various digital assessment tools can be used. For example, online quizzes, project-based assessments can be used. Formative assessment can also be used to focus on students' processes.

This study shows that teachers use various technological tools and programs to increase students' engagements in lessons. This suggests a need for the development of more teaching materials and resources for teachers and more guidance on how to make the best use of existing materials and resources.

Regular research and evaluations should be conducted to monitor and assess the effectiveness of distance education. This provides valuable information to identify best practices and shape future educational strategies.

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GENİŞLETİLMİŞ ÖZET

Giriş: 2019 sonlarında Çin'in Wuhan kentinde başlayıp hızla küreselleşen COVID-19 pandemisi, dünya genelinde yaşamın birçok alanında kesintilere, önemli zorluklara ve hızlı adaptasyon gereksinimlerine yol açmıştır. Türkiye, bu küresel krizden nasibini alarak, sağlık, ekonomi ve özellikle eğitim gibi sektörlerde derinlemesine dönüşümler yaşamıştır. COVID-19 pandemisi sırasında Türkiye'de eğitim, acil uzaktan eğitim (UE) ve dijital platformların kullanımına hızlı bir geçiş yaşamıştır. Millî Eğitim Bakanlığı (MEB), 2010'da başlatılan FATİH Projesi kapsamında ve Yenilik ve Eğitim Teknolojileri Genel Müdürlüğü (YEĞİTEK) tarafından geliştirilen Eğitim Bilişim Ağı (EBA) platformu üzerinden, öğrenci ve öğretmenlere ders materyallerine ücretsiz erişim imkânı sağlamıştır (Aktay & Keskin, 2016). MEB, pandemi döneminde EBA'nın içeriğini genişleterek, öğretmenlerin gönüllülük esasına göre hazırladığı ders videolarını eklemiş ve TRT ile iş birliği içinde EBA TV kanallarını kurarak, internet erişimi olmayan öğrencilere yönelik eğitim içeriği sağlamıştır (MEB, 2020a; MEB, 2020b). Ayrıca, öğrenci ve öğretmenlerin eş zamanlı olarak sanal ortamda bir araya gelmelerini sağlayan EBA Canlı Sınıf uygulaması ile UE'ye erişim daha da genişletilmiştir. Bu uygulama, öğretmenlerin ders anlatımını ve materyal paylaşımını kolaylaştırarak, eş zamanlı öğrenme deneyimlerini desteklemiştir (MEB, 2020b). COVID-19 salgını, eğitim sistemlerinde ani ve beklenmedik değişiklikleri zorunlu kılmış, özellikle uzaktan eğitimin önemini ve gerekliliğini ortaya koymuştur (Bozkurt et al., 2020). Fakat, UE'ye geçiş, öğretmenler için pek çok zorlukla birlikte gelmiştir. Öğretmenler, teknoloji kullanımı, çevrimiçi pedagojik yaklaşımlar ve öğrencilerin UE'ye uyumu gibi yeni yeterlilikler kazanmak zorunda kalmışlardır (Allen, Rowan ve Singh, 2020; Daniel, 2020). Bu süreçte, eğitimcilerin teknolojik yeterlilik eksikliği ve UE uygulamalarına karşı çekinceleri, eğitim kalitesinde düşüşlere yol açabilecek önemli bir engel olarak belirlenmiştir (ILO, 2020).

Öğretmenlerin yeni normale uyum sağlama süreçlerinde karşılaştıkları zorluklar ve ihtiyaç duydukları yeni beceriler, özellikle pedagojik stratejiler ve teknolojik araçların etkili kullanımı konusunda yeterli veri ve araştırma bulunmamaktadır (Zhu ve Liu, 2020). Ayrıca, dünya genelindeki eğitim sistemlerinde pandemi sonrası beklenen değişiklikler ve bu değişikliklere uyum sağlama kapasitesi konusunda kapsamlı bir anlayış eksikliği söz konusudur (Bakker & Wagner, 2020). Öğretmenlerin, teknoloji entegrasyonu konusundaki eğitim ihtiyacı, özellikle TIMSS 2019'un sonuçlarına göre, pandemi öncesinde de belirgin iken, pandemi sonrası bu ihtiyacın daha da arttığı düşünülmektedir. UE uygulamalarında, öğretmenler sıklıkla içeriği dijital formata dönüştürme yaklaşımını benimsemesine rağmen, bu stratejilerin etkinliği sorgulanmaktadır (Ko ve Rossen, 2017). Öğretmenlerin eğitim teknolojilerine yeterlilikleri ve bu süreci nasıl ele aldıkları, uzaktan eğitimin verimliliğini önemli ölçüde etkileyecek bir faktör olarak görülmekte ve Türkiye'de matematik öğretmenlerinin bu süreçte yaşadıkları deneyimlerin incelenmesi önemli görülmüştüri Ayrıca, literatürdeki çalışmaların çoğunluğu genelde öğretmen adayları ile gerçekleştirilmiş ve matematik öğretmenleri ile doğrudan ilgili çalışmaların oldukça sınırlı olduğu belirlenmiştir. Bu bağlamda, öğretmenlerin teknoloji entegrasyonu ve UE uygulamalarındaki yeterliliklerinin artırılması, özellikle pandemi sonrası dönemde, eğitim kalitesinin artırılmasında kritik bir öneme sahiptir. Bu araştırma, öğretmenlerin UE sürecine adaptasyonunu, karşılaştıkları zorlukları ve bu zorlukların üstesinden gelmek için geliştirdikleri stratejileri derinlemesine inceleyerek literatürdeki bu boşluğu

doldurmayı amaçlamaktadır. Ayrıca, pandemi sonrası eğitimde beklenen değişimlere yönelik bir yol haritası sunarak, eğitim politikalarının ve uygulamalarının gelecekte daha dirençli ve esnek olmalarını sağlamak için önerilerde bulunacaktır. UE sürecindeki matematik öğretmenlerinin deneyimlerini, bu sürecin onlara neler kattığını ve sürecin nasıl geliştirilebileceğine dair önerilerini derinlemesine incelemeyi amaçlamaktadır. Temel olarak, araştırma "Matematik öğretmenlerinin UEsürecine yönelik görüşleri nelerdir?" sorusuna yanıt bulmayı hedeflemektedir.

Yöntem: Araştırma, nitel araştırma yöntemlerinden durum çalışması ile yapılmıştır. Durum çalışması, belli bir durumu derinlemesine incelemeyi amaçlar ve bu araştırmada, ortaokul matematik öğretmenlerinin UE sürecine yönelik görüşleri durum olaral ele alınmıştır. Araştırma, matematik öğretmenlerinin UE sürecinde yaşadıkları zorluklara, UE'nin avantajları, dezavantajları ve mesleki yeterliklerindeki değişimlerine ilişkin düşüncelerini belirlemeyi amaçlamaktadır. Araştırmanın çalışma grubu, 2020-2021 eğitim yılında Türkiye'de çeşitli okullarda görev yapan 75 ortaokul matematik öğretmeninden oluşmaktadır. Katılımcıların demografik bilgileri, cinsiyet, öğrenim düzeyi, okul türü ve mesleki deneyimine göre sınıflandırılmıştır. Veri toplama sürecinde yapılandırılmış görüşme formu kullanılmış, Google Forms aracılığıyla çevrimiçi olarak katılımcılara ulaştırılmıştır. Toplanan veriler, MAXQDA nitel veri analiz programı ile analiz edilmiştir. Analiz sürecinde kodlama yöntemi kullanılarak veriler kategorilere ayrılmıştır. Elde edilen bulgular, katılımcılarla paylaşılarak onayları alınmıştır. Araştırmanın güvenirliğini artırmak adına, veri analizi aşaması iki bağımsız araştırmacı tarafından gerçekleştirilmiştir.

Bulgular, Tartışma ve Sonuç: Araştırmada ilk olarak, UE sürecinde öğretmenlerin beceri temelli soruları nasıl ele aldıkları incelenmiştir. Bulgular, öğretmenlerin çoğunun derslerinde bu tür sorulara yer vermiş olduğunu, ancak bunu genellikle ders içi/dışı etkinlikler, dijital ve yazılı kaynaklar kullanarak gerçekleştirmiş olduklarını ortaya koymuştur. UE'de zaman kısıtlamaları ve öğrenciler arasındaki seviye farklılıkları nedeniyle bazı öğretmenlerin bu sorulara yeterince yer veremediğini ancak teknolojik araçları ve ek kaynakları kullanarak bu eksikliği gidermeye çalışmış olduklarını belirtmişlerdir. Ayrıca, öğretmenler yüz yüze eğitime kıyasla online ortamda öğrencilerin dikkatini sorulara odaklamanın daha zor olduğunu ve bu yüzden çoğunlukla sadece temel kazanımlara yer verdiklerini ifade etmişlerdir. Bu durumu telafi etmek için ödevler, WhatsApp grupları üzerinden paylaşımlar ve video izletme gibi yöntemlerle destek sağlamaya çalışmışlardır. Soruların niteliğinin öğrencilerin derse yönelik motivasyonlarını artırdığı (Belcastro, 2017) düşünüldüğünde daha fazla performansa dayalı, gerçek hayatla daha fazla ilişkili, yoruma ve analitik düşünmeye yönlendirmesi (Kuzu, 2020) nedeniyle beceri temelli sorulara UE'de yer vermekte zorlandıklarını da ifade etmişlerdir.

Öğretmenlerin pandemi döneminde UE sürecinde gerçekleştirdikleri ölçme ve değerlendirme faaliyetlerine yönelik görüşleri değerlendirildiğinde, öğretmenlerin büyük bir kısmının bu süreçte ölçme ve değerlendirmeyle ilgili olumsuz görüşler belirttiği; ancak nispeten daha az bir kısmının olumlu düşüncelere sahip olduğu tespit edilmiştir. Olumsuz görüş bildiren öğretmenler, pandemi sürecinin belirsizliğinin, yani okulların açılıp kapanma durumlarının, istedikleri gibi etkili ölçme ve değerlendirme yapmalarını engellediğini ifade etmişlerdir. Ayrıca, tüm öğrencilerin eğitim fırsatlarından eşit şekilde yararlanamaması, öğrencilerin derslere katılım konusundaki isteksizlikleri ve yeterli kaynağa erişim eksikliği gibi nedenlerle yeterli ölçme ve değerlendirme yapamadıklarını belirtmişlerdir. Baki ve Çelik (2021), öğrencilerin genel olarak derslere katılımın istenen düzeyde olmaması nedeniyle öğretmenlerin herhangi bir ölçme-değerlendirme yapmadıklarını ifade etmiştir. Öte yandan, ölçme ve değerlendirme yapabildiklerini belirten öğretmenler, teknolojiyi kullanarak ve özellikle gözlem yoluyla değerlendirme yaptıklarını dile getirmişlerdir. BİLSEM'de görevli matematik öğretmenleri, farklı bir eğitim modeli uyguladıkları ve not bazlı değerlendirmenin bulunmadığı için bu süreçte ölçme ve değerlendirme konusunda sorun yaşamadıklarını ifade etmişlerdir.

UE sürecinde öğretmenlerin ders sürelerine ilişkin görüşleri incelendiğinde araştırmaya katılan öğretmenlerin yarıya yakını, ders süresinin otuz dakikaya indirilmesini yeterli bulmaktadır. Bu öğretmenler, kısaltılmış sürenin öğrencilerin dikkatini dağıtmadığı, sınıf içi yönetim problemlerinin yaşanmadığı ve bu nedenle ideal olduğu görüşündedir. Ayrıca, ek süre kullanımının ders süresini yeterli kıldığını belirten öğretmenler de bulunmaktadır. Öte yandan, öğretmenlerin diğer yarısı da 30 dakikalık ders süresini yetersiz bulmaktadır. Bu görüşü savunanlar, müfredatın yoğunluğu, UE sürecinde karşılaşılan teknik sorunlar ve öğrencilerle etkili iletişim kuramama gibi nedenlerle bu süreyi yetersiz görmektedirler. Süreyi yetersiz bulan öğretmenler, derslerin bu sürede verimli bir şekilde işlenemeyeceği konusunda endişelerini dile getirmişlerdir. Bu araştırmanın bulgularına paralel olarak farklı kademelerde ve branşlarda görev yapan öğretmenlerin ders süresini kısa buldukları, zamanında derse başlayamama, teknik aksaklıklar ve iletişim ve etkileşim eksikliği gibi sorunlar yaşadığı tespit edilmiştir (Arslan ve Şumuer, 2020).

Araştırmada, UE sürecinde öğretmenlerin öğrenci motivasyonunu sağlama yöntemleri ders sonrası, ders esnasında ve ders öncesinde olmak üzere üç ana kategoride incelenmiştir. Ders sonrasında, öğretmenler ödev atama ve bu ödevlere not verme yöntemini kullanarak öğrencilerin motivasyonunu diri tutmaya çalışmışlardır. Ayrıca, WhatsApp grupları aracılığıyla hem öğrencilerle hem de velilerle sürekli iletişim halinde kalarak motivasyonu artırmaya çalışmışlardır. Ders esnasında ise,

öğretmenler öğrencilerle sohbet ederek ve onları derse aktif olarak katılmaya teşvik ederek motivasyonu artırmaya odaklanmışlardır. Oyunlaştırma tekniklerini kullanarak ve öğrencilerden kameralarını açmalarını isteyerek, ders içindeki ilgiyi ve etkileşimi teşvik etmişlerdir. Ders öncesinde ise motivasyonu artırmak için öğretmenler video, hikâye, masal gibi çeşitli materyalleri kullanmış ve dersin başında yoklama alarak öğrencilerin derse aktif katılımlarını teşvik etmişlerdir. Benzer şekilde Alper (2020), öğretmenlerin UE sürecinde öğrencileri ile çeşitli teknolojilerden (Whatsapp, telefon gibi) faydalanarak iletişim kurmaları ve aynı zamanda derste de olabildiğince daha çok öğrenciye söz hakkı tanıyarak (Özçakır Sümen, 2021) öğrencilerin motivasyonlarını sağlamaları araştırmamızın bu sonucunu desteklemektedir.

UE sürecinde, matematik öğretmenlerinin büyük bir kısmı mesleki anlamda kendilerini geliştirdiklerine inanmaktadır. Bu gelişim, özellikle farklı teknolojik araçların kullanımına hâkim olma, kendi mesleki yetersizliklerinin farkına varma ve UE pedagojisinin öğrenilmesi gibi alanlarda daha belrigin olarak öne çıkmaktadır. Araştırmanın bu sonuçları Bakioğlu ve Çevik'in (2020) öğretmenlerin UE sürecinde teknoloji kullanımlarının ve mesleki gelişimlerinin olumlu yönde etkilendiğini belirlediği sonucunu desteklemektedir. Ancak aynı süreç, öğretmenlerde belirgin kaygıları da beraberinde getirmiştir. Bu kaygılar, özellikle UE sürecinde ortaya çıkan öğrenme kayıplarının yüz yüze eğitimle telafi edilemeyeceği endişesi ve yaşanan bu dönemdeki mesleki yetersizlik kaygısından kaynaklanmaktadır. Bu durumlar, öğretmenlerin kendilerini daha donanımlı hissetmelerine rağmen, mevcut şartlar altında öğrencilere gereken eğitimi tam anlamıyla sağlayamama endişelerini de artırmıştır. Bu araştırma sonucuna paralel olarak Ünal ve Bulunuz (2022) öğrencilerin motivasyonunu sağlamada öğretmenlerin yetersiz hissettiklerini ifade etmiştir.

UE sürecinde karşılaştıkları zorlukların üstesinden gelmek için kapsamlı destek ve hedefli eğitime ihtiyaç duymaktadır. Bu bağlamda, beceri temelli soruları etkin bir şekilde derse entegre etme, ölçme ve değerlendirme stratejileri, teknoloji kullanımı ve sınıf yönetimi konularında eğitimler önem arz etmektedir. Eş zamanlı mentorluk ve danışmanlık programları, öğretmenlere yeni teknolojileri ve stratejileri benimsemede ve uygulamada rehberlik edebilir. Ayrıca, teknolojiye erişimin kolaylaştırılması, özellikle dezavantajlı bölgelerdeki öğrenciler için eşitlikçi öğrenme fırsatlarının artırılmasında kritik bir rol oynamaktadır. Öğretmenlerin teknoloji kullanımında yeterlilik kazanmaları ve en iyi uygulamaları paylaşmalarını teşvik etmek için platformlar oluşturulmalı, aynı zamanda çevrimiçi ölçme ve değerlendirme yöntemlerine yönelik hizmet içi eğitimler artırılmalıdır. Son olarak, uzaktan eğitimin etkinliğini sürekli izlemek ve değerlendirmek için düzenli araştırmalar ve değerlendirmeler yapılmalı, bu süreçte elde edilen bulgular gelecekteki eğitim stratejilerinin geliştirilmesinde kullanılmalıdır.