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Countries' responses to covid-19 pandemic in K-12 education: Toward a digital mathematics education

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Highlights

The COVID-19 pandemic has affected many aspects of our lives, including education. As of March 2019, measures have begun to be taken in education in all countries, including the United Kingdom, China and Turkey, where the number of students is high or themselves being the world's leading countries in education. It is very valuable for countries to obtain information about the measures taken by other countries and to benefit from each other's experience. It is important to compile the studies of countries in order to be prepared to meet other possible outbreaks in the future or new waves of COVID-19.

This research examines the measures taken by countries against the COVID-19 pandemic in K-12 educarion, with a particular focus on mathematics education. Measures in three countries (China, The United Kingdom and Turkey, listed in alphabetical order) are presented and compared with each other, with a general focus on education and mathematics education.

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Contries' responses to covid-19 pandemic in K-12 education: Toward a digital mathematics education

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ABSTRACT

The aim of this study is to describe countries' responses to the COVID-19 pandemic in K-12 education, with a particular focus on mathematics education. The cases in three countries (China, The United Kingdom, and Turkey, listed alphabetically) are described and then compared with each other. The findings showed that all three of the countries had intensive measures in education; all have a tendency to move a digital education including mathematics education. While China and the United Kingdom took measures in health and education together, Turkey presented the measures in education separate from the health measures. Hence, we found that despite the varied educational measures, and whether they are together with health or not, all of the countries in this study seem to work hard to provide students with the necessary education through the media channels of their choices.

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Introduction

COVID-19 is one of the most widespread global pandemics, which has caused a major threat to human life and health. The World Health Organization called it a worldwide pandemic on March 11, 2020, when the New Coronavirus Disease (COVID-19) appeared in Wuhan, China, and spread to other nations (World Health Organization [WHO], 2020). The pandemic's fast expansion in society had detrimental consequences on many aspects of human existence, including health, economy, and education. In this context, governments have made a number of choices, and taken a variety of steps including wearing masks and lockdowns to reduce the impact of the worldwide pandemic on social life and to prevent the pandemic from spreading further. There have been various educational policy steps during pandemic, including suspension of schools and health measures in schools; which made it almost compulsory to pass to the digitalization act (see Alhouti, 2020; Ismail et al., 2021; Symonidis et al., 2021).

One of these steps was the conversion of educational activities from face-to-face to distance education, which impacted educators and students all over the world. On February 16th, 2020, China became the first country to execute the distance education decision. On March 13th, it expanded to 45 nations, and by March 26th, 166 countries had closed schools at all levels of education and were preparing for a shift from face-to-face to distance education. The closure of schools to prevent the spread of COVID-19 and the lack of much time for teachers and students to prepare for the online delivery of lessons has made the pace of transition to online education unprecedented (Ali & Kaur, 2020, Saralar-Aras & Güneş, 2022, Sarı & Keser, 2021).

Although the educational institutions, digital learning environments and support systems of many countries were not fully ready, teachers had to start online education in a short time (Spoel et al., 2020). COVID-19 has turned homes around the world into learning environments in a matter of weeks, if not days. The learning environment was radically changed from a classroom to a digital platform (Bayrakdar & Guveli, 2020). Eurasian ountries like Turkey have used a variety of resources to support the learning of students, including teaching packages (textbooks, worksheets and printouts), radio training, educational television and online teaching resources. Countries have often used several tools to achieve the largest possible student participation (to online education) ratio (Reimers et al., 2020).

At the onset of the crisis, governments and education actors have begun developing systems to deliver online education, showing that more than 90 percent of education ministries worldwide have implemented distance learning approaches that include radio, television and/ or the Internet (UNICEF, 2020c). Governments and education institutions have been developing methods to deliver education and training activities remotely since the onset of the COVID-19 pandemic crisis. According to the most recent data, more than 90% of education ministries throughout the world

have begun to employ distant learning methods such as radio, television, and the Internet. Most students (about 70%) continue their education at the global and regional levels in an environment that allows them to learn remotely through digital or asynchronous broadcast sessions at home (UNICEF, 2020a; UNICEF, 2020b). Simultaneously, students and teachers in many nations have been required to transition immediately from traditional classrooms to online courses, with little time to adjust (Sykes, 2020). Most education systems in the OECD's 2018 International Student Assessment Program (PISA) are not equipped for the world of digital learning possibilities, as the COVID-19 issue has demonstrated (Schleicher, 2020). Moreover, the pandemic process has confronted teachers with the reality that they have to learn how to work with previously unfamiliar software and tools in order to prepare teaching materials and deliver synchronized lessons. According to recent studies, Turkish teachers have shown that they have the necessary knowledge and skills on content knowledge, pedagogical knowledge, and skills they need to develop in the intersection of these with technology such as technological pedagogical knowledge that could be described as transferring this knowledge to technological processes, and technological pedagogical content knowledge that constitutes the intersection of content and pedagogy knowledge with technology knowledge (Saralar-Aras & Gunes, 2022; Sarı & Keser, 2021).

Whilst we hope that many countries (e.g., China and Korea) overcame the unforeseen effects of COVID-19 with the developed vaccines, and many other measures, its influence on education and countries' responses played a vital role in students' development and learning as some of these countries used ready-to-use materials, which were already available before the pandemic (Ministry of National Education, 2022). This article reviewed the available literature that reports the educational measures taken by three major countries: China, England, and Turkey. We also looked for whether any particular measure is taken for teaching mathematics given many researchers' dispositions of teaching mathematics using technology for decades (Bolt, 1991).

The significance of the study

Schools, training centers, and higher education institutions have been forced to close in the majority of countries as a result of lockdown and social isolation measures brought on by the COVID-19 epidemic. The way educators deliver high-quality instruction—through a variety of online platforms—has undergone a paradigm shift. Despite the difficulties faced by both teachers and students, online learning, distant learning, and continuing education have emerged as a cure-all for this unprecedented worldwide pandemic. Both students and teachers may experience a completely different learning environment when switching from traditional face-to-face learning to online learning, but they are forced to adjust because there are few or no other options. Through a variety of online channels, the educational system and teachers have accepted "Education in Emergency," forcing them to use a system for which they are not equipped.

Students, parents, and educators all over the world have been affected by the unforeseen massive impact of the COVID-19 pandemic as schools were closed to deal with the global pandemic. Governments of China, The United Kingdom and Turkey, first responders, and health officials were working to limit the outbreak, and educational systems are doing their best to keep providing high-quality instruction to everyone during this challenging time (DfE, 2021b [The United Kingdom]; MoE, 2020a [China]; MoNE, 2020a [Turkey]). Many students were experiencing psychological and emotional distress at home or in their living environment, making it difficult for them to work well. Whilst the ideal methods for homeschooling children online have not yet been determined (Petrie, 2020), we had to teach mathematics which have been found to be difficult to teach by teachers and learn by both students and adults face-to-face even before the pandemic (Cornell, 1999; Larkin & Jorgensen, 2016).

Method

This study followed a literature review of multiple cases to describe the cases in three countries and compare and contrast these cases, where possible. The countries were chosen by using convenient sampling where authors had experienced teaching and learning environments. Data was collected using documentation methods. Whilst literature and policy reports available in English and Turkish were the main source of data collection, documents in other languages were translated and reported where possible. The keywords used were very general to see the overall cases including COVID-19 + Education + K-12 + [Country Name] in various forms of the words. It is excluded the papers which did mention education and COVID-19 in the sample countries but not particularly related to the education in K-12. Then, we further added the word mathematics (in various forms including maths, math, mathematic) to look for specific studies in mathematics. It is important to state that this paper has a specific focus on educational measures in K-12 with a particular focus on mathematics education, hence, countries might as well have other measures in other areas than education, and other educational levels.

Findings

Case of China

Being the first country to be impacted by the COVID-19 pandemic, China has taken a number of serious precautions to avoid, manage, and cure the disease, as well as enacted a number of policy measures at the country level. China followed a governmental policy which was a system where schools were suggested to follow centralized and unified rules and procedures (Xue, Li, Li, & Shang, 2020).

Education was very important for China's COVID-19 policy. According to, Xue et al.'s (2020) study, the country's educational strategies for COVID-19 addressed various areas including education, which constituted more than half (53%) of the content of the policy documents. When having a look at the content of the

educational sections/chapters of the documents, it is realized that health and safety (30%), online education (18%), material supply (16%), student management (15%), teacher training (12%) and curriculum arrangement (9%) were the main focus points (ibid). The percentages shows the ratio of the number of pages devoted to the related topic to the total number of pages of the documents.

At the very beginning, teaching and learning activities at all educational levels were suspended in response to changing circumstances so that the government had the necessary time to regulate education and teaching activities (The Ministry of Education, 2020a).

Curriculum Arrangement

According to the suggestions of the MoE (2020a) in China, the country suggested to the teachers to integrate the study of pandemic measures into the national curriculum (for the disciplines of Mathematics, Science, and History) and made the integration compulsory. It is also suggested by the MoE that teachers encourage students to read necessary sources regarding the COVID-19 pandemic for awareness as after-school work. Online instructional technology consultants have been appointed to support online teaching in schools in China. In addition, it has been suggested that the total daily teaching time should not exceed one hour for the lower grades of primary school, two hours for the upper grades of primary school, four hours for middle school, and five hours for high school (Zhang et al., 2020). Despite all the changes in the total daily teaching time, there was no curriculum change.

About mathematics education, studies reported that learning mathematics during the COVID-19 pandemic was based on a realistic mathematics approach (e.g., Huang et al., 2020; Kollosche & Meyerhöfer, 2021; Xie et al., 2021). For example, Xie and colleagues reported that mathematics teachers use real-life examples and contexts in order to teach mathematics during pandemics. The following presents a sample quote from the article where a mathematics teacher is introducing a topic. The original was Chinese and below is the English translation of the teacher's introduction as presented in the article:

"Hello, everyone! In today's study, we would like to achieve two purposes in the course. We need to (1) further understand the relationship between the same number addition formula in specific situations, and (2) combine with particular examples to realize that the meaning of the same multiplication formula is different in different situations. Well, let's start today's learning journey! Autumn is coming, and the fruits are ripe all over the mountains. The little animals have decided to hold a harvest party. How lively it is. Carefully observe; what do you find? [Opens a picture of nature with animals, and a few moments later students start replying by saying they saw three monkeys, six little squirrels, and three birds.]" (p. 70).

As seen from the example, the teacher in this study introduced a realistic example in order for students to explore the mathematical topic. This was only one of the

examples from many similar others, reported the authors.

Online Education and Material Supply

A national primary and secondary school network cloud platform was founded by the MoE (2020b) whilst the postponement of the beginning of the academic year. This platform was supported with the TV classroom channels, which were accessible to all local governments together with free access to important complementary learning resources. MoE (2020a, 2020b) in China has provided teaching resources to states, relevant provinces, and sometimes directly to the schools. In April 2020, all schools in China reported their reopening dates, and students continued to go to school as they were supposed to do before the COVID-19 (East Asia and Pacific Education Team, 2020). Figure 1(a) shows a sample live lesson from mathematics education, and Figure 1(b) shows a handout with a mathematics teacher's annotations on it.

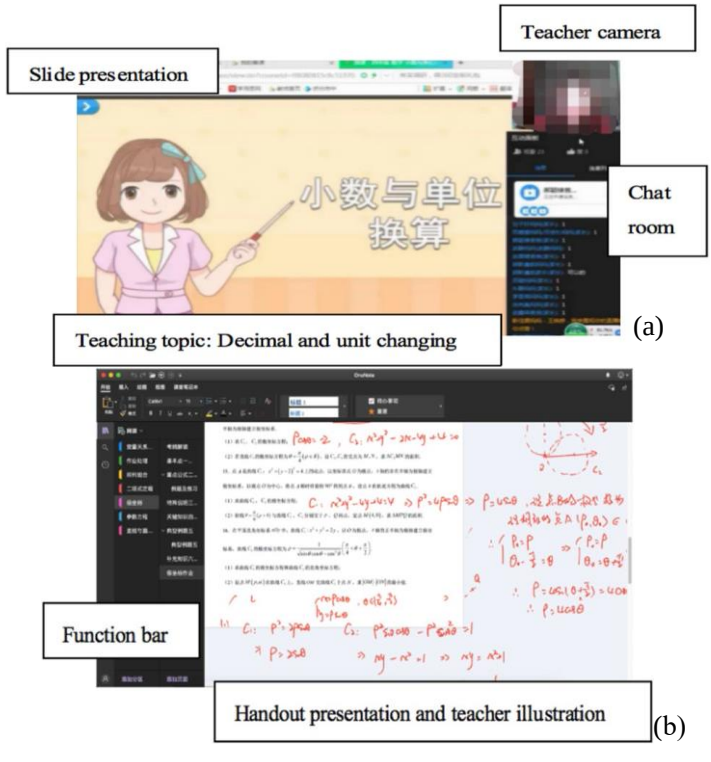

Figure 1. Sample mathematics education materials from China (Cao et al., 2021, p.162)

Teacher Training

During the COVID-19 pandemic, the MoE (2020a) stated that school principals were not only responsible for the health and safety of teachers but also responsible for organizing training sessions for the teachers regarding the possible measures and online teaching pedagogies. The findings of a country-wide national online survey conducted by China National Institute of Education Sciences demonstrated that teachers need support in skills and technologies that promote student interaction in online learning (70.2% of the teachers), technical support to use various online technology software packages (60.9%), ensuring availability of the content to be taught (57.5%), and systematic training on effective ways of conducting online education (53.4%) (Guanming Daily, 2020). In this context, an online teaching feedback system has been created that will encourage teachers to actively summarize and share their experiences and thoughts and to discuss these with their peers (Zhang et al., 2020).

Student Management

In China, it was also important to teach even if sometimes it was not possible to do face-to-face. Immediately after the pandemic had started, the country published an emergency plan (MoE, 2020c), called "Suspending Classes Without Stopping Learning: China's Education Emergency Management Policy in the COVID-19 Outbreak" where the policies regarding online education were clearly stated. Despite online education being strongly suggested, and 80% of the teachers who attended the online survey supporting online teaching, only 37% of the teachers were satisfied with their online teaching experience when it comes to student management (East Asia and Pacific Education Team, 2020; Guanming Daily, 2020).

Health and Safety

The Ministry of Education (MoE) (2020a) in China paid great attention to the psychological intervention of students and teachers to ensure mental health. The MoE aimed at providing guidance and psychological counselling in K-12 schools. Where face-to-face counselling sessions were not possible, an alternative was set as a helpline, called the psychological assistance hotline, with the aim of providing mental support for various populations and governments (of China). Moreover, specific information services were founded in order to assist students and teachers in preventing and reducing diseases caused by not only the pandemic (getting sick) but also psychological stress. Particular attention was shown to those children who were migrants, living in rural areas or in foster care.

According to the policy reports and studies reviewed, this government policy has resulted in various positive results (see East Asia and Pacific Education Team, 2020; MoE, 2020c; Xue, Li, Li, & Shang, 2020).

Case of the United Kingdom

The United Kingdom (The UK) was one of the first countries which responded to the COVID-19 pandemic immediately with necessary policy developments (see Hodgen et al., 2020), which include school closures for health and safety issues, and material supply for the students.

Reports suggest that the four governments across the United Kingdom (Northern Irish government, Scottish Government, The Welsh government, and The UK government -England) made varied decisions on how to support students during the lockdown in the face of immense demand caused by the ongoing pandemic for the provision of education (Sibieta & Cottell, 2020).

Similar to China, in the United Kingdom, teaching and learning activities at all levels of education were first suspended in response to changing conditions so that the government could regulate education and teaching activities. They examined several options for how to open educational facilities and provide more help to children from underprivileged and vulnerable homes.

Curriculum Arrangement

It was seen as critical to keep teaching the regular curriculum in a distant setting; hence, no arrangement was suggested by the Department for Education ([DfE], 2021b). Despite this, mathematics teachers in the United Kingdom had to adapt their lesson plans or slow down in order for teaching the same mathematical topics online, mostly using the suggestions of the researchers including Hodgen and colleagues (2020); the suggestions were based on the data Hodgen et al. (2020) collected from 115 schools in the United Kingdom. The authors stated that they reported any mathematical provision offered by these schools to their students in the online education during the COVID-19 pandemic. Their results showed that schools were choosing broadly one of three options about mathematics teaching: Following planned curriculum at a slower pace (37%), following planned curriculum (33%), reviewing and consolidating (27%) and other (6%). Last but not least, the study found that the lockdown had limited most students' ability to study mathematics; low achievers and other disadvantaged students had suffered much more constraints. Luckily, a small percentage of students had reaped unanticipated rewards in mathematics.

Online Education and Material Supply

The UK announced on March 18, 2020 that schools would close at the end of Friday, March 20, 2020. The Welsh education ministry was the first to make the news, which was quickly followed by statements for Scottish, Northern Irish and English schools (BBC, 2020; Busby, 2020). It was also stated that no public examinations would be held (Sparrow & Campbell, 2020). Instead, qualification marks were used which were based on teacher-predicted grades (not combined with an Ofqual-defined moderation mechanism) in England, Scotland, Wales and Northern Ireland. After this, it was decided that the education continued online with

children at their homes (DfE, 2021b).

For education to continue online, government-funded support was available to teachers and students to use one of the chosen interactive platforms: G Suite for Education (Google Classroom) or Office 365 Education (Microsoft Teams) (DfE, 2021b). Teachers were encouraged to link or embed other applications such as Kahoot and Socrative to these platforms.

The Department for Education (2020a) provided information and guidance for supporting children's online education during coronavirus for parents, guardians, and teachers. The guide for parents on the official website included information on what one should expect for her/his child's remote education, engaging children at home, and mental health and wellbeing. There were also resources for each of these three themes including mathematics curriculum resources for parents of children with special education needs and disabilities.

Studies also showed that mathematics teachers (particularly head of mathematics) were reported that digital education in an online form did not provide attainment (Chirinda et al., 2021; Hodgen et al., 2020; Golding, 2021). For example, Hodgen and colleagues (2020) reported that with over one-third of the head of mathematics contacted claimed, based on school statistics, that at least 30% of Year 7 students did not participate to mathematics lessons frequently in online learning, with some estimating participation rates as high as 70–90%. One head of mathematics noted in the interview that motivating students to participate in online learning presented unique obstacles, saying "Last week I'm talking maybe 90 students didn't do the work that we set for them. In school that would probably be an assembly about 'Hold on a second, why aren't you doing the lessons that your teachers are planning and putting in place for you. This needs to change" (Hodgen et al., 2020, p.10).

Figure 2 shows sample questions from the materials for teachers to use, prepared by the DFE (2020c), and National Centre for Excellence in the Teaching of Mathematics (2022) provided guidebooks for these materials to use during pandemic; these were explained in Teacher Training section.

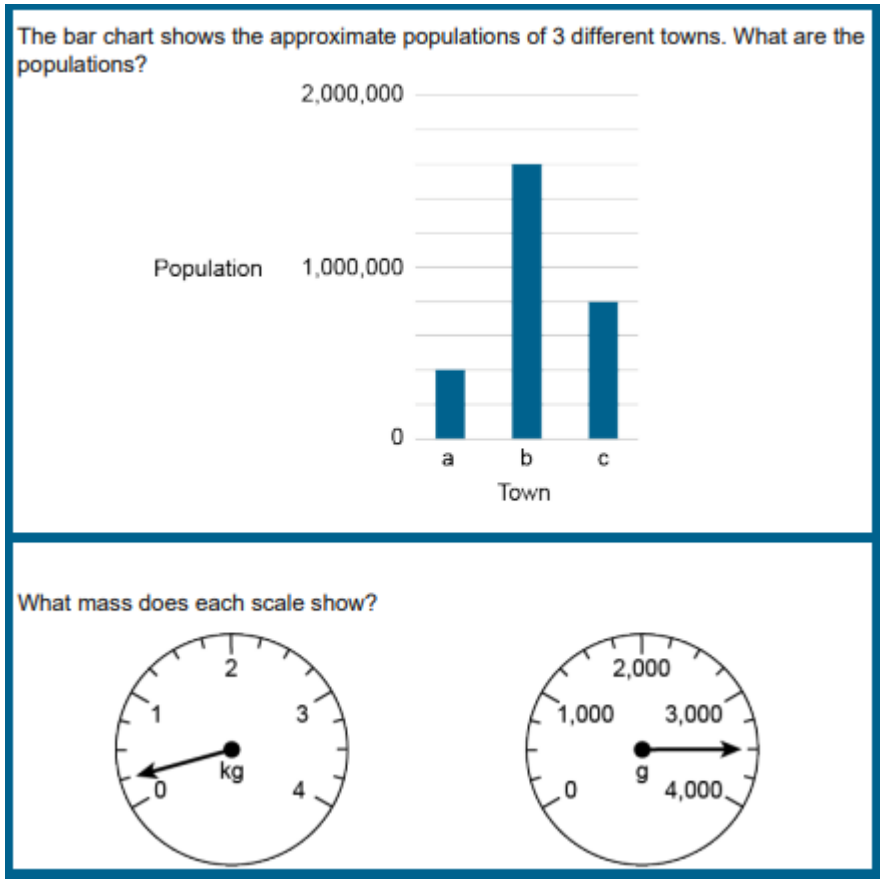

Figure 2**.** Sample mathematics education questions from the guidebook for Year 6 (DFE, 2020c, p.28)

Teacher Training

Information, guidance, and support for teachers and leaders on educating pupils and students who were remote learning during coronavirus (COVID-19) were published by the Department for Education (2020b). These publications included training courses, videos, webinars, good teaching practices and resources, and guidance on and help with technology (Support for teaching staff to set up and use technology effectively document) (DfE, 2021b). Moreover, teachers and school principals were provided with information on statutory obligations, expectations, and safeguarding to keep children safe online. With this information provided, many teachers continued to engage with students and provide assignments to them over the Internet (Brown, 2020). Finally, yet importantly, National Centre for Excellence in the Teaching of Mathematics (2022) in the United Kingdom offered a variety of materials for lesson planning and professional development, including advice on how to prioritize instruction to address the pandemic's lingering consequences.

Additionally, it offered assistance and suggestions for implementing the DfE's guidance on teaching mathematics at Key Stage 3 (2021) and primary schools (2020c).

Health and Safety

In order to direct UK policy during the COVID-19 outbreak, mathematical models were being deployed (Adiga et al., 2020; Moore et al., 2021; Thompson, 2020). The Department for Education (DfE, 2021a) prepared guidelines for schools, students as well as parents so that they always knew what to do, and had continuous support. The country did not start with many restrictions at the beginning. COVID-19 became a notifiable illness in the UK in March after the first case was reported on January 31, 2020. Health and safety measures taken worked quite well in the UK. Similar to the beginning of the COVID-19 pandemic, it was one of the earliest countries which ended restrictions for schools, colleges and universities. That is to say, England explained that all university students can return to face-to-face instruction from May 2021. Similarly, from May 17th, 2021, students at all levels were no longer compelled to wear facial coverings at schools and colleges (The UK Government, 2021). Children were planned to be fully vaccinated by September 2021 before they start face-to-face education.

Case of Turkey

The Ministry of National Education prepared guidelines for schools, students as well as parents so that they always knew what to do, and had continuous support. The country did not start with many restrictions at the beginning. COVID-19 became a notifiable illness in Turkey in March after the first case was reported on January 31, 2020.

In this pandemic, Turkey is one of the nations facing a rapid shift to distant learning education; which was reported at the ministry's official website (MoNE, 2020c). Turkey had a ready to use learning management system, called EBA, through which teachers, students and parents and/or guardians got the information they needed (MoNE, 2022). It followed a governmental change in education, that affected all teachers, students and parents/ guardians in the country regardless of being in different regions or cities. It seems also important to note that EBA platform was available for all regardless of being in public or private schools all around Turkey.

Curriculum Arrangement

As of March 23rd, the MoNE continued to use the Turkish learning management system EBA and offered broadcasts via Turkish Radio and Television channels, TRT Kindergarten, TRT Primary School, TRT Middle School, and TRT High School (MoNE, 2020a, 2020d). Students participated in synchronous and asynchronous distance education until May 31st (MoNE, 2020c), after which they started the summer holiday period. As of August 31st, 2020, schooling resumed, with a supplemental online education program in place to cover the missing topics

and objectives of the second term of the 2019-2020 academic year (MoNE, 2020e).

In Turkey, similar to the United Kingdom, the mathematics curriculum did not change. However, there were various supports for mathematics teachers to teach the existing curriculum. Moreover, as it was in other courses, some of the mathematics teachers volunteered to video-record their teaching so that it could be available on the online educational platform EBA, and as broadcast in TRT TV channels. In our earlier study, teachers reported no particular difficulty in teaching mathematics (Sarı & Saralar-Aras, 2021).

Online Education and Material Supply

To improve the quality of online education, Turkey's Ministry of National Education (MoNE) improved Internet infrastructure and software, as well as supplied essential hardware to schools, very immediately after distance education began.

The shift to online education has occurred at all levels of education, from elementary to upper secondary school (see MoNE, 2020d; 2022). Students and teachers were offered synchronous learning-teaching environments with live lessons on EBA as part of the changeover process, in addition to asynchronous videos and materials. To note, the Ministry of National Education established EBA, a digital education platform, before COVID-19. EBA is available to roughly 18 million students and 1 million educators at all levels from preschool to 12th grade, with over 1.900 courses and over 60.000 rich and trustworthy e-content (MoNE, 2022). There was various studies which examined the quality of mathematics education materials provided to students via EBA (e.g., Karakaş et al, 2022; Kilit & Güner, 2021). These studies found that the course that EBA offered the most advantage was mathematics. Considering these, Turkey started a project called: Mathematics Mobilization. The aim of the project was making students learn mathematics with love and adapt mathematical knowledge and skills to daily life (MoNE, 2022b). This was considered to be possible with the help of the mathematics teachers; hence, a digital platform was prepared. The platform of the project, which is public, included mathematical activities for students from kindergarten to high school, information on history of mathematics, joyful mathematics activities as well as guidebooks and scenarios for mathematics teachers to use (MoNE, 2022c).

Support points have been established for students who do not have access to required mobile phones, tablets, or laptops, and tablets have been distributed to 650.000 pupils (MoNE, 2021a). For individuals who do not have access to the Internet, the Ministry of National Education has signed agreements with GSM providers to supply 6 to 8 GB of Internet for usage on EBA channels (MoNE, 2020b). Figure 3 shows screenshots from sample videos from mathematics education on problem-solving in Year 6 and percentages in Year 7, provided through these channels.

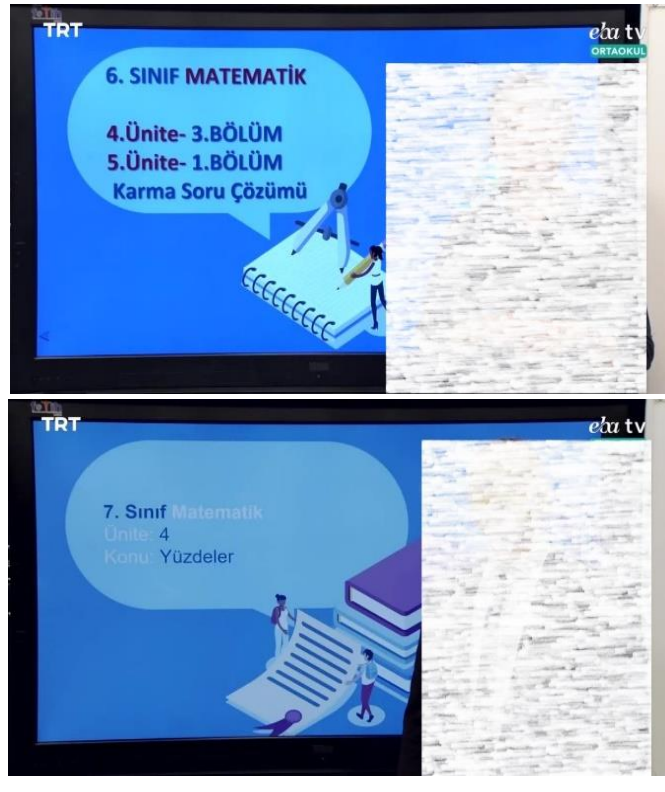

Figure 3. Sample mathematics education materials (MoNE, 2022)

Furthermore, each of the 650.000 tablet computers has a monthly GSM internet service with a capacity of 25 GB, which students will require to access the online lessons and EBA platform (MoNE, 2021a).

Teacher Training

In the COVID-19 process, compulsory online classes encouraged teachers to employ a variety of technology tools. Hence, teachers were required to learn more about how to use these tools. For this purpose, they gave various online courses, training sessions, and webinars, which were available for all teachers in Turkey through various projects such as Scientix and Edusimsteam; over 600.000 teachers registered for these courses, and around 850.000 teachers participated in webinars as part of the MoNE's professional development program (MoNE, 2021b; 2021c).

Moreover, various guide books were published in collaboration with the Ministry of Health for school principals and teachers (Principles and Teachers Information Guide) as well as students and parents, and guardians (The Ministry of Health, 2021). The guidebook for teachers included very detailed information on various topics from what to do in the teachers' room to how to behave in boarding schools

and dorms. In addition to these, the MoNE published books for teachers to support them and help them support their students as part of their guidance, information, and support services (MoNE, 2020f, 2020g, 2020h).

Discussion and Conclusion

To conclude, there have been effects of COVID-19 in all aspects of daily life in education in all of the countries which were reviewed in this study. More importantly, the global exposure of educational institutions to the COVID-19 pandemic has greatly impacted how teachers teach and thus how students learn (Burgess & Sievertsen, 2020). With the help of technology, both online teaching and learning have become the centre of recent discussions (Ching & Roberts, 2020).

Whilst all the countries in our sample immediately started changing their education in the way of shifting from face-to-face education to hybrid and distance education, it took some time for the United Kingdom and China to start initiatives in this regard. There might be various reasons behind these. Having the world's one of the biggest populations, China did not have the same school system in all of its parts, including Mainland China, Taiwan, Hong Kong, and Macau due to regime. The case was different in the United Kingdom in the sense that some of the countries were following the same teaching programme; for example, England and Wales followed the same mathematics curriculum prior to COVID-19 (Department for Education, 2013a, 2013b; Department for Education and Employment, 2009). However, the countries in the United Kingdom (England, Ireland, Scotland, and Wales) had their own measures within themselves despite following the same programme. Lastly, Turkey was one of the countries which started distance education with an existing online platform, which helped both teachers and students, as well as parents as they were familiar with the tool already. With the pandemic, it has enabled teachers to realize the potential of digital technology in their daily practices, and it can be said that it has contributed to their future preparation for integrating technology into their teaching and online teaching, positively. According to Schleicher (2020), the COVID-19 health crisis has pushed teachers to adapt very quickly, especially in countries where they lack the pedagogical and technical skills to integrate digital tools into learning. Moreover, the transition to online education has caused many educators to reevaluate their teaching methods and focus on the core elements of their curriculum (Spoel et al., 2020). The common aspect of online teaching in most countries is that teachers had little experience or training before they started. The negativity experienced in the online education process was mostly due to the lack of resources and time, and partly because they had never imagined that this scenario would happen (Yu, 2020).

Recommendations

When the studies of the countries on education during the pandemic process are evaluated as a whole, it offered all countries an opportunity to reshape the importance of practical and adaptive teacher education. It is vital that policy

makers, educators, and teacher training departments of universities can create the resources that teachers and students will need in terms of software and hardware, and make plans to ensure that teachers acquire the necessary knowledge and skills in the context of technological knowledge in mathematics education. It is appreciated and suggested to start actions and projects similar to the Mathematics Mobilization Act in Turkey, having digital mathematics sources and materials, mobile mathematics games, guides and books, freely available to all who are interested in an online platform.

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Kovid-19 salgınında ülkelerin K-12 eğitimine müdahaleleri: Dijital matematik eğitimine doğru yaklaşım

İpek SARALAR-ARAS

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Öne Çıkanlar

Kovid-19 salgını tüm dünyayı etkilemiş, 2019 Mart ayı itibariyle Birleşik Krallık, Çin ve Türkiye gibi öğrenci sayısı fazla olan ya da dünyanın eğitimde önde gelen ülkeleri de dahil olmak üzere tüm ülkelerde eğitimde önlemler alınmaya başlanmıştır. Ülkelerin birbirinin aldığı önlemler ile ilgili bilgi edinmesi ve tecrübelerden yararlanılması oldukça değerlidir. İlerideki olası diğer salgınları veya Kovid-19'un yeni dalgalarını hazırlıklı olarak karşılayabilmek adına ülkelerin yaptığı çalışmaların derlenmesi önem arz etmektedir.

Bu araştırma, ülkelerin özellikle matematik eğitimine odaklanarak K-12 eğitiminde Kovid-19 salgınına karşı aldığı önlemleri incelemektedir. Üç ülkedeki (Birleşik Krallık, Çin ve Türkiye, alfabetik olarak sıralanmıştır) tedbirler genel anlamda eğitim ve matematik eğitimi odağında aktarılmış ve birbirleriyle karşılaştırılmıştır.

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Kovid-19 salgınında ülkelerin K-12 eğitimine müdahaleleri: Dijital matematik eğitimine doğru yaklaşım.

İpek SARALAR-ARAS

ÖZ

Bu çalışmanın amacı, ülkelerin özellikle matematik eğitimine odaklanarak K-12 eğitiminde Kovid-19 salgınına tepkilerini tanımlamaktır. Üç ülkedeki (Birleşik Krallık, Çin ve Türkiye, alfabetik olarak sıralanmıştır) tedbirler genel anlamda eğitim ve matematik eğitimi odağında aktarılmış ve birbirleriyle karşılaştırılmıştır. Bulgular, üç ülkenin de eğitimde yoğun önlemler aldığını, hepsinin matematik eğitimini de içeren dijital bir eğitime geçme eğiliminde olduğunu; Birleşik Krallık ve Çin sağlık ve eğitim alanında önlemleri birlikte alırken, Türkiye'nin eğitim alanındaki önlemleri sağlık önlemlerinden ayrı düşündüğünü göstermiştir. Dolayısıyla, bu çalışmada bahsi geçen tüm ülkelerin öğrencilere gerekli eğitimi sağlamak için çaba harcadıkları görülmüştür.

MAKALE TARİHİ
Geliş Tarihi 2 Ağustos 2022
Kabul Tarihi 26 Aralık 2022

ANAHTAR KELİMELER
Dijital Eğitim, Eğitim Teknolojileri, Kovid-19 Salgını, Matematik Eğitimi

MAKALE TÜRÜ
Literatür taraması-Derleme

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Giriş

Kovid-19, insan hayatı ve sağlığı için büyük bir tehdide neden olan en yaygın küresel salgınlardan biridir. Salgının toplumda hızla yayılması, sağlık, ekonomi ve eğitim de dâhil olmak üzere insan varlığının birçok alanında zararlı sonuçlar doğurmuştur. Bu bağlamda hükümetler, dünya çapındaki salgının sosyal hayata etkisini azaltmak ve salgının daha fazla yayılmasını önlemek için bir dizi çeşitli adımlar atmıştır. Bu adımlardan biri de eğitim faaliyetlerinin yüz yüzeden, dijital bir eğitim olan uzaktan eğitime dönüştürülmesi olmuştur. Uzaktan eğitime geçiş süreci tüm dünyadaki eğitimcileri ve öğrencileri etkilemiştir. 16 Şubat 2020'de Çin, uzaktan eğitim kararını yürüten ilk ülke olmuştur. Uzaktan eğitime geçiş 13 Mart 2020'de 45 ülkeye yayılırken ve 26 Mart'ta bu sayı 166'ya yükselmiştir. Kovid-19'un yayılmasını önlemek için okulların kapatılması, öğretmen ve öğrencilerin derslerin çevrimiçi sunumuna hazırlanmaları için fazla zaman olmaması, çevrimiçi eğitime geçiş hızını daha önce görülmemiş hale getirmiştir (Ali & Kaur, 2020). Birçok ülkenin eğitim kurumları, dijital öğrenme ortamları ve destek sistemleri tam olarak hazır olmasa da öğretmenler kısa sürede online eğitime başlamak zorunda kalmıştır (Spoel vd., 2020). Kovid-19 salgını, birkaç hafta içinde dünyanın dört bir yanındaki evleri sınıfa dönüştürmüştür. Öğrenme ortamı sınıftan dijital platforma taşınmıştır (Bayrakdar & Guveli, 2020). Birleşik Krallık (OECD, 2020a) ve Türkiye (OECD, 2020b) gibi nüfusu Çin'den daha az olan ülkeler, ülke genelinde, öğrencilerin öğrenmesini desteklemek için öğretim paketleri (ders kitapları, çalışma sayfaları ve çıktılar), radyo eğitimi, eğitim televizyonu ve çevrimiçi öğretim kaynakları da dâhil olmak üzere çeşitli kaynaklar kullanmıştır. Ülkeler genellikle mümkün olan en büyük öğrenci katılım (çevrimiçi eğitime) oranını elde etmek için çeşitli araçlar kullanmıştır (Reimers et al., 2020).

Birçok ülkenin Kovid-19'un öngörülemeyen etkilerini geliştirilen aşılar ve diğer birçok önlemle aşmaya çalışsa da, ülkelerin almış olduğu eğitimsel önlemler öğrencilerin gelişiminde ve öğrenmesinde hayati bir rol oynamıştır. Eğitim politikaları, Kovid-19 gibi bir kriz anında, hibrit ve uzaktan eğitimin bir alternatif olarak kullanılabileceğini vurgular hale gelmiştir (MEB, 2020d; OECD, 2020a; Xue v.d., 2020). Bu makalede, üç büyük ülkenin aldığı eğitim önlemlerini raporlayan mevcut literatür gözden geçirilmiştir: Çin, İngiltere ve Türkiye. Ayrıca, araştırma kapsamında yer alan ülkelerin matematiği öğretmek için belirli bir önlem alınıp alınmadığı araştırılmıştır.

Metodoloji

Bu çalışmada, üç ülkedeki durumu tanımlamak ve mümkün olduğunca bu durumları karşılaştırmak için bir alan yazın taraması yapılmıştır. Veriler dokümantasyon yöntemi kullanılarak elde edilmiştir. İngilizce ve Türkçe olarak mevcut literatür ve politika raporları veri toplamanın ana kaynağı iken, diğer dillerdeki belgeler

mümkün olduğunca tercüme edilmiş ve raporlanmıştır. Bu makalenin K-12'deki eğitim önlemlerine özel olarak matematik eğitimine odaklanıldığını belirtmek önemlidir, bu nedenle araştırma kapsamındaki ülkeler eğitim ve diğer eğitim düzeylerinden başka alanlarda da başka önlemlere sahip olabilirler.

Bulgular

Çalışma bulguları ülkelerin Kovid-19 salgınına yaklaşımlarının benzer olduğunu, sadece uygulamada farklılıklar olduğunu göstermiştir. Ayrıca, ülkelerden Çin ve İngiltere sıklıkla Sağlık Bakanlığı da dâhil olmak üzere diğer bakanlıklarla iletişimde çalışmıştır. Ülkeleri tamamı matematik derslerinde dijital bir eğitim yaklaşımı gütmüş, pandeminin en yoğun olduğu zamanlarda uzaktan eğitimi tercih etmiştir. Bu eğitimlerde matematik derslerinde kullanılan metotlar (özellikle Çin'de) gerçekçi matematik eğitimi olmuştur ve tüm ülkelerde öğrenci merkezli bir yaklaşım kullanılması hedeflenmiştir. Ayrıca, matematik öğretmenleri daha yavaş hızda öğretmeyi (İngiltere) ve ders öncesi çevrimiçi bir platform üzerinden izlenebilecek videolar kaydederek çevrimiçi ders anlatımını daha öğrenci ihtiyaçlarına göre ve öğrenci merkezli yapmayı hedeflemişlerdir.

Çalışmanın ülkeler bağlamında bulguları şu şekildedir:

Kovid-19 salgınından etkilenen ilk ülke olan Çin, hastalığı önlemek, yönetmek ve iyileştirmek için bir dizi ciddi önlem almanın yanı sıra ülke düzeyinde bir dizi politika önlemini yürürlüğe koymuştur. Okulların merkezî ve kural ve prosedürleri izlemesinin önerildiği bir sistemi takip eden bir hükümet politikası izlemiştir (Xue vd., 2020). Çin'in Kovid-19 politikası için eğitim çok önemli görülmektedir. Ülkenin Kovid-19 için hazırlanan politika belgelerinin içeriğinin yarısından fazlasını oluşturan eğitim stratejileri (%53) eğitim dahil çeşitli alanları ele almıştır (Xue vd., 2020). Belgelerin eğitim bölümlerinin içeriğine bakıldığında sağlık ve güvenlik (%30), çevrimiçi eğitim (%18), materyal temini (%16), öğrenci yönetimi (%15), öğretmen eğitimi (%12) ve müfredat düzenlemesi (%9) ana odak noktaları olmuştur. Çin örneklemli matematik eğitimi ile ilgili çalışmalar, Kovid-19 salgını sırasında matematik öğrenmenin gerçekçi bir matematik yaklaşımına dayandığını bildirmiştir (ör. Xie ve diğerleri, 2021). Xie ve arkadaşları (2021), matematik öğretmenlerinin bu salgın sırasında matematik öğretmek için sıklıkla gerçek hayattan örnekler ve bağlamlar kullandığını bildirmiştir.

Birleşik Krallık, sağlık ve güvenlik sorunları nedeniyle okulların kapatılması dâhil olmak üzere gerekli politika geliştirmeleriyle Kovid-19 salgınına anında yanıt veren ilk ülkelerden biri olmuştur. Raporlar, Birleşik Krallık'taki dört hükümetin (Kuzey İrlanda, İskoçya, Galler ve İngiltere hükümetleri) devam eden karantinanın neden olduğu yoğun talep karşısında salgın sırasında öğrencileri nasıl destekleyeceklerine dair çeşitli kararlar aldığını göstermektedir (Sibieta & Cottell, 2020). Çin'e benzer şekilde, Birleşik Krallık'ta da hükümetin eğitim ve öğretim faaliyetlerini düzenleyebilmesi için eğitimin tüm seviyelerindeki eğitim öğretim faaliyetleri, değişen koşullara yanıt olarak ilk önce askıya alınmıştır. Eğitim kurumlarının nasıl açılacağına ve öğrencilere nasıl daha fazla yardım sağlanacağına ilişkin çeşitli

seçenekleri incelenmiştir. Normal müfredatı uzak bir ortamda öğretmeye devam etmek kritik olarak görülmüş; bu nedenle Eğitim Bakanlığı tarafından herhangi bir düzenleme önerilmemiştir (DfE, 2021b). Buna rağmen, Birleşik Krallık'taki matematik öğretmenleri, çoğunlukla Hodgen ve meslektaşları (2020) dâhil olmak üzere, araştırmacıların önerilerini kullanarak aynı matematik konularını çevrimiçi olarak öğretebilmek için ders planlarını uyarlamak veya yavaşlamak zorunda kalmışlardır. Bu önerilerin hazırlanması için Hodgen ve ark. (2020) Birleşik Krallık'taki 115 okuldan veri toplamıştır. Elde ettikleri sonuçlar, okulların matematik öğretimi ile ilgili genel olarak üç seçenekten birini tercih ettiğini göstermiştir: Planlanan müfredatı daha yavaş takip etmek (%37), planlanan müfredatı olduğu gibi takip etmek (%33), gözden geçirmek ve pekiştirmek (%27) ve diğer (%6). Son olarak, çalışma, karantinanın çoğu öğrencinin matematik çalışma yeteneğini sınırladığını bulmuştur; düşük başarılılar ve diğer dezavantajlı öğrenciler çok daha fazla kısıtlamaya maruz kalmıştır. Neyseki, öğrencilerin küçük bir yüzdesi matematikte beklenmedik başarılar göstermiştir.

Son olarak, bu salgında Türkiye, uzaktan eğitime hızlı geçişi sağlayabilmiş olan ülkelerden biri olmuştur. Türkiye, hâlihazırda öğretmenlerin, öğrencilerin ve velilerin ihtiyaç duydukları bilgileri aldıkları, kullanıma hazır bir öğrenim yönetim sistemine olduğundan bu geçişin daha rahat olduğu gözlemlenmiştir. Eğitimde, farklı bölge veya şehirlerde olmasına bakılmaksızın ülkedeki tüm öğretmenleri, öğrencileri ve velileri etkileyen bir hükümet politikası izlenmiştir. 23 Mart 2020 tarihinden itibaren MEB dili Türkçe olan öğrenim yönetim sistemi EBA'yı kullanmaya devam etmiş ve Türkiye Radyo ve Televizyon kanalları, TRT Anaokulu, TRT İlkokul, TRT Ortaokul ve TRT Lise üzerinden yayın yapmıştır (MEB, 2020a, 2020d). 31 Mayıs 2020 tarihine kadar senkron ve asenkron uzaktan eğitime katılan öğrenciler, ardından yaz tatili dönemine başlamıştır (MEB, 2020c). 31 Ağustos 2020 itibariyle, 2019-2020 eğitim öğretim yılının ikinci döneminin eksik konularını ve hedeflerini kapsayacak şekilde ek bir çevrimiçi eğitim programı uygulanarak eğitime devam edilmiştir (MEB, 2020e). İngiltere'de olduğu gibi Türkiye'de de matematik müfredatı değişmemiştir, ancak, matematik öğretmenlerinin mevcut bulunan müfredatı öğretmeleri için çeşitli destekler verilmiştir. Ayrıca, diğer derslerde olduğu gibi, bazı matematik öğretmenleri de derslerinin çevrimiçi eğitim platformu EBA'da ve TRT TV kanallarında yayınlanabilmesi için video kaydına gönüllü olmuştur. Yapılan araştırmalar, matematik öğretmenlerinin matematik öğretimine özel bir zorluk yaşamadıklarını bildirmişlerdir (Sarı ve Saralar-Aras, 2021).

Tartışma, Sonuç ve Öneriler

Sonuç olarak, bu çalışmada gözden geçirilen tüm ülkelerde Kovid-19'un eğitimde günlük yaşamın tüm yönleriyle etkileri olmuştur. Daha da önemlisi, eğitim kurumlarının Kovid-19 salgınına küresel olarak maruz kalması, öğretmenlerin öğretme şeklini ve dolayısıyla öğrencilerin nasıl öğrendiğini büyük ölçüde etkilemiştir (Burgess & Sievertsen, 2020). Salgın, öğretmenlerin günlük pratiklerinde dijital teknolojinin potansiyelini fark etmelerini sağlamıştır. Bu nedenle teknolojiyi öğretimlerine ve özellikle çevrimiçi öğretimlerine entegre etmek için gelecekteki hazırlıklarına olumlu bir şekilde katkıda bulunduğu söylenebilir.

Schleicher'e (2020) göre, Kovid-19 sağlık krizi, özellikle dijital araçları öğrenmeye entegre etmek için pedagojik ve teknik becerilere sahip olmadıkları ülkelerde öğretmenleri çok hızlı bir şekilde uyum sağlamaya itmiştir. Ayrıca, çevrimiçi eğitime geçiş, birçok eğitimcinin öğretim yöntemlerini yeniden değerlendirmelerine ve eğitim programlarının temel unsurlarına odaklanmalarına neden olmuştur (Spoel ve ark., 2020). Çoğu ülkede dijital matematik öğretiminin ortak yönü, öğretmenlerin başlamadan önce çok az deneyime veya eğitime sahip olmalarıdır. Çevrimiçi eğitim sürecinde yaşanan olumsuzluklar çoğunlukla kaynak ve zaman eksikliğinden ve kısmen de bu senaryonun gerçekleşeceğini hiç hayal etmedikleri için olmuştur (Yu, 2020). Ülkelerin salgın sürecinde eğitim konusundaki çalışmaları bir bütün olarak değerlendirildiğinde, Kovid-19 tüm ülkelere pratik ve uygulamaya dayalı öğretmen eğitiminin önemini yeniden şekillendirme fırsatı sunmuştur. Üniversitelerin politika yapıcılarının, eğitimcilerinin, öğretmen yetiştirme bölümlerinin yazılım ve donanım açısından öğretmen ve öğrencilerin ihtiyaç duyacakları kaynakları oluşturabilmeleri, öğretmenlerin teknolojik bilgi bağlamında gerekli bilgi ve becerileri kazanmalarını sağlayacak planlamalar yapabilmeleri hayati önem taşımaktadır.

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