



Mathematics learning loss during school closures in pandemic using online remote teaching and teachers experiences

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ABSTRACT

The main objective of this paper is to find mathematics learning loss in middle school students during covid 19 school closures by using online mode of teaching practices, various challenges and efforts faced by teachers while they were trying to support their students mathematics learning by online resources. Interviews have been conducted with middle school maths teachers, which shows that there were several teaching practices and found existing inequalities among the schools ,classrooms and students. Students lack of motivation and participation, teachers limited use of methods to teach maths , socioeconomic status of families and their lack of collaboration with teachers were the main reasons of existing mathematical learning loss.

KEYWORDS-Mathematics learning loss, inequality, remote teaching(RT) , covid 19, mathematics teachers experiences

I. INTRODUCTION

1.1 Learning loss during the school closures

Teachers and students have been struggling with the psychological, physical, social, and economical consequences of the COVID-19 pandemic and the school closures since March 2020. Several measures, such as distributing online instructional resources, broadcasting the educational content TV or radio channels, promoting the use of online learning management systems. Family environment, which is a highly variable factor, became more influential in students' learning as the influence of the school decreased (Andrew et al., 2020; Tomasik et al., 2020) along with several factors, such as students' learning styles, characteristics, and motivation (Tomasik et al., 2020). The pandemic brought uncertainties for the families and loss of income for many of them (Daniel, 2020; Tomasik et al., 2020; Van Lancker and Parolin, 2020), where children's educational needs became less important compared to the basic needs of the family.

Literature review: Contents lists available at ScienceDirect International Journal of Educational Development journal homepage: www.elsevier.com/ A large number of students did not participate in online lessons and students spent less hours for learning at home compared to the school time. The same study also found that while the school closures prioritized the availability of technology and the internet for the students, to what extent students have a learning space and resources at home was understated despite its importance.

Understanding the magnitude of learning loss, "learning that is not taking place while schools are closed, learning that is forgotten" (Sabates et al., 2021, p. 2) is important because learning loss may have long-term effects on students' participation in society in the future (Tomasik et al., 2020; Andrew et al., 2020).

1.2. Teachers' practices and concerns during school closures Schools were closed rapidly and generally indefinitely in the middle of Spring 2020 semester in almost all countries. The immediate reaction was to conduct remote teaching (RT) by transferring or adapting the content to the available online tools without sufficient planning and infrastructure. Teachers were not prepared for such massive and long school closures in terms of online teaching skills (Alper, 2020; Middleton, 2020; Ozdogan and Berkant, 2020), which resulted in additional stress for them (Trust and Whalen, 2020; Yang, 2020). Many teachers reported that they did not have sufficient tools and internet connection for RT (Barret, 2021; See et al., 2020;). Teachers also had to deal with external factors, such as students' limited access to the technology, rapidly changing policy requirements, and uncertainty of the near future (Code et al., 2020; Kim and Asbury, 2020; Trust and Whalen, 2020).

The initial response of teachers when the uncertainties were reduced was to develop strategies to provide learning opportunities for the students



based on their learning needs (Kim and Asbury, 2020). Teachers initially depended on the existing online options for the RT and tried to learn more about other options either through their own efforts (Trust and Whalen, 2020) or as a part of a regional support system (Yang, 2020).

There were cases that teachers and students communicated via instant messaging applications for mobile phones even when there were learning management systems including such functions (Taipale, 2021; Yang, 2020). Most of the learning-related concerns were related to existing inequalities among the students. Teachers observed that there were students with limited or no access to the online learning resources (Barret, 2021; Code et al., 2020; Kim and Asbury, 2020; Middleton, 2020). The limited learning-related interaction with the students during synchronous teaching did not help teachers respond to students' needs because they did not have sufficient input from the students (Alper, 2020; Barret, 2021; Ozdoğmuş and Berkant, 2020). Another important concern was about the assessment of students' learning.

Teachers could not depend on their in-class assessment and observations as they used to do in face-to-face classrooms (Alper, 2020; Barret, 2021; Ozdoğmuş and Berkant, 2020). They were not sure that they were able to monitor students' learning adequately and have an accurate assessment (Niemi and Kousa, 2020). Teachers who could conduct synchronous teaching had difficulties in observing whether the students were working on the tasks or not especially when the cameras were off (Barret, 2021; Niemi and Kousa, 2020). Despite the concerns for assessment, teachers think that assessing students somehow would be unfair for the students with limited access to the learning resources (Barret, 2021).

Teachers were worried that students without essential self-regulation and self-study skills would have difficulties managing learning remotely (Alper, 2020; Ozdoğmuş and Berkant, 2020; Yang, 2020). Students might not study properly and lose their motivation due to the policies granting them with a pass to the next grade level or accepting their before-school closure grades as the final grade of the course (Barret, 2021; Code et al., 2020).

1.3. The study Studies about teachers' practices and concerns during the RT revealed that students had difficulties in accessing the learning opportunities. Therefore, learning loss was inevitable during the school closures, but reasons for this loss Ç. Haser et al. International Journal of Educational Development 88 (2022) 1025363 as observed and experienced by the teachers, who have the

knowledge and insight about their students, were not explored much.

This learning loss was generally predicted present study delved into how mathematics learning loss took place among middle school students, middle school mathematics teachers' self reported practices, challenges, and efforts while they were trying to support their students' learning.

The initial assumption was that learning loss was mostly due to existing socio-economic inequalities among students and schools. We also assumed that there would be interrelated factors that had the potential to affect teachers' practices during the RT. Based on these assumption and the literature,

Following questions were sought:

1. How did teachers support students' mathematics learning during the school closures due to the COVID-19 pandemic?
2. What were the factors that influenced teachers and support practices, and students' mathematics learning loss?

II. Method

The study employed phenomenology (Creswell and Poth, 2018) because the aim was to explore middle school mathematics teachers' lived RT experiences during school closures in the 2020 semester due to the pandemic. The focus was on their teaching practices during the RT, how they tried to support students' learning, and what factors affected their efforts to reduce students' learning loss during the process. Through these experiences, we aimed to uncover the reasons for students' learning loss in mathematics

2.1. Participants and school contexts

The study took place towards the end of the 2020 semester when teachers were busy with conducting RT and concluding the semester. We decided to access participants whom we had personal contacts, and therefore, who would volunteer for the study at an extraordinarily busy time of the year to talk about their experiences. This led us to contact the mathematics teachers we had varying degrees of communication in the past via e-mail and ask if they would like to participate in the study

2.2. Data collection

A semi-structured interview protocol of eight open-ended questions and related follow-up questions about the RT practices of mathematics teachers after ethical permissions were granted. We did not ask participants questions directly about mathematics learning loss. Rather, we aimed to explore their experiences in-depth in order to gather



more information about the schools, practices, and students, which provided a more comprehensive picture of the learning loss.

Interviews were conducted via Zoom or telephone with 20 teachers. Teachers completed the interview protocol with written responses due to conflicts in schedules or lack of sufficient internet access. Interviews were video-recorded based on participants' consent or participants' responses were noted down extensively. The main interview questions and sample follow-up questions are given in Appendix

2.3. Data analysis

An inductive coding process (Miles et al., 2014) was employed for the data analysis because the goal was to describe teachers' lived experiences during a completely new phenomenon and to understand how they made sense of this process especially in relation to the students' learning loss.

The initial themes, such as "teachers' use of technology" and "students' access to technology", were interlinked with several issues of inequality and mathematics learning loss, which made it difficult to finalize the themes. Therefore, more general themes with several common inequality-related factors in connection to the mathematics learning loss were generated with emphasis on the interlinks.

III. Findings

3.1. school teachers' practices, most of the teachers tried to call students one-by-one and guide them on how to access TV broadcasts and the internet resources. Teachers started to think about options for RT because they realized that they were not returning schools for a long time.

One of the most common initial actions was to create WhatsApp (WA) groups with the parents and students who had phones with internet connection. The "class teachers", the teachers who monitored the students in a specific class and coordinated the communication between the parents and the administration for that class, started the WA groups, many teachers indicated that they could not access some students in the class that they were the class teachers. Many teachers could not access the whole class of students either because the class teacher did not create the WA groups. Teaching took place via WA communication for most of the public school participants. Teachers sent short explanation of the concepts and questions to solve via the WA groups either as a photo file, or rarely as video or voice records. Then, students solved the questions, took photos of their solutions, and sent them back to the

teachers via individual WA communication. However, only few students maintained this communication with the teachers continuously. They either did not have sufficient internet connection to attend the synchronous lessons or did not have access to the internet during the day because their parents were working outside the home.

school teachers' practices were shaped by the decisions made by their mathematics departments and/or the school administration. They worked with the other mathematics teachers in their schools and even in the other schools in the same school group. There seemed to be an effective collaboration among the teachers in the mathematics departments: "Everyone was responsible for certain lessons, that person prepared those lessons. Sometimes it didn't go as planned. We called the teacher who prepared that lesson right away, we helped each other." These schools had personnel for information technology maintenance to support the teachers. Private schools had already been using learning management systems (such Google Classroom and other online platforms)

3.2. Common efforts and concerns school teachers were concerned that students did not have access to the classroom environment and emphasized the limited or lack of learning-related communication with the students. Almost all teachers pointed out that important learning opportunities in the classroom environment were not present in RT and students who depended on these opportunities fell behind in their learning. For example, students were not able to ask questions to teachers immediately when they did not understand an issue. Similarly, those who were rather silent in the classroom were not able to ask questions to their peers as they did in the classroom

"In mathematics, it is not only about explaining, it appears that the classroom environment and the teacher make a big difference.

. Many public school teachers stated that especially 8th grade students who were preparing for the national examination were either stressed because they could not study effectively in the absence of the school and teachers, and the status of the examination was unclear; or discouraged from taking the examination: "There were students who gave up their performance and effort [they used to have] at school."

3.3. Factors affecting mathematics learning loss

The above analyzes seemed to point the inequalities among the students and schools, and the lack of learning environment as the major reasons for learning loss. Below we document these moderating



factors by re-visiting some findings we presented above to provide a comprehensive picture of mathematics learning loss.

3.3.1. Students' low participation and perceived difficulties There seemed to be two major types of student participation in the RT. One was students' communication with the teacher via instant messaging in WA and the other was students' participation in the synchronous lessons.

Most public students did not have smart phones and they tried to maintain this kind of participation via their parents' smartphones. Teachers stated that parents sometimes forgot to inform the students about the teachers' messages. Therefore, many students missed the assignments, could not complete them on time, or they discontinued their communication with the teachers after a while.

3.3.2. Limited use of methods to teach mathematics Teaching mathematics brought its own struggles for the teachers. Most of the teachers in the study stated difficulties with not being able to use the pedagogical approaches they used in the classrooms while teaching mathematics in the synchronous lessons. Some also stated that mathematics was not easy to teach remotely, especially compared to Ç. Haser et al. International Journal of Educational Development 88 (2022) 102536 6 other content areas, such as social sciences. Although teachers tried to teach mathematics content by employing several tools and strategies, there were difficulties when they wanted to explain new topics, complex calculations, and geometry concepts to the students . However, the lack of effective interaction during the RT affected their teaching methods and students' learning of mathematics. Not being able to see how students completed the tasks was a drawback in their RT practices:

3.3.3. Family background and lack of collaboration school students had drastically different family background as described by the teachers. While private school students had access to essential technological resources and study environments, public school students did not have them. Some public school teachers mentioned the parents who lost their jobs during the pandemic and were primarily concerned about feeding the family. Many public school teachers indicated that students did not have a computer and an internet connection, and most of their learning was through the content sent via the parents' smartphones. The small number of students who had computers had limited internet connection, which was not enough to continuously attend the synchronous lessons. Parents' smartphones also had the same problem. Additionally, there were other siblings at home who

needed to follow synchronous lessons or access the content that teachers sent via the parents' smartphones. There was not an effective study environment at home for public school students because they did not have their own room. "Normally, students did not have their study environment, now I don't think they had the study environment when all the children were at home. Because they have many siblings.

IV. Discussion and conclusion

Middle school mathematics teachers' accounts indicated that the major reasons for mathematics learning loss among middle school students was the existing inequalities and students' limited or lack of access to the teacher, learning environment, and learning materials

Findings were also limited to the teachers' self-reported and perceived experiences, and to the interview questions. We did not observe teachers' RT and support practices, students' participation and difficulties, and students' home learning environment. We also did not interview with the students

The students will be taught in the following years under the same curriculum despite the variations in learning loss caused by the cumulative effect of nearly 1.5 years of school closures. Teachers will have to deal with the curriculum pace and learning loss simultaneously. Students may still have learning loss despite the compensation period at schools before the 2021–2022 academic year (Kaffenberger, 2021; Kaffenberger and Pritchett, 2021).

The study revealed that there were several interlinked factors influencing teachers' practices and students' mathematics learning loss during the school closures and that teachers were well-aware of these factors. However, it is important that decision makers are aware of these factors thoroughly and adjust the focus of teaching and learning at schools as compensating for the learning loss, not as maintaining the curriculum pace. .

Further research should focus on how teachers tried to compensate for the mathematics learning loss and what difficulties they experience. They should also concentrate on the students' point of view and the short and long term effects of the mathematics learning loss on their future mathematics learning.



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