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COVID-19 SCHOOL CLOSURES IMPACTS ON PRIMARY SCHOOL STUDENTS' MATHEMATICS COMPETENCE

Mardyanto Barumbun¹, Soma Salim S²

^{1*} Universitas Borneo Tarakan, Tarakan, Indonesia

² Queensland University, Brisbane, Australia

*Corresponding Author. Jalan Amal Lama No. 1, 77115, Kota Tarakan, Indonesia.

E-mail: mardyantobarumbun@borneo.ac.id^{1*)}

s.salim@uq.edu.au²⁾

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Abstract

School closures and home learning policy to prevent the spread of COVID-19 in Indonesia raised concerns about learning loss. This research was focused on examining the potential for learning loss in terms of the mathematical competence of year-3 indigenous primary school students in Indonesia due to school closures during the pandemic. This qualitative research with a phenomenological approach involved 8 year-3 students who had been studying from home for the last 1.5 years. Data collection was carried out using mathematical diagnostic tests and interviews. Results from this study revealed the phenomenon of learning loss in terms of the mathematical competence among the students, where the mastery of prior mathematics knowledge and skills required for grade 3 were not mastered yet. Also, their mathematical competences were below the competency standard in the curriculum for grade 3 primary school in Indonesia. The significancy of this study emphasized that the phenomenon of learning loss that occurred in primary school students during and even after the COVID-19 pandemic should be a serious concern for all parties and stakeholders. Hence, some solutions and quick steps that need to be taken to mitigate the long-term impacts of learning loss are also included in this article.

Keywords: COVID-19 pandemic; learning loss; mathematics competence; primary school students; school closures.

Abstrak

Penutupan sekolah dan kebijakan belajar dari rumah (BDR) untuk mencegah penyebaran COVID-19 di Indonesia menimbulkan kekhawatiran akan terjadinya learning loss. Penelitian ini difokuskan untuk mengkaji potensi learning loss pada kompetensi matematika siswa kelas 3 SD di Indonesia akibat penutupan sekolah selama masa pandemi. Penelitian kualitatif dengan pendekatan fenomenologi ini melibatkan 8 siswa kelas 3 SD yang telah belajar dari rumah selama kurang lebih 1,5 tahun terakhir. Data dikumpulkan melalui tes diagnostik dan wawancara. Hasil penelitian ini mengungkapkan adanya fenomena learning loss dalam hal kompetensi matematika di kalangan siswa, dimana penguasaan pengetahuan dan keterampilan matematika awal yang diperlukan untuk kelas 3 belum dikuasai. Selain itu, kompetensi matematika mereka berada di bawah standar kompetensi dalam kurikulum untuk kelas 3 sekolah dasar di Indonesia. Signifikansi penelitian ini menegaskan bahwa fenomena learning loss yang terjadi pada siswa SD di Indonesia selama bahkan pasca pandemi COVID-19 harus menjadi perhatian serius bagi semua pihak dan pemangku kepentingan. Oleh karena itu, beberapa solusi dan langkah cepat yang perlu diambil untuk memitigasi dampak jangka panjang dari learning loss juga disertakan dalam artikel ini.

Kata kunci: Kompetensi matematika; learning loss; pandemi COVID-19, penutupan sekolah, siswa sekolah dasar Indonesia.



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INTRODUCTION

The global pandemic of Corona Virus Disease (COVID-19) which has occurred since the end of 2019 to the end of 2022 has forced every nation to take preventive measures against the spread of the virus. In the education sector in Indonesia, the government decided to temporarily close all schools or other education institutions as well as required home learning for all students in response to the COVID-19 pandemic (Menteri Pendidikan dan Kebudayaan Republik Indonesia, 2020). The policy taken in such an emergency situation, in its implementation, of course faces its own challenges, such as the unpreparedness of both teachers and students with a considerably new learning system that switched from face-to-face instructions to distance learning (Donnelly & Patrinos, 2022; Middleton, 2020; Rigianti, 2020). Besides, the gaps in educational facilities or access to technology which is expected to help the learning process from home is also another challenge in creating meaningful learning experiences for students, particularly those who are from disadvantaged families (Andrew et al., 2020; Engzell, Frey, & Verhagen, 2021; Handayani, 2020). Apart from that, remote learning for students is also complicated by the fact that not all parents were able to provide adequate assistance to their children while studying at home, simply because they thought they were not teachers, or were too busy to support their children's learning remotely (Azubuike & Aina, 2020; Mardiana, 2021).

The aforementioned challenges faced by students during the remote learning are further exacerbated by the fact that such a condition continued to happen for more than one academic year. World Bank (2020) released

information that the potential impact of the on going school closures would cause learning loss among students. Learning loss refers to a condition where general or specific knowledge or skills are lost mainly because of a long discontinuity or gap in students' education (the Great Schools Partnership, 2013) or because of certain conditions that do not facilitate these competencies to be used. In the context of the current COVID-19 pandemic, Pier, et al. (2021) referred learning to loss as the gap between what students should have learned in a normal year and what they learn during the school closures. Their assertion implies that there was a decline in the level of student competence as a result of the disruption of the pandemic. The phenomenon of learning loss is essentially not a new terminology that emerged in the midst of the COVID-19 pandemic. Several studies on this topic were carried out in most public schools in western countries such as the United States and the United Kingdom which provide summer holidays to students for up to two and a half months which leads to learning loss among students during summer holidays. This condition is broadly referred as "summer learning loss" (Kuhfeld, 2019; Shinwell & Defeyter, 2017). Furthermore, the term is also commonly used in cases of disruption of children's formal education, such as those experienced by immigrant children or due to natural disasters (Andrabi, Daniels, & Das, 2021; the Great Schools Partnership, 2013).

Disruption to children's education such as school closures for a long time for any reason, does not just lead to stagnation in their academic progress but even could cause degradation in children's academic development. Some

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recent studies have claimed that the suspension of face-to-face instruction in school during the pandemic led to learning loss on students' academic achievement (e.g. Donnelly & Patrinos, 2021; Engzell et al., 2021; Kuhfeld et al., 2020; Pier et al., 2021), and also have projected and modelled the potential long-term impacts of the COVID-19 school closures even after students return to school (e.g. Kaffenberger, 2021; Kuhfeld, et al., 2020). While the settings of those studies were carried out in western countries with a more prepared mitigation system, this current study aims to investigate the phenomenon of learning loss in the context of education system in Indonesia where schools are closed much longer while the infrastructures for remote learning is uneven across the students. The limited qualitative empirical data regarding the phenomenon of learning loss that occurs in Indonesia is the novelty of this study. Subsequently, this study will be focused on investigating the impact of school closures in Indonesia on students' mathematical competence at primary education level, as studies showed that greater losses can occur in mathematics and at lower primary school levels (Engzell et al., 2021; Gore et al., 2021; Kuhfeld et al., 2020). Through this study, accurate and authentic information and facts about the phenomenon of students' learning loss in terms of mathematics competence can be analysed. Those expected results can be used as a reference for stakeholders or related parties in taking steps to mitigate these problems.

METHODS

This research was carried out referring to a qualitative research methodology with a phenomenological

approach in order to deeply investigate the learning loss phenomenon in students' mathematical competence at primary level due to the COVID-19 school closures. This method allowed us to examine the topic raised in more depth, because this is considered a more suitable approach for research that involves the subjective understanding, opinions and beliefs of the research subject or respondent.

Next, this study was carried out in one of public primary schools in Tarakan City, North Kalimantan, Indonesia that fully implemented Circular No. 4 of 2020 issued by the Indonesian Ministry of Education and Culture by closing the school and implementing distance learning. This school has been running the distance learning system since April 2020 (3 months prior to the end of the 2019/2020 school year) and continues until the beginning of the 2020/2021 school year. In other words, students have been out of school and studied remotely for around one and a half schooling year. For ethical reasons and in order to maintain confidentiality of participants and the school, information regarding the names of participating students and schools were anonymized.

This study involved eight third-year primary school students who along with their classmates were literally still in the first year of primary school before the outbreak. The selection of participants was carried out by considering student's attainment level in mathematics (high, medium and low attainers). Information regarding the categorization of students' level of mathematics achievement in mathematics was collected from their classroom teacher. We would like to investigate the phenomenon of learning loss in students with different levels.

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Data collection in this study was carried out through the provision of diagnostic test, in-depth interviews and documentation studies. The purpose of the diagnostic test was mainly to gather information regarding students' mathematical competence. The test consisted of 10 mathematics questions that were designed based on the standard of mathematics competence for grades 1 and 2 which included topics related to whole numbers, fractions, measurements of length, weight and time as well as basic plane. The diagnostic test was adapted from the assessment module designed by the Indonesian Ministry of Education and Culture (Kementerian Pendidikan dan Kebudayaan, 2020).

Furthermore, interviews were conducted with 3 out of 8 participants to obtain more detailed and accurate information about the mathematical competence of each participant. The three participants to interview were selected still based on the results from the test and on representation of each category of students' mathematics competence levels. Meanwhile, documentation regarding each child's

mathematical competence prior to the pandemic was also collected from the classroom teacher. Testing the validity of research data to assess the potential for learning loss can be obtained by analysing the results of students' diagnostic tests and then comparing them with the results of interviews and documentation of students' mathematical competence while still in grades 1 and 2 obtained from class teachers.

RESULTS AND DISCUSSIONS

The diagnostic test to measure the mathematical competence level of the participants was one of the three techniques used in obtaining information related to the potential phenomenon of learning loss in students. The diagnostic test results data from the participants with different levels of achievement in mathematics are presented in Table 1. Correct or incorrect answers – labelled 1 and 0 respectively are determined based on the final written answer on each student's answer sheet.

Table 1. Summary from the mathematical diagnostic test results

Students	Question Numbers										Total	Percentage
	1	2	3	4	5	6	7	8	9	10		
A	1	1	1	0	0	0	0	1	0	1	5	50%
B	0	0	0	0	0	0	0	1	0	1	2	20%
C	0	0	0	0	0	0	0	1	0	0	1	10%
D	1	1	1	1	0	0	0	0	0	1	5	50%
E	0	1	0	1	0	0	0	1	0	0	3	30%
F	0	0	0	0	0	1	0	1	0	0	2	20%
G	1	0	0	1	0	0	0	1	0	0	3	30%
H	1	0	0	0	0	0	0	1	0	1	2	20%
Total	4	3	2	2	0	1	0	7	0	4		
Percentage	50%	37.5%	25%	25%	0%	12.5%	0%	87.5%	0%	50%		

Table 1 reveals some significant information, such as none of the students who were able to answer all the questions correctly. The highest percentage of correct answers obtained

by students was only 50% or only 5 correct answers out of 10 total questions given to the students. Moreover, this highest score was obtained by only 2 students, namely student A and student

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D. On the other hand, the lowest percentage of correct answers obtained by students was 10% of the total number of questions, which means this student only got 1 correct answer. In essence, of the ten questions in the test given, students were only able to give the correct answer at most half of the total of questions given. As previously mentioned, the mathematical diagnostic test used consisted of questions compiled based on the standard of mathematics competence at year-1 and year-2 primary schools. Thus, the participating third-year students have not mastered most of the prerequisite knowledge and skills in mathematics that should have been mastered from the previous grades.

Furthermore, the data from Table 1 also demonstrated the number and percentage of students with correct answer for each question on a different topic area in mathematics. Among the ten mathematics questions given, question 8 which required students to identify parts of a two-dimensional shape, was the only type of question that most students can answer with 87.5% of the students able to answer it correctly. This could indicate that students' mathematical abilities in distinguishing elements (angles, corners and sides) of a shape were good. However, the opposite appears in the remaining questions. Half of the total participating students could not demonstrate sufficient understanding of the concept of whole numbers and place values (question 1), and were confused in determining the number of sides that a circle has (question 10). Subsequently, more than half of the students were not able to provide the correct written answers to the remaining questions related to basic fraction and measurements of weight, length and

time. On the top of that, none of the students were even able to solve question 5 and 9 which were respectively related to measuring the length of an object and determining the relationship of a square and a rectangle based on their properties.

Such results from the diagnostic tests which displayed unsatisfactory results are certainly intriguing findings that need to be studied further. Hence, Therefore, interviews with participating students were then conducted in order to obtain more accurate information as well as to reconfirm the students' responses from the diagnostic tests. This interview was conducted on 3 students, each of whom has a different level of mathematical competence, who gave responses that were considered intriguing to be explored further from their answer sheets for the diagnostic test. They are students A, G and C who are students with high, medium and low mathematics competence, respectively, based on the information obtained from the classroom teacher. If we refer back to the results of the previous diagnostic test, the information from the teacher were in line with the test results, despite of the fact that student A who was a high attainer in mathematics were only able to answer five out of 10 questions correctly, this score is the highest score in the class. This fact became one of the interesting topics which further required interviews to obtain in-depth information on the mathematical competence of each student. A more detailed analysis of the mathematical competence of the three students is explained as follows.

Student A (high attainer in maths)

This more able student was capable of solving five out of ten questions correctly (questions 1, 2, 3, 8

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and 10) in the test. Interestingly, similar results were also consistently shown by the student during the interview. In other words, such a consistency both in the diagnostic tests and in the interviews indicated that the student has a solid understanding of the concepts of whole numbers and simple fractions. However, the results of the interview also showed that the student did not understand or only partially understood the concept of measurement of length, weight and time (questions 5, 6, and 7).

“I looked at the tip (of this pencil), and the tip is parallel to the 10 (on the ruler). That's why the length is 10(cm).”

The student assumed that in measuring the length of an object, it is enough to pay attention to the end point of the object on the measuring instrument (see Figure 1a). It can be argued that the student partially understood that to measure an object using a ruler, though the student did not fully aware that the other side of the

pencil was not put aligned with the 0 on the ruler. In other words, this shows that The components of the concept of measuring length with a ruler have not yet been sufficiently developed, in which length indicates the component of the accumulation of distance instead of simply as the endpoint of an object on a ruler (Antić & Đokić, 2019).

The similar response was also shown in measuring weight (see Figure 1b), where the student only looked at the number written on the scale as the objects are weighed.

“The egg weighs 500 (gram), because I see on the scale (pointed at the picture) it says 500.”

Meanwhile, in solving the problem of measuring time, this student completely had no idea the meaning of “the long hand rotates half a turn” in the question which actually indicate half an hour, and rather drew clock hands showing 8 o'clock on the worksheet, as seen in Figure 1c.

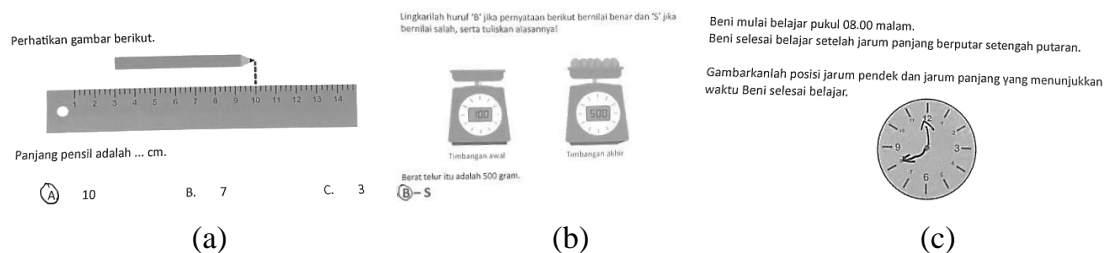


Figure 1. Snippets of Worksheets from Student A

Student G (medium attainer in maths)

This student provided 3 correct written answers through the diagnostic test (questions 1, 4, and 8). In the interview, the student also showed consistent responses to questions 1 and 8 with a solid understanding of the concept of the place value of whole numbers and identification of parts of a flat shape. However, the correct written answer to question 4 about fractions in

the test was inconsistent during the interview. This student basically did not understand the concept of simple fractions while the correct answer to question number 4 was the result of guesswork.

“(I) don't know (how to solve the problem) ... I also forgot how to get the answer. I just guessed. Is the answer correct?”

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When working on the other fraction-related problems (see Figure 2), the student assumed that the smaller cupcake has a smaller fractional value than the bigger cupcake, even though the two cupcakes have the same number of parts.

“Of course, this one (pointing at picture A in Figure 2a) is smaller, because the cake is smaller.”

To this student’s understanding, the value of a fraction depends on the size of the object or different sizes of an object produces different fractional values (see also Deringöl 2019; Ghani and Maat 2018; Ndlichako 2013; Zhang, Clements, and Ellerton 2015).

Furthermore, while being asked why the statement in Figure 2b was answered true, the student said:

“Yes! Because here (pointing at the picture in Figure 2b), the donut was cut into three parts, and Edo only took one part. (It means that) he took 1 out of 3 or 1/3”

The student considered that one part out of three parts that are not equally divided is still worth 1/3. Thus, this indicates that the student had not fully comprehend the concept and definition of fraction. Apart from that, the student also did not understand the concept of measurement and some geometry similar to the student A.

Perhatikan gambar berikut.

Lingkarilah huruf 'B' jika pernyataan berikut bernilai benar dan 'S' jika bernilai salah, serta tuliskan alasannya.
Edo mengambil 1 potong kue seperti pada gambar di samping. Kue yang diambil Edo bernilai 1/3.

(a) (b)

Figure 2. Snippets of Worksheets from Student G

Student E (low attainer in maths)

Based on the diagnostic test, this student was only able to correctly answer 1 question (question 8) regarding the identification of parts of a flat shape. In-depth interviews with the student later showed that he did not understand the concept of place values in whole numbers, fractions, measurements and even basic geometry. While his lack of comprehension of the concept of fractions, measurements and basic geometry was considerably similar to the previous students, Figure 3 specifically illustrates how this student did not have an adequate understanding and reading

comprehension of the problem related to place values in a whole number.

“Hmmm... (long silence) ... the answer is 8, because 5 plus 3 (make 8).”

The student assumed that five bundles of sticks are simply worth 5 ones and three sticks are worth 3 ones, thus adding up 5 and 3 and getting a final score of 8. In other words, this student has difficulty solving numeracy problems related to whole numbers and place values. Students particularly with mathematical difficulties often struggle in tasks on quantity recognition in structured whole number representations (Schindler & Lilienthal,

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2018). Besides, this student does not even understand the concept of fractions at all and has difficulty working on numeracy problems related to basic measurements and geometry.

Udin memiliki 5 ikat lidi dan 3 batang lidi. Jika 1 ikat lidi bernilai 10 dan 1 batang lidi bernilai 1, maka banyaknya lidi yang dimiliki Udin adalah

- (A) 8 B. 53 C. 80

Figure 3. Snippet of worksheets from student c

Before discussing in detail, the findings of this study, it is crucial to describe the portrait of remote learning experienced by the participating students during the COVID-19 school closures in Indonesia. The students have been temporarily out of school due to the pandemic for around one and a half schooling years. Like most public schools in Indonesia, the school was forced to close, while the students ought to learn from home with inequality in access to the cutting-edge technology or internet and very little assistance from adults (Handayani, 2020; Mardiana, 2021; Rigianti, 2020). Due to the gap between students in access to technology, the learning process was only conducted via instant messaging platforms, such as WhatsApp where teachers broadcasted daily instructional materials there. They never used any video conferencing devices to replace the usual face-to-face instructions, because most the students could not afford it.

With such learning portrait in mind, concerningly, yet perhaps unsurprisingly, the results for this study have indicated huge losses in the students' learning during the COVID-19 lockdown. The losses that we mean here refer to the definition of learning loss put forward by Pier et al., (2021), namely the gap between what students

should have learned in a normal year and what they learn during the school closures, that results in a decline in student's learning level. A more detailed discussion of this current study, which contains important points and main concerns related to the phenomenon of learning loss as a result of school closures in Indonesia, is elaborated as follows:

Students' low mathematics competence

Home learning during the pandemic had not only brought detrimental impacts on students with certain level of mathematics competence. Although previous study has argued that low-achieving students might be the most affected by the school closures (Grewenig, Lergetporer, Werner, Woessmann, & Zierow, 2021), this current study revealed that all students, whether they were high-, medium- or even low-attainers in mathematics, did not experience ideal academic progress during the pandemic. It is evident from the results of the diagnostic test given to the participants that indicated that none of the students were able to get 100% correct answers in the test. In fact, the highest number of correct answers was only 5 out of 10 questions obtained by merely 2 students, while the remaining students were only able to obtain 3 to only 1 correct answer in the test. This extremely low achievement signified how low the students' mathematical competence during studying from home during the pandemic. Such an assertion is in line with what was projected by Engzell, et al., (2021) in their study that students learned less during lockdown and hence, made very little or even no progress at all in their academic, particularly in mathematics and reading whilst learning from home. Moreover,

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students demonstrated bigger losses in mathematics than reading while out of school during lockdown (Kuhfeld et al., 2020).

Inequality in students' grade levels with their mathematical competence.

Another significant finding revealed from this study involving some third-year primary school students is the fact that the level of students' mathematical knowledge was still below the curriculum standard at their actual grade level. As mentioned earlier, the diagnostic test was designed based on the competency standards contained in year-1 and year-2 primary schools that consisted of numeracy questions related to whole numbers and place value, fractions, length, mass, time and basic plane. In other words, students must demonstrate their mastery of those topics areas in mathematics before moving on to the next academic level in year-3. This study, however, has indicated that most of the students had not mastered all those fundamental skills. Fractions and measurements were two predominant topic areas in which most of the students had very low understanding, while some others had not mastered the concept of whole numbers and place values yet. Such varying mastery among the students was arguably influenced by the heterogeneity in the learning experience of the students, including the amount of time spent or activities undertaken during the home learning as well as availability of resources to support learning (Andrew et al., 2020). On the other hand, there is no retention or holding students back a grade for those who have not built the academic skills needed for the next grade. This implies that students continued to move up to a higher class at every turn of the school

year during the covid pandemic, even though such grade progression did not necessarily indicate an increase in student knowledge and skills according to the competency standards specified in the curriculum.

The longer the school closures last, the further students fall behind academically.

Kuhfeld, et al. (2020) stated that there is a strong likelihood that missing school for a prolonged period will bring significant impacts on students' academic achievement. Results from this current study has shown that the students in the third year of primary school had a lack of mastery of the fundamental knowledge and skills that were supposed to be mastered from the previous grades after being out of school for more than one and a half academic years due to COVID-19 pandemic. Such basic knowledge and skills that are not mastered from the lower levels certainly have an impact on students' readiness to study advanced mathematics topics in the next grade. As an illustration, a lack of understanding of the students regarding the definition and concept of simple fractions, which should ideally be mastered by the students by the end of the second year of primary school, will make it difficult for them when learning fraction comparisons or simple addition and subtraction operations involving fractions in year 3 of primary school. It is because of the hierarchical nature in learning mathematics which means knowledge and skill learned previously are necessary prerequisites to the subsequent learning in mathematics (Ernest, 1991; Hart, 1981; Lee, Yeo, & Han, 2022). Hence, the longer the school closures last without any significant mitigation, the further

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students will fall behind academically. Interestingly, studies have shown that temporary school closures such as those that recently occurred during the COVID-19 pandemic can contribute to large medium-term learning loss (Andrabi et al., 2021; Kaffenberger, 2021). For example, school closures for around 3 months due to the natural disaster back in 2005 in Pakistan resulted in 1.5 years of lost learning four years later (Andrabi et al., 2021). It arguably happened because the students continued to move up to the higher grade despite having limited knowledge and even still below their actual grade level, while the curriculum and instruction were not adapted to each individual learning level and hence they fell further and further behind (Andrabi et al., 2021; Kaffenberger, 2021).

The three aforementioned alarming facts and concerns related to the phenomenon of learning loss in terms of students' mathematical competence deserved serious attention from all parties, including policy makers, government, schools as well as teachers and parents in Indonesia. Studies have urged that the phenomenon of learning loss likely has a much more severe impact in countries with much longer school closures and limited infrastructures (Engzell et al., 2021), like in Indonesia. Through a series of qualitative analyses of the mathematics competence of third grade elementary school students, this study confirms that school closures clearly have a significant impact on students' academic progress in Indonesia, particularly in mathematics. This finding is different from the study conducted by Gore, Fray, Miller, Harris, & Taggart (2021) which found that there was no significant change in student achievement growth in

mathematics due to COVID-19 closures for 2 months in the State of New South Wales, Australia. One possible explanation for such divergent findings is that the context of the education system and the level of preparedness in mitigating the impact of covid-19 on education are significantly different in Indonesia and in Australia. In contrast to Australia, gaps in access to technology, limited infrastructure or learning resources, and differences in the demographic conditions and socio-economic background of each student in Indonesia have created unequal learning opportunity. Those obstacles hindered teachers to provide instructional materials available for students, because many students in Indonesia like those involved in this study lacked the means to access online learning or materials from home (see also Kuhfeld et al., 2020). Besides, parental support in teaching their own child at home was very limited due to parents' lack of teaching experience or even hindered by work demands (Panaoura, 2020). Moreover, low of supervision of children's academic progress during home learning led to disproportionate learning time because it is replaced with detrimental activities such as watching TV or playing instead of fruitful activities for child's academic development (Grewenig et al., 2021). Alifia, et al. (2020) asserted that students with such limited support who are worse off during the school closures. As a result, learning loss in student's academic progress is inevitable as indicated through this qualitative study. The implication of the study is that learning loss is a significant concern in education, and it should prompt a proactive response from educators, policymakers, and the community to support students in their

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academic progress and overall well-being. Some potential actions that could be taken such as: identifying at-risk students, that is to say, schools and educators can use the findings to identify students who are most at risk of learning loss. This could include students who struggled with remote learning during the COVID-19 pandemic or those facing other challenges that impact their academic progress. Next, the study's findings could inform the development of targeted interventions and support programs such as teacher training (Barumbun et al., 2023). Educators can design strategies to help these students catch up on their missed learning opportunities, as well as encouraging students to apply the mathematical knowledge and skills they gain to real-life situations or other contexts outside of mathematics (Barumbun & Kharisma, 2022).

CONCLUSION AND RECOMMENDATION

The COVID-19 pandemic has led to disruption to conventional school systems around the globe and forced students out of school or remote learning. This study highlighted the phenomenon of learning loss related to mathematical competence that occurred in year-3 primary school students as a result of the prolonged school closures and ineffective home learning. The learning loss is evident from 3 significant facts found in this study, i.e. low level of students' mathematics competence, significant gaps in students' grade levels with their mathematical competence, and the longer period of being out of school made students fell further and further behind academically. With this learning

loss phenomenon in mind, actions and recovery efforts are seriously needed.

Hence, education system needs to be adjusted according to students' mathematics competence level when schools reopen. In doing so, teachers must assess each student's learning level with a series of standardized assessments that can be designed by the government or the teachers themselves. Results from the assessment can be used as a reference for teachers and schools in adapting learning instructions to students' learning level. It also implies that foundational mathematical knowledge and skills are the main priority in the system that need to be strengthened when students return to school. Excellent cooperation from the government, schools, teachers and parents is the main key in mitigating this learning loss. Further study is also needed to measure each of the action in mitigating the phenomenon of learning loss.

REFERENCES

- Alifia, U., Barasa, A. R., Bima, L., Pramana, R. P., Revina, S., & Tresnatri, F. A. (2020). Learning from Home: Portrait of Teaching and Learning Inequalities in Times of The Covid-19 Pandemic. In *Smeru Research Institute* (Vol. 1). Retrieved from https://smeru.or.id/sites/default/files/publication/cp01_covidpjj_eng.pdf
- Andrabi, T., Daniels, B., & Das, J. (2021). Human Capital Accumulation and Disasters: Evidence from the Pakistan Earthquake of 2005. In *Journal of Human Resources*. <https://doi.org/10.3368/jhr.59.2.0520-10887r1>

DOI: <https://doi.org/10.24127/ajpm.v12i3.7382>

- Andrew, A., Cattan, S., Dias, M. C., Farquharson, C., Kraftman, L., Krutikova, S., ... Sevilla, A. (2020). Inequalities in children's COVID-19 lockdown learning during the experiences of home in England. *Fiscal Studies*, 41(3), 653–683.
<https://doi.org/10.1111/1475-5890.12240>
- Antić, M. D., & Đokić, O. J. (2019). The Development of the Components of the Length Measurement Concept in the Procedure of Measurement Using a Ruler. *Korean Society of Mathematical Education*, 22(4), 261–282.
<https://doi.org/10.7468/jksmed.2019.22.4.261>
- Azubuike, O. B., & Aina, B. (2020). How Parents Are Supporting Their Children's Learning during the COVID-19 Pandemic in Nigeria. Retrieved from UKFIET the Education and Development Forum website: <https://www.ukfiet.org/2020/how-parents-are-supporting-their-childrens-learning-during-the-covid-19-pandemic-in-nigeria/>
- Barumbun, M., & Kharisma, D. (2022). Procedural knowledge or conceptual knowledge? Developing the so-called proceptual knowledge in mathematics learning. *Beta: Jurnal Tadris Matematika*, 15(2), 1–14.
<https://doi.org/10.20414/betajtm.v15i2.472>
- Barumbun, M., Toding Bua, M., Muliani, E., Ramadhani, T., Wulandari, A. E., Kasmawati, A., & Syahrisofia, R. (2023). Pendampingan penyusunan asesmen diagnostik kemampuan literasi dan numerasi siswa sekolah dasar pasca pandemi Covid-19. *Jurnal Qardhul Hasan*, 9(1), 8–13.
<https://doi.org/10.30997/gh.v9i1.6434>
- Deringöl, Y. (2019). Misconceptions of primary school students about the subject of fractions. *International Journal of Evaluation and Research in Education*, 8(1), 29–38.
<https://doi.org/10.11591/ijere.v8i1.16290>
- Donnelly, R., & Patrinos, H. A. (2022). Learning loss during Covid-19: An early systematic review. *Prospects*, 51, 601–609.
<https://doi.org/10.1007/s11125-021-09582-6>
- Engzell, P., Frey, A., & Verhagen, M. D. (2021). Learning loss due to school closures during the COVID-19 pandemic. *Proceedings of the National Academy of Sciences of the United States of America*, 118(17), 1–7.
<https://doi.org/10.1073/PNAS.2023761118>
- Ernest, P. (1991). *The Philosophy of Mathematics Education*. Exeter, UK: Taylor & Francis.
- Ghani, A., & Maat, S. N. (2018). Misconception of fraction among middle grade year four pupils at primary school. *Research on Education and Psychology (REP)*, 2(1), 111–125. Retrieved from <https://dergipark.org.tr/en/pub/rep/issue/39781/471516>
- Gore, J., Fray, L., Miller, A., Harris, J., & Taggart, W. (2021). The impact of COVID-19 on student learning in New South Wales primary schools: an empirical study. *Australian Educational Researcher*, 48(4), 605–637.

DOI: <https://doi.org/10.24127/ajpm.v12i3.7382>

- <https://doi.org/10.1007/s13384-021-00436-w>
- Grewenig, E., Lergetporer, P., Werner, K., Woessmann, L., & Zierow, L. (2021). COVID-19 and educational inequality: How school closures affect low- and high-achieving students. *European Economic Review*, *140*(103920), 1–21. <https://doi.org/10.1016/j.euroecorv.2021.103920>
- Handayani, L. (2020). Keuntungan , Kendala dan Solusi Pembelajaran Online Selama Pandemi Covid-19 : Studi Ekploratif di SMPN 3 Bae Kudus. *Journal Industrial Engineering & Management Research (JIEMAR)*, *1*(2), 15–23. <https://doi.org/10.7777/jiemar.v1i2>
- Hart, K. (1981). Hierarchies in Mathematics Education. *Educational Studies in Mathematics*, *12*(2), 205–218. Retrieved from <http://www.jstor.org/stable/3482365>.
- Kaffenberger, M. (2021). Modelling the long-run learning impact of the Covid-19 learning shock: Actions to (more than) mitigate loss. *International Journal of Educational Development*, *81*(102326), 1–20. <https://doi.org/10.1016/j.ijedudev.2020.102326>
- Kementerian Pendidikan dan Kebudayaan. (2020). *Modul Asesmen Awal Matematika SD/MI Kelas III*. Pusat Asesmen dan Pembelajaran Balitbang Kemdikbud.
- Kuhfeld, M. (2019). Surprising New Evidence on Summer Learning Loss. *The Phi Delta Kappan*, *101*(1), 25–29. Retrieved from <https://www.jstor.org/stable/10.2307/26781052>
- Kuhfeld, M., Soland, J., Tarasawa, B., Johnson, A., Ruzek, E., & Liu, J. (2020). Projecting the Potential Impact of COVID-19 School Closures on Academic Achievement. *Educational Researcher*, *49*(8), 549–565. <https://doi.org/10.3102/0013189X20965918>
- Lee, H., Yeo, S., & Han, J. (2022). Challenges and Efforts of Achieving Equity Beyond Gifted Education: Implications From Mathematics Education. *Gifted Child Quarterly*, *66*(2), 139–141. <https://doi.org/10.1177/00169862211037951>
- Mardiana, H. (2021). The Impact of Parents Attitudes on Their Children’s Distance Learning during COVID-19 Outbreak. *DWIJA CENDEKIA: Jurnal Riset Pedagogik*, *5*(1), 85–96. <https://doi.org/10.20961/jdc.v5i1>
- Menteri Pendidikan dan Kebudayaan Republik Indonesia. (2020). *Surat Edaran Nomor 4 Tahun 2020 tentang Pelaksanaan Kebijakan Pendidikan dalam Masa Darurat Penyebaran Coronavirus Disease (COVID-19)* (pp. 1–3). pp. 1–3.
- Middleton, K. V. (2020). The Longer-Term Impact of COVID-19 on K–12 Student Learning and Assessment. *Educational Measurement: Issues and Practice*, *39*(3), 41–44. <https://doi.org/10.1111/emip.12368>
- Ndalichako, J. L. (2013). Analysis of Pupils’ Difficulties in Solving Questions Related to Fractions: The Case of Primary School Leaving Examination in Tanzania. *Creative Education*, *04*(09), 69–

DOI: <https://doi.org/10.24127/ajpm.v12i3.7382>

73.
<https://doi.org/10.4236/ce.2013.49b014>
- Panaoura, R. (2020). Parental Involvement in Children's Mathematics Learning Before and During the Period of the COVID-19. *Social Education Research*, 2(1), 65–74. <https://doi.org/10.37256/ser.212021547>
- Pier, L., Hough, H. J., Christian, M., Bookman, N., Wilkenfeld, B., & Miller, R. (2021). COVID-19 and the Educational Equity Crisis: Evidence on Learning Loss from the CORE Data Collaborative. Retrieved from Policy Analysis for California Education. website: <https://edpolicyinca.org/newsroom/covid-19-and-educational-equity-crisis>
- Rigianti, H. A. (2020). Kendala Pembelajaran Daring Guru Sekolah Dasar di Kabupaten Banjarnegara. *Elementary School*, 7(2), 297–302. <https://doi.org/10.31316/esjurnal.v7i2.768>
- Schindler, M., & Lilienthal, A. (2018). Eye-Tracking For Studying Mathematical Difficulties: Also In Inclusive Settings. *Annual Meeting of the International Group for the Psychology of Mathematics Education (PME-42)*, 4, 115–122. Umeå., Sweden: PME. Retrieved from <http://oru.diva-portal.org/smash/get/diva2:1284102/FULLTEXT01.pdf> <http://urn.kb.se/resolve?urn=urn:nbn:se:oru:diva-71952>
- Shinwell, J., & Defeyter, M. A. (2017). Investigation of Summer Learning Loss in the UK—Implications for Holiday Club Provision. *Frontiers in Public Health*, 5(October), 1–7. <https://doi.org/10.3389/fpubh.2017.00270>
- the Great Schools Partnership. (2013). LEARNING LOSS. Retrieved from the Glossary of Education Reform website: <https://www.edglossary.org/learning-loss/>
- World Bank. (2020). The COVID-19 Pandemic: Shocks to Education and Policy Responses. In *World Bank Group Education*. <https://doi.org/10.12968/bjon.2020.29.8.456>
- Zhang, X., Clements, M. A. (Ken., & Ellerton, N. F. (2015). Conceptual mis(understandings) of fractions: From area models to multiple embodiments. *Mathematics Education Research Journal*, 27(2), 233–261. <https://doi.org/10.1007/s13394-014-0133-8>