



After School Closure: How Indonesian Senior High School Responded to Students' Learning Loss

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Abstract. This study examined the phenomenon of learning loss that occurs due to school closures during the COVID-19 situation. Some previous studies have predicted severe learning loss due to this pandemic. This research reveals the evidence of learning loss in high school and how schools anticipate it so that learning loss does not get worse. The research method used in this study is a qualitative research method. The data collected were in the form of observation, interviews, and analysis of documents. The participants in this study were 36 10th-grade students in the same class, the mathematics teacher, and the principal. This research was conducted during one semester. It shows that 60% of students experience learning loss on the topics of function and triangles, which they should have completed when they were in junior high school. To respond to the test results, the teacher made changes in learning methods and added a recommended resource. The principal introduced several new school programs to increase student interest and creativity in welcoming students to school. With these programs, schools make full efforts to restore students' enthusiasm for learning at school and the teacher changed her teaching methods in order to facilitate students learning in uncertain conditions.

Keywords: learning loss · school innovation · mathematics learning · senior high school · COVID-19

1 Introduction

Learning loss is a phenomenon in which students experience a decline in their abilities and knowledge due to school closures during COVID-19 [1–3]. Since the closing of schools in Indonesia on March 16, 2022, the government has been trying as quickly as possible to facilitate students learning from home. It has been starting with quota subsidies [4], learning websites from several educational technology platforms that can be accessed for free [5], to learning applications that can also be accessed for free [5].

Schools were also required to respond quickly to this unusual educational condition. Schools were asked to adjust the conditions of the school and students with their socio-economic backgrounds to carry out learning and teaching activities. Public schools

mostly used Whatsapp to share school materials with students during school closures because of the pandemic. The consideration for selecting a certain application to teach students and collect their homework was based on their social-economic and home locations [6]. Most Indonesian people use Whatsapp to communicate with each other. So, they did not need to install another application that could take their handphone memory.

Eventually, many efforts and innovations have been made to facilitate students to continue learning from home. They used Google Classroom to collect their homework and share school materials, Google Meet, or Zoom Meeting for teaching and learning activities. Some teachers also created videos and upload them to YouTube so students can access them anytime and anywhere.

However, learning loss is inevitable. Many studies have warned of learning loss that would be disastrous if there were no significant changes in the education system during COVID-19 [3, 7, 8]. Some researchers have conducted studies about learning loss in Indonesia. A study showed that Indonesian college students experienced learning loss during online learning [9]. Learning loss also happened to primary students on the topic of GCD (Greatest Common Divisor) and LCM (Least Common Multiple) [10]. Research about learning loss also has been conducted in a vocational school [11].

This study discussed the learning loss that happened to 10th-grade students in mathematics topics, namely: functions and triangles. It assessed if students can solve a diagnostic test before they learn about function and trigonometry for 10th grade. After collecting data, we interviewed six students, a math teacher, and the principal to enrich our research results and how the school adapted to the new learning condition after reopening to students. We also observed how the school welcomed students with their new programs.

2 Methods

This research used qualitative research methods with a case study approach. In this case, we have a similar condition to Yin said that the researchers have little control over the event of learning loss that students possessed. The approach was chosen so that it is in line with the purpose of this study is to discover the learning loss phenomenon of 10th-grade students in a public school and to investigate how the school recognized and responded to these phenomena.

2.1 Participants

This research was conducted in a public high school in Bandung, Indonesia. The participants were 36 students in one class in the grade 10 mathematics and science program in one school (15–16 years old), the school principal, and the mathematics teacher. The mathematics teacher of this study was the first author of this study. The participants got examined for their readiness by diagnostic assessment in the following mathematics topics: the definition of relation, and function, and how to calculate the area of triangles in the junior high school stage. We selected these topics to assess how their readiness and whether school closure gave them effect on their mathematical abilities before learning about inverse and composition functions and trigonometry.

This study was conducted from January to June 2022. At that time the Indonesian government allowed schools to conduct limited face-to-face learning with only 50% of people in the school. However, in February and March, the Indonesian government asked schools to be closed again because the rate of addition of COVID-19 cases rose again. After the increase in cases slumped, schools were allowed to conduct face-to-face learning again. Situations like this require teachers to prepare two teaching methods so that students were ready to even in uncertain situations.

2.2 Data Collection

The first author conducted a diagnostic assessment, analyzed answers, made observations about the school's program, and conducted semi-structural interviews with the principal and six students. Six students were selected based on the results of the diagnostic assessment which showed that their mathematical ability was not ready to learn 10th-grade mathematics material to be interviewed as corroborating evidence of the existence of learning loss in students and the factors based on the students' experience. The researcher interviewed the students and the principal of the school in a semi-structured mode in the school. The first author of this paper approached this research from the perspective of a mathematics teacher. She has been working as a math teacher since 2017 teaching senior high school and holds a Master's degree in mathematics education. She collected data, designed, analyzed, and took the lead in writing the manuscript.

The second author conducted semi-structured interviews with the mathematics teacher virtually and how she responded after obtaining the results of the student's diagnostic assessment and facing uncertain situations. He contributed to the development of the writing of the paper and improved how to deliver the findings of the research.

2.3 Data Analysis

The researchers examined the written work and interview data of students and how they solve problems about the definition of a function, the value of a function, and triangles. After that, the researcher will conduct an analysis using the technical steps of deductive data analysis as below:

1. Identify the theories that will be used as the foundation of the analysis
2. Read data, marking things related to theory
3. Look for patterns, relationships, and themes by using theories
4. Read data, enter codes based on identified patterns, and keep track of the direction in which the patterns are headed.
5. Decide whether the patterns found match the data, and look for data that are examples of patterns
6. Look for relationships between identified patterns.
7. Write the patterns found in general as the theory obtained in this study
8. Choose data that supports the theory found

3 Results

The first data we collected and analyzed was from the written work of students. We find that 60% of students could not mention the definition of a function, which they should have understood when they were in the 8th grade of junior high school. Some students also could not find the value of a function. Figure 1 below is one example of the respondent's answer that could not find the value of a linear function.

In English, the question is that "If given $f(x) = x + 1$, the value of $f(2^2) + (f(1))^2 - 2|f(-5) + f(2)|$ is..." The student only added the result of the square of the value of x , yet substituted the value of x of the formula of function. Absolute value also has been introduced to them in the first semester of 10th grade. Students should be able to solve this kind of problem. However, in this case, the students could not find the value of the various types of a linear function. Another student also could not find the value of the logarithm function.

In Fig. 2, there is a question stated, "If given information that $f(x) = \log_2 x$, the value of $f(1) - f^2(4) + f(\sqrt{8})$ is ...?". In Indonesia, we write logarithm expression by ${}^a\log b$, while in International term, we use expression: $\log_a b$ with the same value. The student tried to operate on the value of each x , so she got the value of x as 5 from $1 - 4 + 8$. After that, she substituted the 5 to the formula of function. She did not completely understand how to operate the value of a function. In an interview session, the student confessed that she did not learn from home. Her home was not comfortable to learn, and she felt lonely during learning by herself rather than learning with her friends in school. Students' willingness to learn during school closure dramatically decreased.

In addition, nine students (25%) cannot distinguish between acute and obtuse angles. Questions to determine which are functions and which are not are also not answered

Jika diketahui $f(x) = x + 1$, nilai dari $f(2^2) + (f(1))^2 - 2|f(-5) + f(2)|$ adalah...

$f(-2) = -2 + 1$
 $- - 1$

The student's work shows the function $f(x) = x + 1$ and the expression to be evaluated. They have written $f(-2) = -2 + 1$ and $- - 1$, which appears to be a miscalculation or a misunderstanding of the problem's requirements.

Fig. 1. Student's response to find the value of a linear function.

Jika diketahui $f(x) = {}^2\log x$, nilai dari $f(1) - f^2(4) + f(\sqrt{8})$ adalah...

$f(x) = {}^2\log x$ $f = {}^2\log 10$
 $f(5) = {}^2\log 5^2$
 $f(5) = {}^2\log 10$

The student's work shows the function $f(x) = {}^2\log x$ and the expression to be evaluated. They have written $f(x) = {}^2\log x$, $f(5) = {}^2\log 5^2$, and $f(5) = {}^2\log 10$, which shows a misunderstanding of the function's operation.

Fig. 2. Student's response to finding the value of the logarithm function

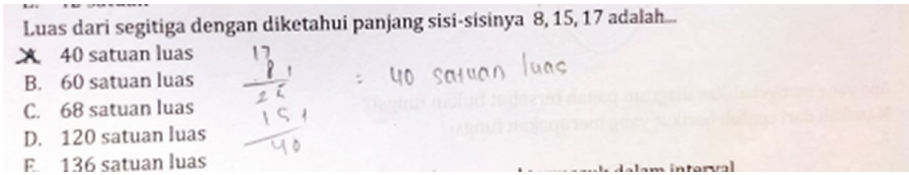


Fig. 3. Student's response to the area of a right triangle

by several students. Eleven students (30%) could not solve the problem consisting of adequate information, such as finding the area of the triangle if there is information that the length of three sides forms a right triangle. Figure 3 illustrates the student's response to the problem.

Responding to this phenomenon, the teacher changed how mathematics material was delivered in the classroom. At the beginning of the lesson, she recommended a book that students could use to study from home. She provided two teaching methods in the regular and online classes. During offline class, she will explain the material as before in front of the class, and the students then interact with their classmates to complete the interactive worksheet. In an online class, the teacher used Zoom meetings by explaining on her tablet as she explains on the blackboard in offline meetings. Although this is the most traditional and boring method, it is still helpful for students in a pandemic situation. This way, students feel that the teacher is present in their learning process instead of only using WhatsApp or videos. Not only books, she also provided additional material videos that she made and uploaded to YouTube, educational websites, and a summary of material notes that she had delivered in online meetings.

Responding to the learning loss, the principal gave opportunities to students to explore their interests by utilizing technology and improve their literacy skill. Some exciting programs are as.

- Create podcasts
- Make YouTube videos
- Literacy Program

This podcast program trained students to structure questions, practice interviewing, and communicate with many types of people. Students are also trained to build interesting conversations with resource persons. The principal encouraged students to make creative videos to upload to YouTube. Through this program, students are trained to create creative content that requires learning to make and edit videos. This program also trained their creativity outside of class hours so that they are not only trained to solve math problems but also to creativity in other fields. The third program from the principal was a book writing program for students and teachers. From April 2022 to July 2022, the number of books ready to be published reached 29 books. This program developed students' literacy and creativity to express their ideas in written form. These programs aimed to enable students to develop their creativity in completing school assignments and practice their creativity in other fields that were needed in their time, such as social media, which requires creativity in making videos and practicing interesting communication in podcasts.

4 Discussion

The result of the study showed that 60% of students experienced difficulties in solving problems on the topic of function and triangles. Using a semi-structured interview, they admitted that they did not study from home for many reasons. One of them was that they wanted to be at school. Although their teacher has facilitated them with YouTube videos, using Google Meet to convey materials directly using a tablet, and giving them the resume each meeting, they still could not learn from home as well as in school. In the interview, they said they wanted to socialize with their peers and study together, not alone. Learning alone can be stressful for students that usually learn with their peers and discuss it together when they find difficulties. This further information correlates with Hanafiah's [12] statement that learning loss can be influenced by social conditions. The social condition possibly could change the learning environment giving an impacting students' learning interests.

Another finding reveals that the math teacher added some methods to deliver the mathematics materials. She prepared two different methods, mobile learning, and face-to-face meeting when the situation was uncertain at that moment. She/he also provided various resources for the students based on their learning styles. The math teacher prepared a summary of materials, videos of explanation on YouTube, and a recommended textbook. Nabayra [13] stated that the videos are effective, including the videos being available on their phones so they can watch them anywhere, anytime. The teacher's voice effective design feature of the videos which manifests his/her social presence. In the interview session, a student also mentioned that their teacher's videos helped her understand the material.

School programs for welcoming students need to get attention. One of them was a literacy program to increase their interest in both reading and writing. This program has benefited students by accommodating their interest in writing and encouraging them to read a lot as a reference for their writing. Forcing students in literacy program became a recovery strategy to tackle lack of literacy in children caused by the online learning process, which is solely carried out from home without teacher supervision [14].

5 Conclusion

Based on the findings in this study, 10th-grade high school students experienced learning loss on the topic of functions and triangles. To respond to the test results, the teacher made changes in the delivery of learning methods and added a recommended source. The principal also introduced several new school programs to increase students' interest and creativity outside the classroom materials for welcoming students back to school. The main limitation of this study is it only considered the data collection of learning loss from one class of 10th-grade students in the same school in Indonesia: one might wonder if the result would be different for other classes, other topics, or other countries. The data are based on how school members responded to students' learning loss. We need further research on how the effectiveness of the changing teaching methods about students' mathematics abilities.

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