
Analysis of Elementary School Students' Numerical Abilities in Online Learning

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Abstract. Mathematics is a subject that must be mastered as it indirectly influences individuals' numerical abilities at further educational levels. This research aims to analyze the numerical analysis skills of sixth-grade elementary school students in mathematics during the Covid-19 pandemic. A qualitative descriptive approach is employed in this study. The research sample is selected using purposive sampling technique, specifically targeting students with low numerical abilities. Data are collected through observation, interviews, and documentation. The collected data are then analyzed using data reduction, presentation, and conclusion drawing techniques. `

The research findings indicate that students' learning outcomes have not yet reached an optimal level. Online learning during the Covid-19 pandemic faces various challenges. Observations and interviews reveal that online learning is not as effective as face-to-face instruction. Both teachers and students encounter limitations in implementing the learning process. Additionally, the research findings uncover errors in performing simple arithmetic operations by students. The Mid-Term Assessment results indicate that students have not achieved the maximum level of achievement. Interviews with teachers also indicate numerous barriers and difficulties in conducting effective online learning during the Covid-19 pandemic. This research holds novelty value in the context of utilizing online learning in emergency situations such as a pandemic. The research findings provide insights into the challenges and constraints faced by students and teachers in online mathematics education. To address these issues, the development of more interactive and participatory teaching strategies, as well as the utilization of diverse and engaging learning media, are necessary. Future research could explore teaching methods that enhance students' numerical abilities during online learning and develop more adaptive and innovative instructional media.

Keywords. Numerical Ability; Mathematics Learning; Online Learning

INTRODUCTION

Mathematics is one of the crucial subjects in the education curriculum, playing a pivotal role in the development of individuals' numerical abilities (Elvira & Sainuddin, 2020; Sainuddin et al., 2022). Good numerical skills are highly essential in daily life and influence students' ability to grasp further mathematical concepts at subsequent educational levels (Genc & Erbas, 2019; Reyna et al., 2009). However, with the emergence

of the Covid-19 pandemic, many schools worldwide have been compelled to adopt online learning as an alternative to ensure the safety and health of students and teaching staff.

The Covid-19 pandemic has posed serious challenges to education, including mathematics instruction (Hesmatantya & Wijaya, 2023). Online learning, which has emerged as a solution in this emergency situation, presents a number of issues that need to be understood and addressed effectively (Mpungose, 2020). In this context, it is important to examine the impact of online learning on students' numerical abilities, especially at the Elementary School (ES) level.

Several previous studies have explored the effects of online learning on students' academic achievement in various subjects, including mathematics (Sainuddin & Taufiq, 2016). For instance, some studies investigating the effectiveness of online learning on ES students during the pandemic (Dina & Sulistiani, 2022; Gopal et al., 2021; Khan et al., 2021). The findings of these studies indicate that online learning has a negative impact on students' academic achievement, including in mathematics. Other studies (Putra et al., 2020; Rasmitadila et al., 2020; Sari & Aras, 2022) found that students struggle to understand mathematical concepts virtually, and the lack of direct interaction with teachers and classmates affects their ability to apply mathematical concepts.

Furthermore, some studies have revealed that online learning is less effective than face-to-face instruction in developing mathematical problem-solving skills (Alenazi, 2022; Cao et al., 2021; Lenzen, 2013). Researchers found that students face barriers in understanding instructions delivered virtually and the lack of opportunities for direct practice with appropriate learning materials.

Although there have been previous studies examining the impact of online learning on students' numerical abilities (Lestari, 2019; Sudiasa, 2012), there is still a need to continue this research, especially in the context of online learning during the Covid-19 pandemic. This study has its own uniqueness because it involves sixth-grade ES students who face difficulties in their numerical abilities. Therefore, the aim of this study is to analyze the numerical abilities of sixth-grade ES students in mathematics learning during the Covid-19 pandemic. Using a qualitative descriptive approach, this study aims to describe the challenges and obstacles faced by students in online learning and identify factors influencing students' numerical ability achievement in the context of online learning.

Based on the facts, some research questions arising from this study are: What are the numerical abilities of sixth-grade ES students in online mathematics learning during the Covid-19 pandemic? What are the obstacles and difficulties faced by students and teachers in online mathematics learning? What are the common mistakes made by students in performing simple arithmetic operations? How can more effective learning strategies be developed in the context of online learning? By answering these questions, this study is expected to make a significant contribution to understanding the impact of online learning on students' numerical abilities and provide practical recommendations for improvement in online mathematics learning. Additionally, this research can provide insights to education policymakers on the steps needed to enhance the effectiveness of online learning in emergency situations (Astrini & Elvira, 2016).

Through this research, it is hoped that effective solutions and strategies can be found to improve online mathematics learning. One of the steps that can be taken is the development of more interactive and participatory learning strategies, utilizing various tools and features in online learning platforms. Furthermore, the use of more varied and engaging learning media can also help increase students' interest and engagement in mathematics learning.

Regarding the educational context in the digital era, this research will also provide insights into the importance of meeting the technological needs and adequate internet access for all students. This can provide input for relevant parties in addressing the technology access gap and ensuring that all students have fair opportunities in online learning. Additionally, this research will contribute to existing research literature by exploring the context of online learning during the Covid-19 pandemic. In emergency situations like this, it is important to continue conducting relevant and up-to-date research to understand and address challenges in education.

The authors hope that this research can provide a deeper understanding of students' numerical abilities in online mathematics learning. The findings of this research are expected to provide a basis for the development of more effective learning strategies and better solutions in addressing the challenges of online learning.

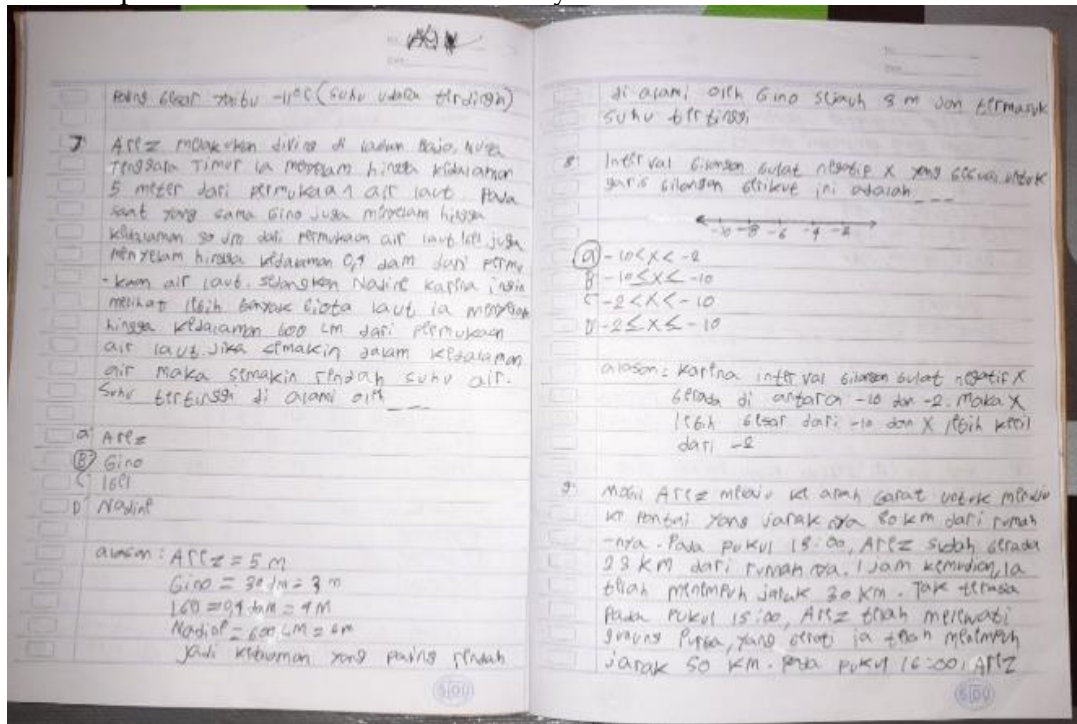
METHOD

This research was conducted using a qualitative descriptive approach. Researchers revealed and described students' numerical abilities when forced to participate in online learning during the pandemic. Data collected in this study consisted of primary and secondary data. Primary data collection was conducted by providing mathematics test sheets to students to assess their ability to answer mathematical problems in writing. The test questions used were mid-semester exam questions in multiple-choice format that already covered four indicators of numerical knowledge. Additionally, researchers conducted in-depth data mining through interviews with students and mathematics subject teachers. Researchers obtained secondary data through supporting documents such as syllabi, lesson plans (RPP), and mathematics test sheets. Researchers determined the sample using purposive sampling technique. The selected sample consisted of three sixth-grade elementary school students considered to have low numerical abilities. Data analysis technique was conducted by describing the results of observations, interviews, and documentation obtained. Furthermore, the students' learning outcomes based on the number of correct answers that could be solved by the students and the reasons for the correctness in delivering the correct answer choices will also be explained. This research used interview sheets with interview guidelines that had been validated by the researchers using content validity. Data analysis technique was carried out through data reduction, presentation, and drawing conclusions.

RESULTS AND DISCUSSION

Result

This study collected data through observations of students' answer sheets, documentation of Mid-Semester Assessment (MSA) results, and interviews with two mathematics teachers. The comments obtained through the answer sheets for mathematics questions from three elementary school students are as follows:



Figures 1. Student A's Answer

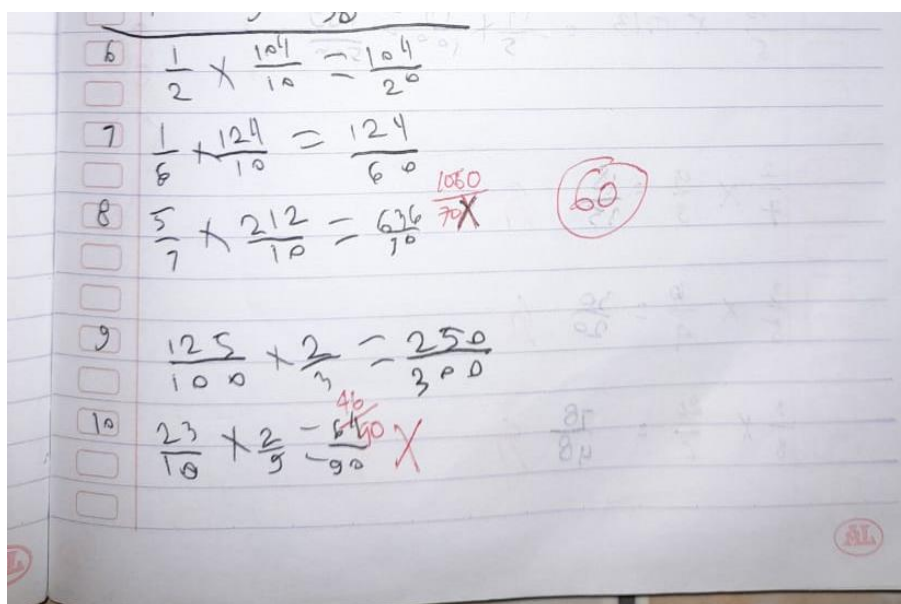


Figure 2. Student B's Answer

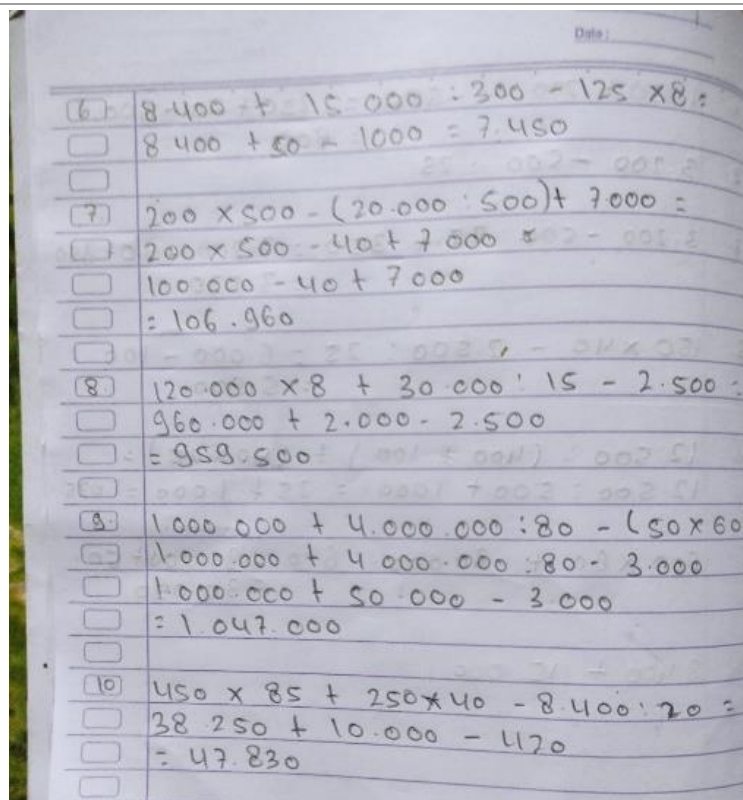


Figure 3. Student C's Answer

Table 1. Summary of Student Observation

Student	Numerical Ability	Description
A	Difficulty in explaining the sequential calculation process in word problems	Unable to explain the sequential calculation process in word problems
B	Difficulty in correctly performing multiplication operations in fraction questions	Unable to correctly perform multiplication operations in fraction questions
C	Able to solve mixed arithmetic operations correctly but fails to separate parentheses in multiplication operations	Able to solve mixed arithmetic operations correctly but fails to separate parentheses in multiplication operations

Student B experienced difficulty in correctly performing multiplication operations in fraction questions. This student was unable to calculate multiplication accurately in the context of fractions. Student B's limitations in mastering multiplication operations on fractions indicate the need to improve basic understanding of mathematical concepts. A deep and focused learning approach on understanding the concept of multiplication and its application in the context of fractions is required. Efforts to address Student B's difficulties should involve intensive practice and learning approaches that help students understand the concept of multiplication of fractions deeply.

Student C was able to solve mixed arithmetic operations correctly. However, this student did not separate parentheses in multiplication operations, which should be done according to mathematical rules. Student C's skill in carrying out mixed arithmetic operations shows good ability. However, attention needs to be given to understanding and applying the correct mathematical rules, such as separating parentheses in multiplication operations. Improving understanding of more detailed mathematical rules can help Student C improve accuracy and precision in carrying out mixed arithmetic operations.

Table 2. Learning Outcomes

Student	Mathematics MSA Result	MSA Average
A	65	68
B	60	65
C	90	85

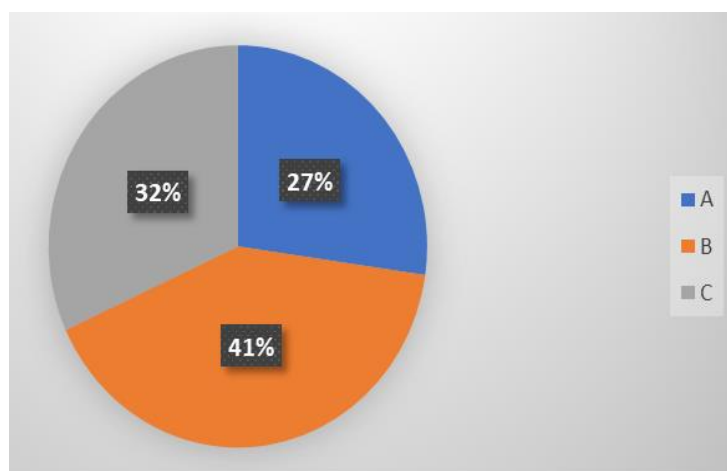


Figure 4. Percentage of Student Learning Outcomes

Additional information from the documentation of Mid-Semester Assessment (MSA) results is presented in Table 2 and Figure 4, where MSA result scores are then averaged, calculated, and presented in percentage form. Percentage improvements for each student based on expected competencies are then converted into final student grades as presented in Table 3.

Table 3. Conversion Scores

Criteria	Description
91 -100	Excellent
76 - 90	Good
61 -75	Average
51 - 60	Low
≤ 50	Very Low

Table 4. Analysis of Teaching Methods and Challenges in Online Mathematics Learning

Teacher	Teaching Method	Main Challenge	Learning Media
1	Systematic	Difficulty in engaging students in logical thinking and problem-solving	Google Classroom, YouTube
2	Direct Learning	Difficulty in maintaining students' attention	WhatsApp Group, Google Meet, Zoom Meeting, Google Forms, Quizizz, Futmath

Table 4 shows the results of interviews with two Mathematics Subject Teachers, where the interview results with the first teacher regarding the teaching methods applied in explaining calculation stages are done systematically by providing examples and guiding students before working on problems using the following steps: 1) analyzing the question command first, 2) identifying known information in the question, 3) answering the question using the required formulas. At this stage, the teacher provides example work. Meanwhile, the second teacher uses Direct Learning method when teaching through zoom meetings, google meet, WhatsApp, and Quizizz.

According to the first teacher, the constraints experienced are when assisting students in logical thinking and problem-solving. He tends to use instant methods by using gadgets to search for and solve problems. Therefore, it is difficult to encourage thinking and problem-solving. Meanwhile, the second teacher has difficulty in focusing students' attention. The learning models used by both teachers to help students understand numerical patterns, especially in improving students' numerical abilities, are Project Based Learning and Discovery Learning.

The first teacher's learning media in online learning is still limited to Google Classroom and YouTube. Meanwhile, the second teacher uses media such as WhatsApp groups, Google Meet, Zoom meetings, Google Forms, Quizizz, and Fun math. According to the first teacher, students' numerical abilities during the online learning period are still relatively low. Students often have difficulty understanding some forms of problem-based questions, such as formulas or concepts not covered in the questions. Students tend to prefer using applications to do practice problems.

Meanwhile, according to the second teacher, the analysis of students' abilities has not been fully optimized. This is due to online learning having many non-technical constraints. However, during video communication via Zoom meetings, research shows that no more than 30% of students have good numerical abilities, and the rest have low numerical analysis.

According to both teachers, students' mathematics learning outcomes are unsatisfactory. About 50% of students reach the Minimum Competency Standard (MCS). Constraints in teaching mathematics online include: 1) Technical constraints ranging from unstable internet connections, high internet tariffs from providers available in the Tarakan area, device ownership by each student; 2) Constraints from the students

themselves, sometimes students feel bored and tired when learning using gadgets due to their limitations in expressing answers and opinions. At the same time, the second teacher conveyed the constraints experienced, namely the interest and motivation of students to participate in online learning. Meanwhile, according to the first teacher, the challenges in teaching during the COVID-19 pandemic are to provide understanding to students about basic concepts in solving mathematical problems in their own way. At the same time, the second teacher explained the obstacles experienced, namely creating interest and motivation for online learning for students who are starting to get bored.

The study results indicate that students' learning achievements have not been fully optimal. Several problems were faced during online learning during the COVID-19 pandemic. Based on observations and interviews, researchers concluded that this occurred because learning was done online, making education less effective. Teachers and students have limitations in carrying out the learning process. According to the teachers' explanations, some students are very enthusiastic about learning but have low absorption rates.

Meanwhile, on the other hand, some students were initially very active during face-to-face education. Students who were busy during face-to-face learning became slow and passive. This condition makes them reluctant to do learning activities given by teachers, including completing tasks after participating in online learning.

Discussion

Several learning issues during the COVID-19 pandemic revealed in the research include students' difficulties in utilizing logical skills in solving mathematical problems; they tend to use instant methods using gadgets and applications to solve problems when given assignments or exercises (Mamolo, 2022).. This statement supports the notion that students tend to be lazy in solving mathematical problems during online learning and prefer to use alternatives such as mathematical tools and applications (Lumbantoruan & Male, 2022).

Learning media remains limited, so learning during the COVID-19 pandemic is not as optimal as face-to-face learning. Undeniably, learning during the COVID-19 pandemic requires teachers and students to use online-based learning media in a short time (Salim & Hanif, 2021). This rapid change creates various constraints in the learning process for teachers in those areas who still lack knowledge of information technology (Zainal, 2020).

Students' low-level numerical abilities are generally caused by students often not understanding non-routine problem-based questions (Legarde, 2022; Widodo & Kartikasari, 2017). This may be due to changes in teaching methods (from offline to online) causing students difficulty in understanding the material (Hamid et al., 2020). Especially if online learning has many non-technical constraints, this causes the analysis of students' abilities cannot be done optimally.

Teachers consider obstacles in delivering material during online learning during the pandemic have an impact on students' numerical abilities. Future teachers must make more effort to guide students to think logically to improve students' numerical abilities.

This is also in line with research results showing that numerical abilities can be optimized through intensive practice, understanding new terms, and mathematics courses (Cohen Kadosh et al., 2013; Wongupparaj & Kadosh, 2022). Simply put, mathematics only consists of arithmetic operations of addition, subtraction, multiplication, and division. In addition, the level of thinking ability of each student needs to be honed to support problem-solving skills in improving numerical abilities (Huang et al., 2020). This study provides a direct comparison to identify better predictors of numerical operations and mathematical problem-solving in normally developing children (Widjaja, 2013). Fatoke et al. (2013) state that there is a significant relationship between numerical ability and problem-solving skills. The contribution of numerical knowledge to students' ability to solve mathematical problems shows that the higher students' numerical abilities, the higher their problem-solving abilities. Furthermore, researchers hope that students can improve their performance through changes in study habits (Borba et al., 2016). Learning habits/patterns and learning facilities are also enhanced to influence students' thinking and improve learning outcomes.

Based on the observations and discussions conducted, it can be concluded that students' numerical abilities in facing online learning, especially during the COVID-19 pandemic, still show various levels of proficiency. Some students encounter difficulties in explaining sequential calculation processes in word problems, correctly performing multiplication operations in fraction questions, and properly handling parentheses in multiplication operations. These findings indicate challenges in fostering students' numerical abilities within the context of online learning. Several studies have shed light on this issue. According to Vygotsky's (1978) instruction tailored to students' actual developmental levels can assist them in overcoming difficulties and enhancing their abilities. Additionally, Dewi (2021) suggests that online learning may diminish social interaction between teachers and students, potentially impacting teaching quality and student understanding. In contrast, Joksimović et al (2015) indicate that online learning can provide flexibility for students to grasp materials independently, thereby enhancing their self-reliance in learning.

In the context of online learning, there are several factors that can affect students' numerical abilities, such as limited learning media, lack of experience in using technology, and students' learning motivation (Nortvedt & Wiese, 2020; Wongupparaj & Kadosh, 2022). Therefore, deeper efforts are needed to improve students' numerical abilities during online learning (Bouck & Long, 2023; Sipayung et al., 2022). One solution that can be implemented is the use of more interactive and participatory learning methods, the development of more varied and interesting learning media, and an approach that encourages students to think logically and apply mathematical concepts in problem-solving (Anitha & Kavitha, 2022; Cóndor-Herrera & Ramos-Galarza, 2021).

Finally, this research provides an important contribution to understanding the challenges faced by students in developing numerical abilities during online learning. In an evolving context, continuous efforts need to be made to improve online learning by considering factors that affect students' numerical abilities. Thus, it is hoped that the results of this research can provide insights and recommendations for educators and

policymakers in improving the effectiveness of mathematics learning during emergency situations such as the COVID-19 pandemic.

CONCLUSION

Based on the results of the research and discussions conducted, it can be concluded that students' numerical abilities during online learning amid the COVID-19 pandemic face various challenges. There is variation in students' ability to answer numerical problems, especially in terms of understanding word problems, multiplication operations, and the use of parentheses. This indicates the need for more intensive efforts to improve students' numerical abilities in the context of online learning. Regarding the context of online learning, several factors influencing students' numerical abilities were found, such as limitations of learning media, lack of technological experience, and students' level of learning motivation. Therefore, an interactive and participatory learning approach, development of diverse learning media, and efforts to encourage students to think logically and apply mathematical concepts in problem-solving are needed. As a next step, it is recommended to continue improving online learning by considering the factors influencing students' numerical abilities. Educators and policymakers need to develop more innovative teaching methods, use engaging learning media, and pay special attention to students' learning motivation. Additionally, it is important to continue strengthening the collaboration between teachers, students, and parents in supporting students' numerical learning processes during online learning. This conclusion can serve as a guide for education practitioners in enhancing the effectiveness of mathematics learning during emergency situations such as the COVID-19 pandemic. By addressing these challenges, it is hoped that students can develop better numerical abilities and achieve optimal learning outcomes.

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