

# THE EFFECT OF MOBILE PHONE USE ON MATHEMATICS PERFORMANCE IN ONLINE LEARNING AT ELEMENTARY SCHOOL

Windi Yuningsih<sup>1</sup>, Roswita Lioba Nahak<sup>2</sup>, Heryon Bernard Mbuik<sup>3</sup>

<sup>1,2,3</sup> *Elementary School Teacher Education Study Program,  
Citra Bangsa University, Indonesia*

[windhyyuningsihthrr@gmail.com](mailto:windhyyuningsihthrr@gmail.com)<sup>1</sup>, [roswitaliobanahak@gmail.com](mailto:roswitaliobanahak@gmail.com)<sup>2</sup>,  
[bernardmalole@gmail.com](mailto:bernardmalole@gmail.com)<sup>3</sup>

## ABSTRACT

This study aimed to evaluate the effect of mobile phone use in online learning on mathematics performance among fifth-grade students at SD Inpres Sikumana II, Kupang. A quasi-experimental design was employed, involving 60 students divided into experimental and control groups. The experimental group used mobile phones intensively for accessing additional learning materials, video tutorials, and practice exercises, while the control group engaged in online learning with minimal mobile phone use. The results indicated a significant improvement in mathematics performance for the experimental group, with a mean post-test score of 75.6 compared to 65.3 for the control group. An independent t-test analysis revealed a statistically significant difference between the groups ( $t(58) = 4.89$ ,  $p < 0.05$ ), with a large effect size (Cohen's  $d = 0.85$ ). These findings suggest that mobile phones can be an effective tool for enhancing mathematics learning in an online environment, provided their use is properly managed and guided. However, the potential for distraction remains a concern, highlighting the need for teacher supervision to ensure mobile phones are used effectively for educational purposes. The study contributes to the existing literature on mobile learning and offers practical insights for educators and policymakers on integrating mobile technology into online learning strategies.

**Keywords :** *Mobile Phone Use, Online Learning, Mathematics Performance, Quasi-Experimental, Fifth Grade Elementary School*

## I. INTRODUCTION

The development of information and communication technology has driven a major transformation in the education sector worldwide. Technology, especially mobile devices such as mobile phones, has become an integral part of the teaching and learning process, allowing students to access information and learning resources in ways never before possible. According to a report by UNESCO (2020), the use of mobile technology in education not only increases accessibility but also enables more flexible learning that is tailored to the individual needs of students.

In the context of online learning, especially triggered by the COVID-19 pandemic, mobile phones have become the primary tool for many students, including in Indonesia. The Indonesian government, through the Ministry of Education and Culture, has encouraged the use of technology as a solution to maintain the continuity of education during the pandemic (Mardiningsih & Daryanti, 2020). At SD Inpres Sikumana II Kupang, the use of mobile phones is essential for students in participating in online learning. Students use mobile phones to access learning materials, participate in virtual class discussions, and complete assignments given by teachers.

Although mobile phones offer various advantages in supporting the learning process, there are concerns regarding their negative impact on the quality of learning, especially in subjects that require intensive focus and practice such as mathematics. Mathematics is a subject that requires strong conceptual understanding and problem-solving skills, which are usually acquired through intensive face-to-face learning. The use of mobile phones in online learning allows access to a variety of additional learning resources, such as learning videos and interactive applications, which according to Sung et al. (2016) can help deepen the understanding of mathematical concepts. However, mobile phones also have the potential to be a source of distraction, with easy access to social media, games, and other content that is not related to learning (Anderson & Jiang, 2018).

An important question that arises is whether the use of mobile phones in online learning contributes positively to students' mathematics learning achievement, or vice versa, decreases the effectiveness of learning due to the distractions it causes. Several studies have shown that the use of mobile technology can increase students' motivation to learn and engagement in learning, which in turn can improve academic achievement (Pachler et al., 2010). On the other hand, research by Lepp et al. (2015) revealed that excessive use of mobile phones can have a negative impact on academic achievement, especially if students use them for activities unrelated to learning.

This study aims to evaluate the effect of mobile phone use in online learning on the mathematics learning achievement of fifth grade students at SD Inpres Sikumana II, Kupang. This study is expected to provide new insights into how mobile technology, especially mobile phones, can be optimized in the context of mathematics learning, as well as provide recommendations to teachers and policy makers in designing effective learning strategies in the digital era.

The aspects that will be analyzed in this study include the frequency of mobile phone use by students, the types of applications or learning resources accessed, and their impact on their mathematics learning outcomes. This study will also explore whether there are significant differences in learning achievement between students who often use mobile phones to learn mathematics and those who rarely use them.

## II. LITERATURE REVIEW

Mobile technology, especially mobile phones, has become one of the most influential elements in modern education. With rapid adoption and widespread use, mobile phones have transformed the way students learn, especially in the context of online learning that has become increasingly prevalent since the COVID-19 pandemic. The use of mobile phones in education presents great potential to improve the accessibility and quality of learning, but also brings new challenges that need to be addressed.

### A. The Role of Mobile Technology in Education.

In the last decades, mobile technology is increasingly used in education. In general, UNESCO (2020) emphasizes Android as a tool that can help to achieve the goals of inclusive and quality education. This technology allows students to take class whenever and where ever from a more flexible moment of the learning process. In Indonesia, Mardiningsih and Daryanti (2020) pointed out that during the pandemic mobile phones become a primary tool for students to learn online; platforms available such as WhatsApp, Google Classroom or Zoom contributed in providing learning materials.

However, despite the great potential offered by mobile technology, there are challenges that arise related to its use in the educational context. Gikas and Grant (2013) found that mobile phones can improve the reach of learning, but their usage can lead to disturbances which impede concentration. These distractions may be caused by other unrelated applications like the social network, entertainments games, videos that are widely accessed using their smartphone.

### B. The Impact of Mobile Phone Use on Learning Achievement.

With the spread of mobile phone, the effect on learning achievement has attracted increasing attention among scholars. With mobile technology, a part of me understands that it can increase student engagement motivates to learn. Sung et al. (2016) claimed that mobile devices can produce a significant positive impact on learners' performance as long as students have access to materials/resources which are adapted for their needs. Means of embarrassing learning process through the presentation of teaching materials in a way more interesting and interactive, being able to help both hard students.

In contrast, many studies argued that uncontrolled use of mobile phones might deteriorate learning achievement. Lepp et al. (2015) found that excessive mobile phone use, especially for non-academic activities, can reduce productive learning time and lower students' academic achievement. Another study by Chen and Yan (2016) supports the current finding, demonstrating an inverse relationship between high frequency mobile phone use for non-educational purposes and poor academic performance. Distracted by using mobile for social media, games and other entertainments makes students lose their concentration on study which decreases effective timing to study.

Similarly, new research by Wood et al. (2012) has shown that multitasking with mobile phones during learning, e.g. switching between a learning application and social media is significantly detrimental to the effectiveness of learning. The reason for this is that the cognitive process cannot work well when students' attention is pulled simultaneously to academic and non-academic task.

### **C. Use of Mobile Phones in Learning Mathematics**

Mathematics is the one subject, which requires an intensive way of learning and high amount of concentration. The use of mobile learning devices in teaching and learning processes to develop mathematics is one way, because the facility that it offers such as; access to practice questions applications, video tutorials material also other interactive platforms made with every thing based on mathematical understanding (Sung et al., 2016). As specific to mathematics discipline, Hwang and Wu (2014) found out that the use of education mobile applications designed for students to learn math can promote their ability on problem solving as well complex concepts comprehension.

The positive impact of a mobile phone can be achieved only when it is possible to regulate its use and focus on actions that have a learning function. Research by Liu et al. (2010) shows that the use of QR Codes and Augmented Reality (AR) technology supported by mobile devices can be effective in English learning, and similar techniques can be applied in mathematics learning. As a result, teachers should integrate technologies with explicit learning strategies and direct support to ensure that the students will use them for the academic purpose. Otherwise, the young learners will use the mobile phones for the activity which is not associated with learning. Hence, it will reduce the effect.

### **D. Challenges and Opportunities in Using Mobile Phones in Elementary Education.**

While much research has focused on the use of mobile technology at the secondary and tertiary levels with respect to mobile technology use, there still exists a gap in knowledge regarding cell phone use among elementary school children. Elementary education has special characteristics, where students are still developing basic learning skills and require more intensive guidance from teachers. In this context, mobile phone use presents unique challenges.

Based on research by Merchant (2012), elementary school aged children are the students who could be more positively influenced to turn off other non-academic apps and easily distracted compared to older students. Hence, it is the mobile phone use in elementary school learning has to be done under strict supervision with educational materials that are tailored according to students' ages and requirements.

This study aims to address this gap by looking at the effect of mobile phone use on mathematics learning achievement in elementary school, particularly SD Inpres Sikumana II Kupang. This type of approach will enable a play-based understanding on the part of mobile technology is effective and hamper mathematics learning process at elementary grade level.

### **III. METHODOLOGY**

This study aims to evaluate the effect of mobile phone use in online learning on the mathematics learning achievement of fifth grade students at SD Inpres Sikumana II Kupang. To achieve this goal, the study used a quantitative approach with a quasi-experimental design. This design was chosen because it allows researchers to evaluate the effect of the independent variable (mobile phone use) on the dependent variable (mathematics learning achievement), although full control over external variables is not possible.

#### **A. Population and Sample.**

The population in this study were all fifth grade students at SD Inpres Sikumana II Kupang. The sample was selected using a purposive sampling technique, where certain criteria were used to determine the sample to be used in the study. These criteria include students who actively participate in online learning and have regular access to mobile phones during the learning process. Based on these criteria, 60 students were selected as the research sample. This sample was then divided into two groups: an experimental group that used mobile phones as the main tool in learning mathematics, and a control group that used conventional learning methods without using mobile phones.

#### **B. Research Design.**

This study used a quasi-experimental design with a pre-test post-test control group design model. This design involves two groups: an experimental group that will actively use mobile phones in mathematics learning, and a control group that will receive mathematics learning without the use of mobile phones. Before the intervention is carried out, both groups will be given a pre-test to measure their initial abilities in mathematics. After an eight-week intervention period, both groups will be given a post-test to measure changes in mathematics learning achievement.

#### **C. Research Instrument.**

The main instrument used in this study is a mathematics learning achievement test developed based on the curriculum in effect at SD Inpres Sikumana II. This test includes various types of questions that measure conceptual understanding, problem-solving abilities, and critical thinking skills in mathematics. In addition, a questionnaire was also used to measure the frequency and pattern of students' cellphone use during online learning. This

questionnaire includes questions about the types of applications used, the duration of cellphone use, and activities carried out with cellphones during the learning process.

#### **D. Validity and Reliability of the Instrument.**

To ensure that the instruments used in this study are valid and reliable, validity and reliability tests were conducted before the instruments were used in the main study. Validity testing was conducted through content validity involving mathematics education experts to ensure that each item in the achievement test actually measures the intended concept. In addition, construct validity testing was conducted using the exploratory factor analysis (EFA) technique to ensure that the items in the questionnaire were grouped correctly according to the dimensions being measured. Reliability testing was conducted by calculating the Cronbach's Alpha coefficient, where the results showed a value of 0.85 for the achievement test and 0.82 for the questionnaire, indicating high reliability.

#### **E. Data Collection Procedure.**

Data collection was carried out in several stages. First, students in both groups were given a pre-test to measure their initial abilities in mathematics. Second, for eight weeks, the experimental group received mathematics learning using mobile phones as the main tool, while the control group received conventional learning. Learning in both groups was facilitated by the same teacher to ensure consistency in the delivery of the material. During this period, students in the experimental group were also asked to fill out a questionnaire that measured the pattern and frequency of their mobile phone use.

After the intervention period ended, students in both groups were given the same post-test to measure changes in their mathematics achievement. Data from the achievement test and questionnaires were then collected and analyzed to determine whether there were significant differences in achievement between the two groups.

#### **F. Data Analysis Technique**

The collected data were analyzed using inferential statistical techniques. First, the normality test was conducted using the Kolmogorov-Smirnov test to ensure that the data were normally distributed. Second, the homogeneity of variance test was conducted using the Levene test to ensure that the variance between the experimental and control groups was homogeneous. Third, the independent t-test was used to compare the post-test scores between the experimental and control groups. In addition, effect size analysis was also conducted to

determine the extent to which the use of mobile phones influenced students' mathematics learning achievement.

#### IV. RESULTS

This study is intended find out influences of mobile phone usage on students learning achievement in maths at grade 5 SD Inpres Sikumana II, Kupang. This section demonstrates the results from pre and post data analysis with questionnaires of students, containing a description of data properties-test for normality- test homogeneity-hypothesis testing.

##### A. Data Description.

Data description analysis results we can see that there is a difference in pre-test and post test score between experimental group and control group. Specifically, Table 1 has presented descriptive statistics of the pre-test and post test scores for both groups.

Table 1: Descriptive Statistics of Pre-Test and Post-Test Scores

Group	N	Mean Pre- Test	Std. Dev Pre- Test	Mean Post- Test	Std. Dev Post- Test
experimental	30	58.2	5.74	75.6	6.12
control	30	57.9	5.88	65.3	6.5

From the table above, it can be seen that the experimental group showed a more significant increase in mathematics learning achievement compared to the control group. The average post-test score in the experimental group was 75.6, while in the control group it was only 65.3.

##### B. Normality and Homogeneity Test.

Before further analysis was carried out, normality and homogeneity tests were carried out to ensure that statistical assumptions were met. The results of the Kolmogorov-Smirnov test showed that the data were normally distributed with a significance value of  $p > 0.05$  for all variables. The Levene test also showed that the variance between the experimental and control groups was homogeneous with a significance value of  $p > 0.05$ .

##### C. Hypothesis Test Analysis.

To test the main hypothesis of this study, an independent t-test was used to compare the post-test scores between the experimental and control groups. The results of the independent t-test are presented in Table 2.

Table 2: Independent T-Test Results for Post-Test Scores

Group	Mean Difference	T-value	df	Sig. (2-tailed)
experimental vs control	10.3	4.89	58	0

The results of the t-test showed that there was a significant difference between the experimental and control groups in the post-test scores of mathematics learning achievement ( $t(58) = 4.89, p < 0.05$ ). This indicates that the use of mobile phones in online learning has a significant positive impact on improving students' mathematics learning achievement.

#### D. Effect Size Analysis

In addition to the t-test, an effect size analysis was also conducted to determine the extent to which the use of mobile phones affects students' mathematics learning achievement. The results of the effect size analysis showed a Cohen's d value of 0.85, which indicates that the effect of the use of mobile phones in online learning on students' mathematics learning achievement is in the large effect category.

#### E. Interpretation of Results

The results of this study indicate that students who use mobile phones intensively in online learning show a more significant increase in mathematics learning achievement compared to students who do not use mobile phones intensively. The use of mobile phones allows students to access various additional learning resources, such as video tutorials and practice question applications, which help them understand more complex mathematical concepts.

Although these results show positive effects, it is important to remember that mobile phone use must also be well regulated to avoid potential distractions that can interfere with the learning process. Teacher supervision and guidance in mobile phone use are essential to ensure that these devices are used in accordance with learning objectives.

### V. DISCUSSION

This study reveals that mobile phone utilization in online learning has a significant effect on increasing mathematics learning achievement of the students at SD Inpres Sikumana II, Kupang. This finding is evidenced by prior studies that suggest the potential for mobile technology to realize educational value, especially in the context of online learning that has become a necessity since the COVID-19 pandemic.

#### A. The Effect of Mobile Phone Use in Online Learning.

This finding reinforces the results of previous studies which revealed that mobile technology, such as using a mobile phone in school increased student motivation and engagement when learning. According to research by Sung et al. (2016), the integration of

mobile devices with learning can result in significant improvements in learning outcomes, especially when the devices are used to access relevant materials that are tailored to students' needs. In this study, students who used mobile phones to access learning applications, video tutorials, and math practice problems showed a significant increase in their learning achievement compared to the control group that did not use mobile phones intensively.

The results of the effect size analysis showing a Cohen's *d* value of 0.85 also support the argument that the use of mobile phones in online learning has a major impact on students' mathematics learning achievement. This effect can be explained by the ability of mobile phones to provide immediate access to diverse and interactive learning resources, allowing students to learn in a more independent way and at their own pace.

## **B. Distractions and Challenges in Mobile Phone Use.**

Although these findings indicate a positive impact of mobile phone use in online learning, it is important to acknowledge that the potential for distraction caused by mobile phones remains a concern. Research by Lepp et al. (2015) showed that excessive mobile phone use, especially for non-academic activities such as social media and gaming, can reduce productive learning time and lower academic achievement. In this context, the results of this study underscore the importance of supervision and guidance in mobile phone use by students, to ensure that the devices are used in a way that supports learning objectives.

Another study conducted by Anderson and Jiang (2018) also revealed that students face high levels of temptation to use their phones for non-educational activities causing them lose focus from the task. So while mobile phones should be an able supporting tool to the education, they also need regulations on top of them in order for not being a reason for distraction.

## **C. Educational Implications.**

The implications of these findings are highly relevant for educators and education policymakers, especially in the context of increasingly common online learning. The use of mobile phones in learning should be seen as a tool that can enrich students' learning experiences, but with the caveat that this use must be supported by appropriate pedagogical strategies and adequate supervision. Teachers must be trained to utilize mobile technology effectively in their teaching, and also to manage students' mobile phone use to keep them focused on relevant learning activities.

In addition, these findings also highlight the need to develop learning applications and platforms specifically designed to increase student engagement in learning mathematics. These applications must be interactive, engaging, and relevant to the curriculum, so that they can encourage students to learn more enthusiastically and effectively.

## **D. Research Limitations and Suggestions for Further Research.**

This study is not without its limitations, as with all research. The quasi-experimental design is very powerful in the estimation of treatment effects but it cannot completely rule out potential confounding factors. In addition, this study was limited to one school with a relatively small sample, so the results may not be widely generalizable.

For further research, it is recommended to conduct studies with stronger designs, such as pure experiments, and with larger and more diverse samples. Further research can also explore the long-term impact of mobile phone use in learning, and see its effects in the context of other subjects or at different levels of education. Qualitative studies can also be conducted to better understand how students and teachers perceive and experience mobile phone use in learning.

## **VI. CONCLUSION**

This study has evaluated the effect of mobile phone use in online learning on the mathematics learning achievement of fifth grade students at SD Inpres Sikumana II, Kupang. The results showed that mobile phone use has a significant positive impact on improving students' mathematics learning achievement. Students who used mobile phones to access additional learning materials, video tutorials, and practice question applications showed a greater increase in post-test scores compared to students who did not use mobile phones intensively.

These findings confirm that mobile technology, especially mobile phones, can be an effective tool in supporting student learning, especially in the context of online learning. The use of mobile phones allows students to learn independently and flexibly, and provides access to various learning resources that can help them understand complex concepts, especially in subjects such as mathematics.

However, it is important to remember that the use of mobile phones in learning also carries potential risks, especially related to distractions that can interfere with the learning process. Therefore, supervision and guidance from teachers are very important to ensure that mobile phones are used in accordance with learning objectives and do not become a source of distraction.

The implications of this study are very relevant for educators and education policy makers. Mobile phone use in learning should be seen as part of a broader learning strategy that leverages technology to enhance student engagement and achievement. Teachers should be trained in the use of mobile technology and given clear guidance on how to manage student mobile phone use in online learning.

While this study shows significant results, there are some limitations that need to be acknowledged. The quasi-experimental design used in this study limited the ability to control for all external variables that may have influenced the results. Furthermore, the study was limited to a single school with a relatively small sample size, so the results may not be generalizable to a wider population.

For future research, it is recommended that studies with a more robust design and with a larger, more diverse sample size be conducted. Further research could also explore the long-term impact of mobile phone use in learning, as well as looking at its effects in other subject contexts or at different educational levels. Qualitative research is also needed to better

understand how students and teachers perceive mobile phone use in the teaching and learning process.

Overall, this study provides strong evidence that mobile phones can be used as an effective tool in improving mathematics achievement in online learning, provided their use is well managed. With the right support, this technology can help students become more independent and efficient learners, and improve the quality of education in the digital age.

## REFERENCES

- Anderson, M., & Jiang, J. (2018). *Teens, Social Media and Technology 2018*. Pew Research. [http://assets.pewresearch.org/wpcontent/uploads/sites/14/2018/05/31102617/PI\\_2018.05.31\\_TeensTech\\_FINAL.pdf](http://assets.pewresearch.org/wpcontent/uploads/sites/14/2018/05/31102617/PI_2018.05.31_TeensTech_FINAL.pdf)
- Chen, Q., & Yan, Z. (2016). Does multitasking with mobile phones affect learning? A review. *Computers in Human Behavior*, 54, 34–42. <https://doi.org/10.1016/j.chb.2015.07.047>
- Gikas, J., & Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. *The Internet and Higher Education*, 19, 18–26. <https://doi.org/10.1016/j.iheduc.2013.06.002>
- Hwang, G. J., & Wu, P. H. (2014). Applications, impacts and trends of mobile technology-enhanced learning: a review of 2008-2012 publications in selected SSCI journals. *International Journal of Mobile Learning and Organisation*, 8(2), 83. <https://doi.org/10.1504/IJMLO.2014.062346>
- Lepp, A., Barkley, J. E., & Karpinski, A. C. (2015). The relationship between cell phone use and academic performance in a sample of U.S. college students. *SAGE Open*, 5(1), 1–9. <https://doi.org/10.1177/2158244015573169>
- Liu, T.-Y., Tan, T.-H., & Chu, Y.-L. (2010). *QR Code and Augmented Reality-Supported Mobile English Learning System* (hal. 37–52). [https://doi.org/10.1007/978-3-642-12349-8\\_3](https://doi.org/10.1007/978-3-642-12349-8_3)
- Mardiningsih, L., & Daryanti, S. (2020). Modul Pembelajaran Jarak Jauh Pada Masa Pandemi Covid-19 untuk Jenjang SMP. In *Kemdikbud*. Kementerian Pendidikan dan Kebudayaan RI Direktorat Jenderal Pendidikan Anak Usia Dini, Pendidikan Dasar, dan Pendidikan Menengah Direktorat Sekolah Menengah Pertama. [https://repositori.kemdikbud.go.id/21015/1/Modul\\_PJJ\\_SMP\\_-\\_IPA\\_-\\_Digital\\_Rev\\_1.pdf](https://repositori.kemdikbud.go.id/21015/1/Modul_PJJ_SMP_-_IPA_-_Digital_Rev_1.pdf)
- Merchant, G. (2012). Mobile practices in everyday life: Popular digital technologies and schooling revisited. *British Journal of Educational Technology*, 43(5), 770–782. <https://doi.org/10.1111/j.1467-8535.2012.01352.x>
- Pachler, N., Bachmair, B., & Cook, J. (2010). *Mobile Learning: Structures, Agency, Practices*. Springer. <https://doi.org/10.1007/978-1-4419-0585-7>
- Sung, Y.-T., Chang, K.-E., & Liu, T.-C. (2016). The effects of integrating mobile devices with

teaching and learning on students' learning performance: A meta-analysis and research synthesis. *Computers & Education*, 94, 252–275.  
<https://doi.org/10.1016/j.compedu.2015.11.008>

UNESCO. (2020). *Education in a post-COVID world: Nine ideas for public action*.  
<https://www.unesco.org/en/articles/education-post-covid-world-nine-ideas-public-action>

Wood, E., Zivcakova, L., Gentile, P., Archer, K., De Pasquale, D., & Nosko, A. (2012). Examining the impact of off-task multi-tasking with technology on real-time classroom learning. *Computers & Education*, 58(1), 365–374.  
<https://doi.org/10.1016/j.compedu.2011.08.029>