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Optimizing Mathematics Learning through Digital Media: Classroom Action Research on Elementary School Students

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Article Info

Abstract
This research aims to improve the mathematics learning outcomes of grade 5 students at Tunas Daud Elementary School, Bali, through digital media-based learning methods. Using Classroom Action Research with two cycles and a post-test, the research subjects involved 18 students. The results of the one-way ANOVA test showed an increase in the average value from 78.15 (cycle 1) to 83.26 (cycle 2) and 89.63 (post-test) with a P-value of 0.032 (P<0.05). This method is effective in increasing student motivation and understanding, although other factors also influence learning outcomes. This research offers guidance for teachers to integrate digital media in mathematics learn.

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Introduction

Improving the quality of education is one of the main priorities to create a generation that is able to compete in the global era. Mathematics, as one of the strategic subjects, has an important role in training students' logical and analytical thinking skills. However, in reality, mathematics is often considered difficult by some students, including 5th grade students at SD Tunas Daud, Bali. This difficulty is often caused by teaching methods that are less interesting, monotonous, and not in accordance with the digital world that is familiar to students. As a result, students' learning motivation decreases, which ultimately has an impact on the achievement of suboptimal learning outcomes.

One approach that can be applied is media and digital-based learning. Digital media such as interactive videos, educational applications, and online learning platforms are able to present materials that are more interesting and easier for students to understand (Nurjanah & Mukarromah, 2021) [1]. This approach can also adapt to various student learning styles and encourage their active participation in the learning process (Ulia & Sari, 2018) [2]. In addition, digital technology opens up opportunities to integrate various relevant learning resources, thereby enriching students' learning experiences.

Classroom Action Research (CAR) is a relevant method to identify and address learning problems systematically in the classroom. CAR allows teachers to design, implement, evaluate, and reflect on the learning strategies applied (Prihantoro & Hidayat, 2019) [3]. In this context, CAR can be used to evaluate the effectiveness of media and digital-based learning methods in improving mathematics learning outcomes of grade 5 students at SD Tunas Daud.

To measure the effectiveness of the learning method, statistical analysis is important. One technique that can be used is the one-way ANOVA test which aims to compare the average learning outcomes between groups of students. Through the one-way ANOVA test, it can be seen whether there are significant differences in the learning outcomes of students using media-based and digital methods compared to conventional methods. This analysis is expected to provide in-depth insight into the benefits of using digital technology in mathematics learning. The results of this study are expected to contribute to the development of innovative, fun, and effective learning models in elementary schools, especially for mathematics subjects. In addition, this study is also expected to be a guide for teachers in integrating digital technology into the learning process to improve student motivation and learning achievement.

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Research Method
This study uses a Classroom Action Research approach consisting of two cycles, with each cycle covering the stages of planning, implementation, observation, and reflection. The subjects of the study were 18 5th grade students of SD Tunas Daud in Bali. The purpose of this study was to improve mathematics learning outcomes through the application of media-based and digital learning methods.

Research Stages
1. Cycle 1:
- Planning: Develop a learning plan based on interactive digital media, such as animated videos and digital quizzes, and prepare assessment instruments for task 1.
- Implementation: Carrying out learning according to the plan that has been prepared.
- Observation: Recording student activities and identifying obstacles that arise during the learning process.
- Reflection: Analyse the results of task 1 and design improvements for the next cycle.

2. Cycle 2
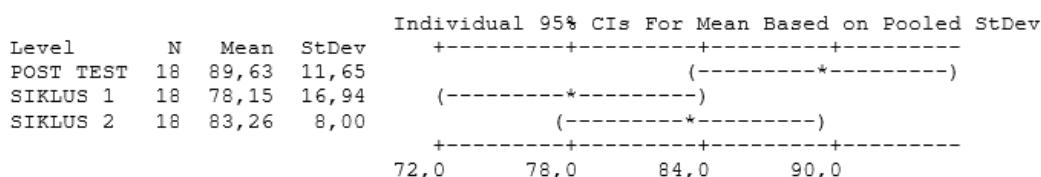- Planning: Revise the learning plan based on reflections from cycle 1.

Result and Discussion
The research will consist of two cycles and a post-test.

- Implementation: Implement learning with improved methods.
- Observation: Observing changes in student behaviour and learning effectiveness.
- Reflection: Evaluate the results of task 2 to ensure whether the learning objectives have been achieved.

3. Post-Test:
- After cycle 1 and cycle 2 were completed, a post-test was conducted to measure overall learning outcomes.

Research instruments
The instruments used to conduct this research include
- Observation sheets to monitor student activities during learning.
- Assignment questions for cycle 1 and cycle 2.
- Post-test questions to evaluate student learning outcomes.

Data Analysis
The data obtained were analyzed using one-way ANOVA test to compare student learning outcomes in cycle 1, cycle 2, and post-test. This analysis was used to identify significant differences in student learning outcomes after the implementation of media-based and digital learning methods. [14].

One-way ANOVA: NILAI versus TAHAP

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Source  DF    SS   MS     F      P
TAHAP    2  1191  596  3,67  0,032
Error   51  8273  162
Total   53  9464

S = 12,74   R-Sq = 12,59%   R-Sq(adj) = 9,16%


                               Individual 95% CIs For Mean Based on Pooled StDev
Level        N   Mean  StDev   +---------+---------+---------+---------
POST TEST   18  89,63  11,65                        (---------*---------)
SIKLUS 1    18  78,15  16,94    (---------*---------)
SIKLUS 2    18  83,26   8,00            (---------*---------)
                               +---------+---------+---------+---------
                              72,0      78,0      84,0      90,0
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Based on the ANOVA results, the P-value obtained was 0.032, so P<0.005 means rejecting H0, so there is significance at each stage.

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                    Pooled StDev = 12,74

Level        N   Mean  StDev
POST TEST   18  89,63  11,65
SIKLUS 1    18  78,15  16,94
SIKLUS 2    18  83,26   8,00
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It can be seen from the results of the one-way ANOVA test that the average value in cycle 1 was 78.15 then increased in cycle 2 to 83.26 and increased in the post-test stage to 89.63.

This shows an increase in the value of each stage.
• **Comparison of Cycle 1 with Cycle 2**
Cycle 2 showed an increase in mean scores compared to

Cycle 1 (83.26 vs. 78.15), although the increase was not as large as the increase seen between Cycle 1 and Post-Test. This suggests that while there was an increase in learning outcomes, other factors such as consistency in the implementation of learning, classroom management, or evaluation techniques may have played a role in determining the effectiveness of each cycle.

• Comparison between Cycle 2 and Post-Test
There was an increase in student learning outcomes from Cycle 2 to Post-Test, indicating that the learning cycle implemented contributed to the improvement of overall learning outcomes. Cycle 2 provided a strong foundation, but Post-Test showed better results. Greater variation in Post-Test: Although the mean score of Post-Test was higher, the variation in scores was greater. This indicates that some students had difficulty achieving maximum results in Post-Test even though the majority of students improved. Although Cycle 2 had lower results than Post-Test, this stage still made an important contribution in preparing students to achieve higher results in Post-Test. Further adjustments in teaching and evaluation can be made to reduce variation and improve performance in Cycle 2.

Although there is a significant difference between stages, the contribution of the Stage variable to the variation in scores is only 12.59% (R-Sq), which indicates that there are still many other factors that influence student learning outcomes besides the testing stage itself. The lower R-Sq (adj) value, which is 9.16%, indicates that the factor used in this analysis (i.e., testing stage) only explains a small portion of the variation that occurs in student scores.

Various previous studies have shown that the use of digital media in learning has a significant positive impact on various aspects of education. Arif *et al*. (2023) [4] finding that digital media effectively supports history learning, with the majority of students giving very positive responses. Kamilah *et al*. 2024 [5] shows that the use of animated videos can increase students' interest in learning.

In the context of the Covid-19 pandemic the important role of digital platforms such as Google Classroom and Zoom in maintaining learning continuity and enhancing teacher-student interaction. According to Nurqozin *et al*. (2023) [6] the positive impact of digital-based media on the quality of Islamic Religious Education learning is that students are more enthusiastic about learning, making it easier for teachers, and teachers are more skilled in delivering material and can manage time and improve student learning outcomes. Astriani *et al*. (2022) [7] stated that learning media using Lectora Inspire is quite valid, practical and effective for use in social studies learning. Comparison between conventional and digital media conducted by Yuniarti *et al*. (2023) [8] shows that digital media is more effective in attracting attention and motivating students. D Umboh *et al*. (2021) [9] finding that application of Kahoot learning games can improve the student mathematics learning outcomes at 02 Public Elementary school in Tomohon, North Sulawesi, in Indonesia.

Nabilah & Warmi (2023) [10] found that the use of learning media based on the Wordwall game website in mathematics learning can make a good contribution to student learning motivation. Nisa & Susanto (2022) [11] examined there is a positive and significant influence between wordwall-based educational games on learning motivation in mathematics learning for class V C students at SDN Kapuk Muara 03.

Conclusion
This study shows an increase in learning outcomes from Cycle 1 to Cycle 2 and Post-Test, with the average score continuing to improve. Cycle 2 is an important foundation in preparing students to achieve maximum results in the Post-Test. However, the greater variation in scores on the Post-Test indicates that not all students have succeeded in achieving optimal results. In addition, the contribution of the learning stage to the variation in scores was only 12.59% (R-Sq), indicating that other factors, such as teaching strategies, student engagement, and learning environment, have a significant influence on learning outcomes.

Hopefully this article can be a reference for researchers or education practitioners in understanding the influence of learning stages on student learning outcomes. It is hoped that further research can dig deeper into the external factors that influence learning outcomes and develop more effective and adaptive learning strategies to support student success as a whole.

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