

Research Article

Differences in Student Learning Outcomes Between Multiplication Board and Abacus Media in Grade II of Elementary School

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Abstract

Multiplication, as one of the materials found in elementary schools, is often taught using the rote method, so that the concept of multiplication is not ingrained in students. Therefore, it is necessary to use learning media in teaching multiplication so that students better understand the concept of multiplication. The learning media used in this research are the multiplication board and abacus. The aims of this research are 1) to find out differences in student learning outcomes, 2) to find out differences in students' psychomotor skills, 3) to find out better learning outcomes, and 4) to find out better psychomotor skills. This research is experimental research with the research subjects being second grade elementary school students. This research uses test instruments to determine student learning outcomes as well as observation sheets to determine students' psychomotor skills. This research was carried out in the odd semester of the 2024/2025 academic year at the Kasihan State Elementary School. The results of this research are 1) there is no difference in learning outcomes, 2) there is no difference in psychomotor skills, 3) the learning outcomes of students using the multiplication board are better, 4) the psychomotor skills of students using the abacus are better. Even though there was no difference in learning outcomes and psychomotor skills, there was an increase in learning outcomes between the pretest and posttest and an increase in psychomotor skills between the first meeting and the second meeting.

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Introduction

Education is a continuous process that is never completed (a never-ending process), it can produce qualities aimed at the formation of the future human individual rooted in cultural values and Pancasila. Education is also the most important capital that every person must have to survive in the face of development over time (Susanti et al., 2020). Education is all the learning that is given in every place and situation throughout life and that has a positive impact on the life of every person (Pristiwanti et al., 2022).

Based on this opinion, it can be concluded that education is a continuous process that takes place for each individual to achieve security, well-being, quality of life and to face current developments.

The success of training often depends on the high or low learning outcomes of students. Higher student learning outcomes correspond to better quality of education and vice versa. Learning outcomes are the performance of students in both cognitive, affective and psychomotor domains (Marlina & Ardiyaningrum, 2021). Learning outcomes can also be interpreted as the skills that students acquire after participating in a particular class learning activity (Nurrita, 2018). One of the places where education can be provided to students is school. School is a place where students learn under the guidance of teachers. Schools are part of formal education, whether they are public schools managed by local governments or

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private schools managed by certain foundations. Students attend school for approximately 6-7 hours per day (Khusna et al., 2021). During class time, students are taught various subjects, including mathematics.

Mathematics, as one of the subjects in basic education, often holds little interest for students. This is because many students consider mathematics to be a difficult subject (Fatimah, 2020), (Dewi et al., 2020), (Permatasari, 2021), (Suherdi et al., 2020). Many students also consider mathematics to be an uninteresting subject (Sulistiani, 2016), a boring subject (Afriani et al., 2019), a scary subject (Wijayanti & Suswandari, 2022), or a difficult subject to understand (Permatasari, 2021). One of the teaching materials included in the elementary school mathematics curriculum is multiplication operations. When teaching this material, many teachers still rely on memorization alone to learn the concept of multiplication. As a result, the strength of the concept being taught to students is low, and students quickly forget how to multiply (Suherdi et al., 2020), (Sulistiani, 2016).

Piaget's developmental theory suggests that primary school-aged children are in the concrete operational stage. At this stage, students are considered to be able to think logically about something practical/concrete (Khaulani et al., 2020). The results of the preliminary research observations conducted showed that there are still many second graders who have not mastered multiplication. We often confuse addition and multiplication. These results are reinforced by the research of Lestari et al (2024) explaining that students' difficulties in mathematics are due to poor calculation skills and inability to understand learning materials. Therefore, to instill the concept of multiplication in students, it is necessary to use appropriate learning media. Learning media are educational tools that can be used to support the learning process to improve students' abilities (Khalida & Sari, 2022). Learning materials that can be used to teach multiplication include multiplication board and abacus. The use of multiplication tables and abacus is not only related to cognitive skills but also to students' psychomotor skills when using these materials. Psychomotor skills are a domain related to a person's acting skills after receiving learning (Dudung, 2018). Therefore, this study not only assessed students' cognitive abilities after using learning media but also assessed students' psychomotor skills during the learning process. Therefore, this study aimed to 1) determine the differences in students' learning outcomes between multiplication tables and abacus, 2) determine the

differences in students' psychomotor skills between multiplication tables and abacus, 3) determine the better learning outcomes between multiplication board media and abacus, and 4) to determine the better psychomotor skills between multiplication board and abacus media.

Methodology

The subjects of this study were grade II at Kasihan State Elementary School in the odd semester of the 2024/2025 school year, a total of 50 students. The students were divided into two classes, Class A for Experiment 2 and Class B for Experiment 1, with 25 students in each class. This study uses quantitative experimental methods. Quantitative research is research designed to study a specific population or sample with the goal of testing a given hypothesis (Sugiyono, 2020). The research design used is quasi-experimental, an experiment in which only the most dominant variables are examined because it is not possible to control all variables (Ibrahim et al., 2018). Details of the research plan to be carried out are given in the following table:

Table 1. Research Design

Experimental class 1 (a)	Ta ₁	X ₁	Ta ₂
Experimental class 2 (b)	Tb ₁	X ₂	Tb ₂

Information:

Ta₁ : pretest (initial test) experimental class 1

Tb₁ : pretest (initial test) experimental class 2

X₁ : implementation of treatment using multiplication board media

X₂ : implementation of treatment using abacus media

Ta₂ : posttest (final test) experimental class 1

Tb₂ : posttest (final test) experimental class 2

The data collection technique in this study used tests and observations. Tests are conducted to determine the learning outcomes and observations are conducted to determine the psychomotor skills of the students. The research instruments used were a questionnaire containing 10 multiplication questions and an observation sheet on psychomotor skills which also contained 10 statements measured using a Likert scale from 1 to 5. The marking formula used to determine the value obtained by the students was:

$$score = \frac{\text{score obtained}}{\text{maximal score}} \times 100$$

Data Analysis Method Using T-Test to Determine Differences Between experimental class 1 and experimental class 2. To simplify the experimental calculations, t-test was performed using SPSS software. Since the samples are more than 50, before analyzing the data using t-tests, we first perform a precondition test with a normality test using the Kolmogorov-Smirnov test. Then, an additional homogeneity test is performed using a one-way ANOVA test. Once the data is declared normal and homogeneous, we can proceed to perform the t-tests.

Results

This research was conducted by conducting a pretest (initial test) first to determine the initial abilities of students before the implementation of the action. The pretest was conducted in each experimental class. The results of the pretest that have been conducted can be seen in the table below:

Table 2. Student Pretest Result

	Experimental class 1	Experimental class 2
The highest score	90	90
Lowest value	20	20
Average	58.40	54.80

These findings indicate that student' average pretest scores remain low. Therefore, in order to enhance student learning outcomes, action is required. The statistical differences in learning outcomes between experimental classes 1 and 2 were subsequently ascertained by processing these results using SPSS. The sig value (2-tailed) was $0.560 > 0.05$, indicating that H_0 was accepted and H_1 was rejected, according to the data processing results using SPSS. Thus, it may be concluded that experimental class 1 and experimental class 2's pretest findings no difference. Statistically, there is no difference even though the average is different.

Following the pretest, an exercise utilizing the prepared learning materials was conducted, with the experimental class 1 using the multiplication board media and the experimental class 2 using the abacus. The outcomes of the posttest can be used to determine the level of learning that has occurred. The following are the posttest results:

Table 3. Student Posttest Result

	Experimental class 1	Experimental class 2
The highest score	100	100
Lowest value	50	40
Average	80.40	76.40

These results demonstrate that, with a difference of 4.0, the average value of experimental class 1 is higher than that of experimental class 2. Additionally, SPSS was used to process the posttest results in order to statistically ascertain the variations in learning outcomes. A sig value (2-tailed) of $0.392 > 0.05$ indicates that H_0 is accepted and H_1 is rejected, according to the results of the t-test that was conducted. There is no difference in the posttest results, according to this statement. Statistically speaking, there is no difference even though the average is different. As previously mentioned, this study evaluates pupils' psychomotor as well as cognitive abilities. When employing learning media to treat actions, psychomotor evaluation is done through observation. The table below displays the findings from the observations of psychomotor skills:

Table 4. Psychomotor Observation Results

	Meeting 1	Meeting 2
Average of experimental class 1	67.04	77.04
Average of experimental class 2	69.20	77.84
Hypothesis testing	0, 189	0, 566

Based on the results of the hypothesis test that has been carried out, it was found that in the two meetings the results were both more than 0.05, where from these results it can be concluded that there is no difference in psychomotor skills between experimental class 1 and experimental class 2.

Discussion

The application of media in the classroom is very suitable for elementary school pupils' cognitive growth stage. Since elementary school pupils are still in the concrete operational stage and require tangible items to grasp concepts, learning media might assist them in solving logical difficulties (Ibda, 2015).

Both experimental classes 1 and 2 have shown a rise in student scores, despite the fact that there is statistically no difference in learning outcomes. According to studies by Wahyuni et al (2022) and Azizah et al (2022), using a multiplication board can enhance student learning results. According to Pradana & Ummah (2020) and Lestari et al (2024), using abacus media enhances student learning outcomes and has a major impact on numeracy abilities. Students can better comprehend the lessons that teachers are teaching them by using learning media. Because they play in addition to learning, students are more eager to participate in class and are less likely to become disinterested easily. According to the psychological function of learning media, which can affect students' emotional, mental, and behavioral states, using learning media presents students with unique challenges that pique their interest in learning (Hasan et al., 2021).

The method of using the multiplication board media is more familiar to students than the abacus media, so students find it easy to understand how to use the multiplication board media. This makes the learning outcomes of experimental class 1 higher than experimental class 2. The use of abacus media for class II students is considered less interesting because the activities carried out are only shifting the beads on the axis. In addition, the use of abacus media also requires skills in its use because not all students are skilled and agile in using the media (Martindah, 2022).

In addition to cognitive abilities, students' psychomotor skills are also assessed. This is because the use of learning media, both multiplication boards and abacus, both involve students' psychomotor skills when using them. The use of multiplication board and abacus learning media is included in fine motor activities because it only involves small muscles and eye and hand coordination (Winingsih et al., 2020). Based on the results of observations that have been carried out, there was an increase in student scores at meetings 1 and 2. This is due to a pleasant learning atmosphere will stimulate positive student activities (Maghfiroh et al., 2023).

Students that learn with an abacus are generally more focused on what they are learning. This is consistent with an abacus's ability to help kids become more focused, self-reliant, and self-assured (Martindah, 2022). Students become more engaged and excited in class when they use a multiplication board to study. in order to create a less favorable learning environment in the classroom. When there is not enough learning media available for every student, the student become impatient while waiting for their turn to use it. Because students in

experimental class 2 are more conditioned and listen to the instruction given by the teacher, this is one of the reasons why their psychomotor assessments are superior to those in experimental class 1.

Conclusion and Recommendation

Based on the research results that have been presented previously, the following conclusions can be drawn: 1) There is no difference in learning outcomes between the multiplication board media and the abacus. This is evidenced by the results of the t test > 0.05 , 2) There is no difference in psychomotor skills between the multiplication board media and the abacus. This is evidenced by the results of the t test > 0.05 , 3) Based on the average value of the posttest results, learning outcomes using the multiplication board are better than learning outcomes using the abacus. 4) Based on the results of observations of psychomotor skills, the value of psychomotor skills using the abacus is better than using the multiplication board media.

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