Utilization of Smart Cards in Integer Operations Material to Improve Junior High School Students' Understanding

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ABSTRAK

Permasalahannya yang terjadi saat ini yaitu masih banyak siswa yang menganggap matematika sebagai ilmu yang rumit karena matematika bersifat abstrak. Hal ini berdampak pada minat belajar dan hasil belajar siswa yang rendah. Olehnya, tujuan penelitian ini yaitu menganalisis pengaruh penggunaan pembelajaran berupa smart card dalam meningkatkan pemahaman konsep operasi bilangan bulat siswa. Jenis penelitian ini yaitu penelitian kuantitatif dengan mengguankan metode eksperimen semu. Desain penelitian yang digunakan adalah desain eksperimen pre-eksperimental dengan bentuk one group pretest posttest design. Subyek penelitian yaitu siswa sekolah menengah pertama dengan jumlah 21 siswa. Metode yang digunakan untuk mengumpulkan data adalah observasi dan tes. Instrumen yang digunakan untuk menganalisis data adalah lembar soal tes. Teknik yang digunakan untuk menganalisis data adalah statistik inferensial. Teknuk analisis data dalam penelitian ini menggunakan uji t-test dan uji hipotesis. Hasil dari penelitian ini ditemukan bahwa setelah diterapkannya media smart card dalam proses pembelajaran nilai rata-rata siswa mengalami peningkatan dimana pada saat pretest siswa hanya memperoleh nilai rata-rata 50,24 dan setelah diterapkannya media smart card nilai rata-rata siswa pada saat posttest menjadi 72,62. Selain itu penelitian ini juga menemukan bahwa terdapat pengaruh yang signifikan antara pemanfaatan media smart card terhadap pemahaman konsep operasi bilangan bulat siswa. Disimpulkan bahwa media smart card dapat meningkatkan pemahaman konsep operasi bilangan bulat siswa sekolah menengah pertama.

ABSTRACT

The problem currently occurring is that there are still many students who consider mathematics to be a complicated science because mathematics is abstract. This has an impact on student interest in learning and low learning outcomes. Therefore, this research aims to analyze the effect of using learning in the form of smart cards in increasing students' understanding of integer operations. This type of research is quantitative research using quasi-experimental methods. The research design was a pre-experimental experimental design with a one-group pretest post-test design. The research subjects were junior high school students with 21 students. The methods used to collect data are observation and tests. The instrument used to analyze data is a test question sheet. The technique used to analyze data is inferential statistics. The data analysis technique in this research uses the t-test and hypothesis testing. This research found that the average student score increased after implementing smart card media in the learning process. In contrast, at the pretest, students only got an average score of 50.24, and after implementing smart card media, the average student score on the post-test was 72.62. This research also found a significant influence between the use of smart card media and students' understanding of integer operations. It was concluded that smart card media can improve junior high school students' understanding of integer operations.

1. INTRODUCTION

Learning is an interaction process carried out by teachers and students in order to achieve educational goals. Teachers act as educators, mentors, assessors, facilitators, and evaluators for students (Machaba & Bedada, 2022; O'Brien et al., 2020; Tondeur et al., 2019). In the learning process, teachers must understand the foundations of education, apply learning and learning theories, and master various learning methods (Agustini et al., 2020; Aryana et al., 2022; Kholis, 2019). This educational foundation can determine the success of learning (Agustini et al., 2020; Salmawati et al., 2017). Apart from that, teachers must also be able to foster students' learning motivation and build an appropriate learning environment. Teachers must also have social and professional competence and an exemplary personality for students (Hartanti & Yuniarsih, 2018; Syarifuddin, 2019; Wulandari & Nurhaliza, 2023). Junior high school students' learning covers a variety of subjects. Middle school education provides a solid foundation for students to develop their potential. One of the lessons learned by junior high school students in mathematics (Faidah et al., 2019; Hermawan et al., 2022; Yumeri et al., 2022).

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Mathematics learning is essentially a process that is deliberately designed with the aim of creating an environmental atmosphere that allows students to carry out mathematics learning activities, and this process is centered on teachers teaching mathematics (Effendi, 2017; Ridwan, 2021). In learning carried out at school, mathematics learning is intended as a process that is deliberately designed with the aim of creating an environmental atmosphere that allows students to learn mathematics at school (Fauzy & Nurfauziah, 2021; Hariati et al., 2020; Masitoh & Aedi, 2020). Basic operations on integers are material that is the basis of mathematical material as a counting practice in everyday life. One of the competency standards socialized by the government in mathematics lessons is adding, subtracting, dividing and multiplying whole numbers (Nurmala et al., 2016; Rangkuti & Hasibuan, 2019). The basic competency in learning mathematics, the material that is most difficult and encounters many obstacles, is whole number operations. Lack of understanding of concepts can have a negative impact so that teaching mathematics requires teacher abilities as professionals, both in the field of mathematics and in the field of learning difficulties (Srintin et al., 2019).

The problem is that many students still consider mathematics a complicated science because mathematics is abstract. This is reinforced by previous findings, which stated that students had difficulty understanding mathematics learning material (Faidah et al., 2019; Hermawan et al., 2022; Pratini T et al., 2021; Yumeri et al., 2022). Other research also states that the cause of low mathematics learning outcomes for students is the need for more supporting learning media or inappropriate learning models so that students have difficulty understanding learning material (Aditya, 2018; Laksono et al., 2016; Masitoh & Aedi, 2020). The difficulties experienced are that many students do not understand mathematical concepts and students lack interest in learning mathematics (Febriyanti et al., 2021; Hermawan et al., 2022). Based on the results of observations at Sb SMP An Nahdloh Malaysia, it was found that teachers did not use media during the learning process, but used lecture or conventional methods to students. This causes students to get bored easily during the ongoing learning process. The boredom felt by students results in a lack of student focus on the material presented by the teacher so that students' understanding of the material presented by the teacher decreases. In dealing with this problem, it is necessary to use creative and enjoyable learning media for students (Graceota et al., 2020).

One strategy that teachers can use is to create fun learning. One way that can be done to create fun learning is to learn while playing. The use of media in mathematics learning is one way to visualize abstract mathematics material so that students can easily understand it and can improve their memory of the material presented (Fauzy & Nurfauziah, 2021; Salsabila et al., 2020). Learning media are materials, tools or techniques used in teaching and learning activities with the aim that the educational communication interaction process between teachers and students can take place in an effective and efficient manner (Graceota et al., 2020; Hobri et al., 2021; Sumarwati et al., 2020). Media in learning greatly influences students' interest in learning and can improve student learning outcomes. Media also really helps teachers in conveying material, so that students can understand concepts well because students are motivated to learn (Akmalia et al., 2021; Darmayanti et al., 2022; Saputri & Qohar, 2020). If teachers use media in classroom learning, students will not only learn but can also play so that the atmosphere in the classroom is not boring (Simangunsong & Irvan, 2023; Tabuena & Pentang, 2021).

One of the learning media that can be used is using smart cards. These math cards aim to make learning easy to understand, that is, students can directly observe, hold, and even analyze the images on the cards (Izah & Auliya, 2023; Mahardika et al., 2013). The use of learning media provides more positive benefits to students. In general, the benefit of teaching aids/media in the teaching and learning process is to facilitate interaction between teachers and students, so that teaching and learning activities that occur in ordinary classes become more efficient (Anam & Sari, 2020; Sabella et al., 2022; Sutopo, 2019). Apart from increasing students' enthusiasm for learning, using interesting learning media will also increase students' conceptual understanding of the material being taught, as well as mathematics learning material such as whole number calculation operations. Other research states that students are more enthusiastic and active in the mathematics learning process with the help of learning media in the form of cards compared to conventional learning by teachers (Herawati et al., 2018; Heswari & Patri, 2022; Oktafianto et al., 2019). Previous research results also found that using smart card media in the mathematics learning process can improve student learning outcomes where student learning scores during the posttest increased compared to pretest. These results show that the use of learning media in the form of smart cards influences student learning outcomes (Devi et al., 2020).

Several studies also found that using cards as a learning medium will influence students' understanding of mathematical concepts. The use of learning media in the form of cards had a significant effect on understanding. students' mathematical concepts (Ashari & Wati, 2022; Herawati et al., 2018; Shintya et al., 2022). In other research, it was also stated that by using learning media in the form of cards there was an increase in student learning outcomes from pretest to posttest, this shows the influence of

using learning media in the form of cards on students' understanding of mathematical concepts in whole number operations material (Srintin et al., 2019). Apart from that, a previous study stated that based on the results of the t-test, the use of learning media in the form of cards given to class VIII SMP students had a positive and significant influence on students' understanding of mathematical concepts (Prihatin et al., 2022). There has yet to be further study regarding using smart cards in integer operations material to improve mathematical understanding in junior high school students. The use of smart card learning media is very suitable for increasing students' understanding of concepts in learning activities. This happens because smart cards are a learning media that can help students understand learning material effectively, have fun and can provide a concrete picture of how to operate integers (Audia et al., 2020). By using the "Smart Card" card game, the game is almost the same as the UNO card game. Smart Card is a game made using buffalo paper which is made and shaped like a UNO card. But with a different design and way of playing from the UNO card game (Anam & Sari, 2020). Based on this, the aim of this research is to analyze the use of smart cards in integer operation material to improve mathematical understanding in junior high school students. Using smart card learning media is a media that is suitable for use in the learning process because this media helps students understand learning material effectively and is also fun, especially in whole number material.

2. METHOD

This research includes a quantitative method with a quasi-experimental method in the form of giving a pretest and posttest. The research subjects were SB SMP AN Nahdloh Malaysia students with a total of 21 students. Data were analyzed using the t-test and hypothesis testing. Then the pretest scores (before treatment) and posttest (after treatment) can be compared as a reference in proving whether the use of smart card learning media can improve students' understanding of the material or not. The research design used was a pre-experimental design experiment design in the form of one group pretest posttest design. One Groups Pretest-Posttest Design is a research design that contains a pretest before treatment and posttest after treatment (Ma et al., 2019; Surur et al., 2020). Thus it can be known more accurately, because it can compare before treatment and after treatment. The independent variable in this research is smart card learning media. Meanwhile, the dependent variable is students' learning outcomes or students' understanding of the concept of integers. The methods used to collect data are observation and tests. The observation method is used to directly observe students' difficulties in learning mathematics. The test method is used to determine the effectiveness of using Smart Card media in mathematics learning. The assessment of student learning outcomes in this study used pretest and posttest to see whether after implementing smart card learning media it could improve students' understanding of the concept of integers. The instrument used to analyze the data is the test question sheet. The questionnaire grid is presented in Table 1.

Table 1. Mathematics Test Question Grid

No	Measured Aspects	Question Item
1	Complete integer calculation operations that contain positive integers and negative integers	1,2,4
2	Complete integer calculation operations related to x and y values	3
3	Complete integer arithmetic operations related to everyday problems	5

The technique used to analyze data is inferential statistics. Statistical inference is a technique used to draw conclusions and make generalizations about a population based on a sample of data. It is essential in experimental research to ensure that the sample selected accurately represents the population. Statistical inference includes using formulas such as regression analysis, hypothesis testing, and interesting comparative analysis to draw meaningful conclusions from data samples. In the context of experimental research, statistical inference plays a vital role in making conclusions about the effect of experimental manipulations on the variables under study. This may involve testing hypotheses about relationships between variables, comparing experimental conditions, or predicting population parameters based on sample statistics. Hypothesis testing in this research uses the sample t-test formula.

3. RESULT AND DISCUSSION
Result

To find out the results of differences in understanding the concept of integers before using the media and after using the smart card learning media, the data was processed using a frequency distribution. The calculation results in Table 2.

Table 2. Comparison of Pretest and Posttest Results of an Nahdloh Malaysia SB SMP Students

No.	Student Name	Pretest	Posttest
1	$\bar{X}$	50.24	72.62
2	σ^2	201.19	59.084
3	s^2	14.184	7.684

Based on the table above, the average student score during the posttest increased compared to the pretest. The analysis showed that the pretest results showed that the average student score was 50.24. Then, after implementing learning media in the form of smart cards, the average student score increased to 72.62 (posttest). These results show that using smart card learning media is very effective in learning activities because it can increase students' understanding of mathematical concepts in whole number operations. These results show increased students' understanding of integer operations after implementing smart card media compared to using learning media in teaching and learning activities. Next, a data normality test was carried out. The normality test results are presented in Table 3.

Table 3. Data Normality Test Results

Group	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
pretest	0.173	21	0.099	0.963	21	0.586
post-test	0.206	21	0.020	0.919	21	0.081

The results of data analysis using SPSS show that the Shapiro-Wilk value from the pre-test is 0.586, so the value is 0.586 > 0.05, so the data is normally distributed. The results of data analysis using SPSS show that the Shapiro-Wilk value from the post-test is 0.081, so the value is 0.081 > 0.05, so the data is normally distributed. The homogeneity test results are presented in Table 4.

Table 4. Homogeneity Test Results

Statistics/Parameters		Levene Statistic	df1	df2	Sig.
	Based on Mean	2.579	1	40	0.116
	Based on Median	2.678	1	40	0.110
Variable	Based on Median and with adjusted df	2.678	1	34.006	0.111
	Based on trimmed mean	2.650	1	40	0.111

The results of the homogeneity analysis obtained a value of 0.116 so that 0.116 > 0.05, so the data is homogeneous. Furthermore, a Correlation Coefficient Test (r) is carried out before testing the hypothesis, the value of the correlation coefficient between the two research variables is first calculated. This is necessary because in the calculation of the hypothesis test, the value of the correlation coefficient (r). Based on the data from the pretest and posttest results, the correlation coefficient (r) value obtained is 0.843. After conducting the coefficient correlation test, the last is to conduct a Hypothesis Test to prove the hypothesis of this study, then hypothesis testing is carried out. The data used for hypothesis testing are pretest and posttest result data. A hypothesis test was then carried out using the related sample t-test. The results of hypothesis testing using the t-test sample related in Table 5.

Table 5. Related Sample T-Test Results

Statistics	Value
N	21
t-count	8.338
t-table	1.729
H_0	Rejected

Based on the results of calculations using the sample related T-test, it was found that the t-count value was 8.338, this value was greater than the t-table value of 1.729 (8.338 > 1.729). Based on the results of these calculations, it shows that H0 is rejected, which means that the use of smart card media in the learning process influences students' understanding of the concept of integer operations at An Nahdloh Middle School, the influence given is to improve students' understanding for the better.

Discussion

The data analysis results show that using smart card media influences students' understanding of concepts. This shows that smart card media is suitable for use in learning. This is caused by several factors, namely as follows. First, using smart card media can increase students' understanding of concepts. Using smart card media in learning can increase students' understanding of mathematical concepts through various interactive and exciting activities. Previous research findings also state that interactive activities will make learning easier for students (Damayanti & Qohar, 2019; Winatha et al., 2020; Margarita et al., 2018; Sina et al., 2019). Smart card media can create interactive learning experiences that help students visualize and understand mathematical concepts (Ashari & Wati, 2022; Devi et al., 2020). This media can be used in learning activities such as memory games, matching exercises, and interactive quizzes, making learning more fun and effective for students. Comfortable learning activities will make it easier for students to understand concepts (Biassari et al., 2021; Hendi et al., 2020; Sakiah & Effendi, 2021). In addition, smart cards can provide immediate feedback, allowing students to assess their understanding of mathematical concepts quickly. By integrating media into mathematics learning, educators can create a more dynamic and immersive learning environment that supports students in developing a deeper understanding of mathematical concepts ((Biassari et al., 2021; Buchori, 2019; Febriyandani & Kowiyah, 2021; Sanusi et al., 2015). These results are in accordance with the results of previous research which found that using smart card media in the mathematics learning process can improve student learning outcomes where the value of student learning outcomes during the posttest increased compared to the pretest. These results indicate that the use of learning media in the form of smart cards influences student learning outcomes. (Devi et al., 2020).

Second, using smart card media can make it easier for students to learn. Using smart card media can make it easier for students to learn because this media can make students more active in the learning process. This can develop their creativity, innovation, and memory for the material studied (Hendi et al., 2020; Murod et al., 2021; Ode et al., 2021). Smart card media also helps students recognize concrete mathematical forms, making it easier for them to understand mathematical concepts that may be difficult to understand abstractly. Smart card media can also increase students' motivation and provide different learning experiences, so students are more helped in understanding and remembering lesson material (Ashari & Wati, 2022; Audia et al., 2021). Thus, the use of smart card media can create a more dynamic, interactive learning environment and support students in developing a better understanding of mathematical concepts (Anam & Sari, 2020; Aziz et al., 2016).

Third, the use of smart card media can improve the learning atmosphere for students. These results are in line with the results of previous research which found that the use of learning media in the form of cards had a significant effect on students' understanding of mathematical concepts (Ashari & Wati, 2022; Shintya et al., 2022). In other research, it was also stated that by using learning media in the form of cards there was an increase in student learning outcomes from pretest to posttest, this shows the influence of using learning media in the form of cards on students' understanding of mathematical concepts (Sabella et al., 2022; Srintin et al., 2019; Sutopo, 2019). The use of smart card learning media is very effective in increasing students' understanding of mathematical concepts in learning activities, this happens because smart cards are a learning media that can help students understand learning material effectively, have fun and can provide a concrete picture of how to operate whole numbers (Audia et al., 2020). This can be seen from the research results where when students learn using smart card learning media the learning process in the classroom becomes more active, students are also more enthusiastic and enthusiastic during the learning process, students also become more focused on the material provided by the teacher. So that students' understanding of the concept of integer operations increases.

Previous research findings also state that using media in mathematics learning is essential because it can improve student learning outcomes (Diah Purnami Dewi et al., 2022; Gusmania & Dari, 2018; Mujahadah et al., 2021). Other research also states that using media in mathematics learning can make it easier for students to learn (Azzahra & Pramudiani, 2022; Laksono et al., 2016; Wigati, 2019). The advantage of the Smart Card being developed is that using smart card learning media is very suitable for increasing understanding of concepts, which can help students understand learning material effectively. Smart card learning media is a suitable medium because learning becomes fun, especially in whole number material. Although the research results show that the use of smart card media is effective in increasing students' understanding of the concept of integer operations. However, in this research there are still weaknesses, where the use of smart card media in the learning process is something new for students so students need to adapt to learning activities using smart card media. The student adaptation process takes quite a long time because the use of smart card media is quite complicated for students to understand. Not only students, teachers also cannot use smart card media in the learning process because previously teachers used conventional methods in the learning process so adaptation is also needed for teachers in

using smart card media in the student learning process. Even though the adaptation process for teachers and students requires quite a long process in understanding the concept of using smart card media in learning activities, the use of smart card media is still very effective in increasing students' understanding of mathematical concepts. The implication of this research is that the use of smart card media can make it easier for students to learn. It is recommended that teachers use smart card learning media in learning activities so that students are more motivated in learning.

4. CONCLUSION

There is a significant influence between the use of smart card media on understanding the concept of integer operations in An Nahdloh Middle School students. Apart from that, the use of smart card media has a positive impact on mathematics learning. It can be concluded that using smart card media can increase students' understanding of the concept of integer operations, which can be seen from the average student score, which has increased when the smart card media is applied compared to before the media is applied to the learning process. The use of smart card media makes students enthusiastic about learning mathematics.

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