



THE EFFECT OF INNOVATIVE LEARNING MEDIA POP-UP BOOK ON IMPROVING MATHEMATICAL COMMUNICATION SKILLS AND MATHEMATICS LEARNING INTEREST OF GRADE III STUDENTS IN ELEMENTARY SCHOOL

Olvi Steva Surentu¹, Philotheus E. A. Tuerah², Juliana Margareta Sumilat³

Program Studi Pendidikan Guru Sekolah Dasar S2 Universitas Negeri Manado

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ABSTRACT

This research aims to determine the effect of innovative pop-up book learning media on improving students' mathematical communication skills and mathematics learning interest. This research was conducted at Inpres Kayawu Elementary School. This research is using experimental method. Data collection techniques use tests and questionnaires whose validity and reliability have been tested. To determine the validity of each item, the Pearson Product Moment technique is used. Reliability testing is carried out on each item whose validity has been tested using the Cronbach Alpha (α) technique. Data management in this research uses descriptive analysis, normality test, hypothesis I and II tests using the t test, hypothesis III test using the Manova test, and coefficient of determination (R^2) test. The results of this research show that, 1) there is an influence of the use of pop-up book innovative learning media on mathematical communication skills in grade III students at Inpres Kayawu Elementary School, and 2) there is an influence of the use of pop-up book innovative learning media on mathematics learning interest grade III students at Inpres Kayawu Elementary School, and 3) there is an influence of the use of innovative pop-up book learning media on mathematical communication skills and mathematics learning interest in grade III students at Inpres Kayawu Elementary School

KEYWORDS: Pop-Up Book Media, mathematical communication skills, mathematics learning interest

Abstrak

Penelitian ini bertujuan untuk mengetahui pengaruh media pembelajaran inovatif pop-up book terhadap peningkatan kemampuan komunikasi matematis dan minat belajar matematika siswa. Penelitian ini dilakukan di SD Inpres Kayawu. Penelitian ini menggunakan metode eksperimen. Teknik pengumpulan data menggunakan tes dan angket yang telah diuji validitas dan reliabilitasnya. Untuk mengetahui validitas tiap item adalah teknik Pearson Product Moment. Uji reliabilitas dilakukan pada setiap item-item yang sudah teruji validitasnya dengan teknik Cronbach Alpha (α). Pengelolaan data dalam penelitian ini menggunakan analisis deskriptif, uji normalitas, uji hipotesis I dan II menggunakan uji t, uji hipotesis III menggunakan uji manova, dan uji koefisien determinasi (R^2). Hasil penelitian ini menunjukkan bahwa, 1) terdapat pengaruh penggunaan media pembelajaran inovatif pop-up book terhadap kemampuan komunikasi matematis pada siswa kelas III SD Inpres Kayawu, dan 2) terdapat pengaruh penggunaan media pembelajaran inovatif pop-up book terhadap minat belajar matematika pada siswa kelas III SD Inpres Kayawu, serta 3) terdapat pengaruh penggunaan media pembelajaran inovatif pop-up book terhadap kemampuan komunikasi matematis dan minat belajar matematika pada siswa kelas III SD Inpres Kayawu

Kata Kunci: Media Pop-Up Book, Kemampuan Komunikasi Matematis, Minat Belajar Matematika

INTRODUCTION

Learning is a functional communication process between students and teachers and students with students, in order to change attitudes and mindsets that will become habits for the students concerned. Especially through learning mathematics, a person is trained to think creatively, critically, honestly, and can apply mathematics in solving problems of everyday life and other disciplines (Katihokang et al., 2024). In this case communication is a process of expressing ideas or ideas and mathematical understanding using numbers, pictures, and words, in various communities including teachers and students. Interactions between teachers and students during classroom activities provide opportunities to develop their mathematical skills. Student interactions where mathematical ideas are

explored from various views can help students to deepen their understanding, and develop their skills to communicate, explain, justify, and discuss mathematical ideas. In this case, mathematical communication skills are important things that students must have. The importance of mathematical communication skills to develop the ability to convey information or communicate ideas, among others, through oral talks, pictures, graphs, maps, diagrams, in explaining ideas.

Mathematical communication is the skill to express mathematical ideas coherently to friends, teachers, and others through oral and written language accompanied by explanation and justification. Lomibao et al. (2016) stated that mathematical communication skill is the ability to express ideas, describe,



and discuss mathematical concepts coherently and clearly. Prayitno et al. (2013) argues that mathematical communication is needed to communicate ideas or solve mathematical problems, either orally, in writing, or visually, either in mathematics learning or outside of mathematics learning. Mathematics learning emphasizes more on written mathematical communication because during the learning process there is a lot of use of symbols or images to make it easier to solve a problem. Students' mathematical communication skills can be developed through the education process at school, one of which is the mathematics education process (Hodiyanto, 2017). In addition to mathematical communication skills, students must have an interest in learning.

Interest in learning is a sense of preference and a sense of interest in a thing or activity, especially interest in learning, without anyone telling you to. According to Aldefer (Achru P., 2019) learning interest is the tendency of students to carry out learning activities which are driven by the desire to achieve the best possible learning achievement. Interest is basically the acceptance of a relationship between oneself and something outside oneself. Interest in learning is an act of behavior change that occurs because of a desire in the form of attention so that there is a feeling of pleasure. Supardi et al. (2012).

In the world of education, especially in mathematics subjects after using innovative learning media, it can increase students' mathematical communication skills and mathematics learning interest. As for the results of research by Yuwono et al. (2021) the use of pop-up book learning media can be used effectively in learning mathematics. However, most teachers do not never use teaching media in class, but teachers lack innovation and only use teaching media in the form of image media directly from textbooks with the lecture method. So that the learning process is less varied and less interesting.

This research was conducted using alternatives for the implementation of learning as desired, namely with innovative learning media that are in accordance with the characteristics of students and in accordance with learning needs. So that the learning process can provide a variety of material presentations in the form of innovative learning media. Media is an important component in the learning process. "Learning media according to (Aqib, 2013) is anything that can be used to channel messages and stimulate the learning process in students. Media is used to help create good learning. Innovative learning media that can be used to help the learning process in elementary schools are very diverse. In this study, researchers used products that had been made as learning media, namely pop-up book media. Pop-up book media provides learning materials that can provide more interesting visualizations to students.

Pop-up book media is a three-dimensional teaching tool that can stimulate children's imagination and increase knowledge so that it can make it easier for children to know the depiction of the shape of an object, and increase children's understanding (Hanifah, 2014). This is in line with Ningtiyas et al. (2019) who suggest that a pop-up book is a card or book that when opened can present a 3-dimensional or embossed construction.

Solichah & Mariana (2018) also explained that pop-up book media includes a type of 3D media that can provide an interesting effect, because each page opened will reveal a picture that appears and the material contained in the pop-up book can be adjusted to the teaching material to be conveyed. Based on this explanation, it can be concluded that pop-up book media is a book that has three-dimensional elements that can move when the page is opened, and provides a more interesting visualization and display to increase student understanding of the material.

This study discusses pop-up book media (X), mathematical communication skills (Y_1) and mathematics learning interest (Y_2). The difference between this research and previous research conducted by Ni Kadek Diana Yuni Pertiwi et al (2022) is in the pop-up book background object. The object of pop-up book media in this study is math material while in the research conducted by Pertiwi et al. (2022) the object of pop-up book media uses Balinese Cultural Nuances Picture Background ". Then the difference between this research and the second previous research conducted by Sari & Soesanto (2022), is in the learning media. This study uses innovative learning media pop-up book while in the research conducted by Sari & Soesanto (2022) using kahoot media.

This research can provide material for teachers in conducting self-development in improving performance as an educator and innovating in making learning media and improving students' mathematical communication skills and learning interests. The purpose of this study was to analyze the effect of innovative learning media pop-up book on improving mathematical communication skills and mathematics learning interest of grade III students in elementary school".

METHOD

This study uses a quantitative research approach. Quantitative research data is in the form of numbers and analysis using statistics (Sugiyono, 2019). This study aims to test the hypothesis proposed by analyzing the relationship between existing variables, namely the effect of using pop-up book learning media on mathematical communication skills and students' mathematics learning interest.

This research was conducted at Inpres Kayawu Elementary School. This research was conducted in the 2023/2024 school year. The population of this study were grade III students at Inpres Kayawu Elementary School in the odd semester of the 2023/2024 school year based on characteristics related to the three variables in this study. The sample in this study were all grade III students of Inpres Kayawu Elementary School, totaling 20 students.

The data collection techniques used in this study were tests and questionnaires. In this study using the initial test/pretest and final test/posttest and questionnaire using student response questionnaire to innovative pop-up book learning media and questionnaire student mathematics learning interest. The instruments in this study have been tested for validity and reliability and the results are valid and reliable instruments used. Furthermore, the data analysis techniques used in this study are descriptive analysis, normality test, hypothesis testing



in this study, namely simple linear regression analysis using the t test to measure the effect of pop-up book media (X) on mathematical communication skills (Y_1) and the effect of pop-up book media (X) on mathematics learning interest (Y_2) partially. Multiple linear regression analysis using the manova test aims to determine the effect of pop-up book media (X) on mathematical communication skills (Y_1) and mathematics learning interest (Y_2) simultaneously, and the coefficient of determination (R^2) test.

RESULT AND DISCUSSION

This research was conducted in grade III students of Inpres Kayawu Elementary School based on the formulation of existing research problems. Respondents in this study amounted to 20 students who were students enrolled in the 2023/2024 school year. After completing the research, the next step is to analyze the data and then process the existing data with the aim of seeing the effect of pop-up book media on mathematical communication skills and mathematics learning interest in grade III students of Inpres Kayawu Elementary School with the help of the IBM SPSS application. In this study, descriptive analysis, normality test, hypothesis test, and coefficient of determination (R^2) test were first conducted. Descriptive analysis was carried out to see a general description of the data such as the average value (Mean), highest (Max), lowest (Min), and standard deviation of each variable, namely Pop-Up Book Media (X), mathematical communication skills (Y_1), and mathematics learning interest (Y_2). The results of descriptive analysis on variable X are known to have an average value (mean) of 94, the highest value (max) 100, the lowest value (min) 80, standard deviation 4.99368. The results of descriptive analysis on variable Y_1 are known to have an average value (mean) of 93, the highest value (max) 100, the lowest value (min) 73, standard deviation 7.83296. The results

of the descriptive analysis on variable Y_2 are known to be the average value (mean) 94, the highest value (max) 100, the lowest value (min) 80, standard deviation 4.99368. The results of descriptive analysis on variable Y_1 are known to be the average value (mean) 98, the highest value (max) 100, the lowest value (min) 93, standard deviation 1.86096.

Before conducting hypothesis testing, a normality test is first carried out to determine whether the data is normal or not by looking at the significant value of the One Sample Kolmogorov-Smirnov Test using the SPSS application. The results of normality testing on the XY_1 data group show a significant number of $0.741 > 0.05$. This indicates that the data is normally distributed. While in the XY_2 data group the results of normality testing showed a significant number of $0.801 > 0.05$. Thus, the data is normally distributed.

After doing the normality test, the next step is to test the hypothesis. Hypothesis testing in this study aims to determine the effect of the independent variable on the dependent variable and answer the research hypothesis. There are two hypothesis tests carried out in this study. Namely simple linear regression analysis to determine the effect of variables partially and multiple linear regression analysis to determine the effect of variables simultaneously. Simple linear regression analysis was carried out to test hypotheses I and II, while multiple linear regression analysis was carried out to test hypothesis III.

Hypothesis I in this study is that there is an effect of using innovative learning media pop-up book on mathematical communication skills in grade III students of Inpres Kayawu Elementary School. Data analysis used t test to test hypothesis I about the effect of pop-up book innovative learning media variables on mathematical communication skills. The results of the t test analysis are as follows:

Table 1. Simple Regression Test Results (X - Y_1)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	132.486	16.737		7.916	.000
	Pop-Up Book Media	-.423	.178	-.489	-2.377	.029
a. Dependent Variable: Mathematical Communication Skill						

Based on the analysis results in table 1, a significant value of $0.029 < 0.05$ was obtained. So the obtained significance value of $0.029 < 0.05$, so it can be concluded that the pop-up book media variable (X) affects the mathematical communication ability variable (Y_1). Then H_0 is rejected, so it can be concluded that the pop-up book media variable has an effect on the mathematical communication skills variable. Thus, H_a is accepted which states that there is an effect of pop-up book media on mathematical communication skills in grade III students of Inpres Kayawu Elementary School.

Hypothesis II in this study is that there is an effect of using innovative learning media pop-up book on mathematics learning interest in grade III students of Inpres Kayawu Elementary School. Data analysis used t test to test hypothesis II about the effect of pop-up book innovative learning media variables on mathematics learning interest. The results of the t test analysis are as follows:



Table 2. Simple Regression Test Results (X - Y₂)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	48.901	15.936		3.069	.007
	Pop-Up Book Media	.513	.169	.581	3.029	.007

a. Dependent Variable: Mathematics Learning Interest

Based on the analysis results in table 2, a significant value of $0.007 < 0.05$ was obtained. So the significance value is $0.007 < 0.05$, so it can be concluded that the pop-up book media variable (X) has an effect on the mathematics learning interest variable (Y₂). Then H₀ is rejected, so it can be concluded that the pop-up book media variable has an effect on the mathematics learning interest variable. Thus, H_a is accepted, which states that there is an effect of pop-up book media on mathematics learning interest in grade III students of Inpres Kayawu Elementary School.

Hypothesis III in this study is that there is an effect of using innovative learning media pop-up book on mathematical communication skills and mathematics learning interest in grade III students of Inpres Kayawu Elementary School. Data analysis used manova test to test hypothesis III about the effect of pop-up book innovative learning media variables on mathematical communication skills and mathematics learning interest. The results of the manova test analysis are as follows:

Table 3. Multiple Regression Test Results

	Value	F	Hypothesis df	Error df	Sig.
Wilks' lambda	.080	2.542 ^a	18.000	18.000	.028
Hotelling's trace	8.980	3.991	18.000	16.000	.004
Roy's largest root	8.685	9.649 ^b	9.000	10.000	.001

Each F tests the multivariate effect of X. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

b. The statistic is an upper bound on F that yields a lower bound on the significance level.

Based on the results of data analysis through SPSS using the Wilk's Lambda method, it is known that the significance value is $0.028 < 0.05$, so from the results of this data analysis it can be concluded that the regression model has a significant effect together between the pop-up book media variables on mathematical communication skills and students' mathematics learning interest. Thus, H_a is accepted in this study which states that there is an influence between pop-up book media on mathematical communication skills and mathematics learning

interest in grade III students of Inpres Kayawu Elementary School.

The next stage is to analyze the coefficient of determination (R₂) test to estimate the extent to which the independent variable plays a role in influencing the dependent variable. The results of the coefficient of determination (R₂) test analysis using the help of IBM SPSS obtained model (Model Summary) can be seen in table 4 below.

Table 4. Summary of Pop-Up Book Media Variable Model on Mathematical Communication Ability

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.489 ^a	.239	.197	3.87460

a. Predictors: (Constant), Pop-Up Book Media

Based on the results of the analysis of the coefficient of determination (R₂) test of pop-up book media on mathematical communication skills in table 4, it is known that $\hat{Y} = 132.486 + 0.423X$. The coefficient X of 0.423 states that every 1% addition of pop-up book media value, the value of mathematical communication skills increases by 0.423. The regression coefficient of mathematical communication skills is positive,

this shows the unidirectional movement of these two variables which explains that the better the pop-up book media, the students' mathematical communication skills increases. The coefficient of determination or the determining coefficient (KP) is obtained by the formula $KP = r^2 \times 100\%$, so that the coefficient of determination is 23.9%. This means that 23.9% of mathematical communication skills can be explained by the



pop-up book media variable, while the remaining 76.1% is explained by other variables.

Table 5. Summary of Pop-Up Book Media Variable Model on Interest in Learning Mathematics

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.581 ^a	.338	.301	3.68907
a. Predictors: (Constant), Pop-Up Book Media				

Based on the results of the analysis of the coefficient of determination (R_2) test of pop-up book media on mathematics learning interest in table 5, it is known that $\hat{Y} = 48.901 + 0.513X$. The coefficient X of 0.513 states that every 1% increase in the value of pop-up book media, the value of students' mathematics learning interest increases by 0.513. The regression coefficient of student learning interest is positive, this shows the unidirectional movement of these two variables which explains that the better the pop-up book media, the student's mathematics learning interest increases. The coefficient of determination or the determining coefficient (KP) is obtained by the formula $KP = r^2 \times 100\%$, so that the coefficient of determination is 33.8%. This means that 33.8% of students' mathematics learning interest can be explained by the pop-up book media variable, while the remaining 66.2% is explained by other variables.

In hypothesis I research shows that there is an effect of pop-up book media on mathematical communication skills in grade III students of Inpres Kayawu Elementary School. The results of this study are in line with research by Setiyanigrum (2019) where the results showed that the mathematical communication skills of students taught with the savi model assisted by pop-up book can reach the minimum completion value. So it can be concluded that the activities of elementary school students using the Savi model assisted by pop-up book have a positive effect and improve students' mathematical communication skills. Thus, the first hypothesis, namely that there is an effect of pop-up book media on mathematical communication skills in grade III students of Inpres Kayawu Elementary School, is accepted and very significant.

In hypothesis II research shows that there is an effect of pop-up book media on mathematics learning interest in grade III students of Inpres Kayawu Elementary School. This research is in line with the research statement by Tumurang et al. (2022) that media is a tool that functions and can be used to convey learning messages. The results of this study are in line with research conducted by Riana et al. (2023) which examines the use of pop-up book media on student learning interest, where the results show that the use of pop-up book media effectively affects student learning interest in grade III elementary school mathematics subjects. In addition, the results of this study are also in line with the results of research by Tangkudung et al. (2022) that learning media has a positive and good impact on increasing student interest and motivation to learn. Thus, the second hypothesis, namely that there is an effect of pop-up book media on mathematics learning interest in grade III students of

Inpres Kayawu Elementary School, is accepted and very significant.

In hypothesis III research shows that there is an effect of pop-up book media on mathematical communication skills and mathematics learning interest in grade III students of Inpres Kayawu Elementary School. The results of this study are also in line with the results of previous studies examining mathematical communication skills and student learning interest, such as the results of research conducted by Lubis et al. (2023) which examines students' mathematical communication skills in mathematics learning, where it is explained in the introduction that students' mathematical communication skills are very important and affect the learning process in class, considering that mathematical communication is the ability of students to express their mathematical ideas through language, notation or symbols so that they are able to understand, interpret, describe relationships and solve contextual problems into mathematical models orally and in writing. The results of research by Banobe et al. (2022) which discusses learning interest where it is explained that interest has a huge influence on a person's activities because with interest he will do something he is interested in. Conversely, without interest a person is unlikely to do something.

CONCLUSION

The results showed that the better the pop-up book media, the mathematical communication skills and students' mathematics learning interest increased. The results of this study provide implications for teachers to be able to always develop existing knowledge so that in learning in order to improve performance as an educator and innovate in making learning media. For students to be able to further improve their mathematical communication skills and mathematics learning interest so that learning can be optimal. Then, from the results of this study, the school also needs to create a good environment where teachers can be more creative and innovative in carrying out their duties and responsibilities, especially in learning mathematics, so that students' mathematical communication skills and mathematics learning interest can continue to increase.

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