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The Effectiveness of the Use of Android-Based Andro Poster Learning Media on the Numeracy Skills of Seventh Grade Junior High School Students

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Abstract: Numeracy skills or numeracy literacy is a basic competency that is important for junior high school students to master in facing the challenges of the 21st century and the Industrial 5.0 era. However, PISA 2023 data shows that Indonesian students are still ranked low in math skills, reflecting students' weak numeracy skills. This study aims to test the effectiveness of Android-based Andro Poster learning media in improving the numeracy skills of grade VII junior high school students. The research uses a pre-experimental quantitative method with a One Group Pretest-Posttest Design. The research sample consisted of 30 students in grades VII-9 of junior high school who were selected through purposive sampling techniques. The research instrument was in the form of a numeracy multiple-choice test of 10 items, which was developed based on indicators of numeracy ability in the submaterial of algebraic forms. Data were obtained through pretest and posttest, then analyzed using paired sample t-tests and effect sizes (Cohen's d). The results showed that the average posttest score (72.87) increased significantly compared to the pretest (60.97), with a p value of < 0.001. The correlation between pretest and posttest of 0.865 shows a very strong relationship. In addition, Cohen's d value of -2.905 indicates a very large measure of effect on students' improved numeracy skills. Andro's Poster Media successfully presents algebra material visually, contextually, and interactively, so that it can increase students' motivation to learn and understand. This study concludes that the use of Android-based learning media such as Poster Andro is an effective and innovative strategy in improving the numeracy skills of junior high school students. This finding is expected to be a practical solution in mathematics learning as well as contribute to the development of digital media that is adaptive to the learning needs of students in the digital era.

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INTRODUCTION

The numeracy skills of students in Indonesia continue to be a concern in the context of global education. Based on the Programme for International Student Assessment (PISA) 2023 report, Indonesian students rank low in terms of math skills, which shows a fundamental weakness in numeracy literacy among students (OECD, 2023) . Numeracy skills are one of the basic skills in numeracy that are very important for junior high school students to master. However, the facts on the ground show that many seventh-graders still have difficulty solving basic arithmetic problems, especially in the context of applying the concepts to real life. The main challenges faced are the low interest in learning mathematics lessons and the limited learning media that are able to accommodate students' learning needs in an interesting and contextual manner. In addition, the integration of technology in numeracy learning at the junior high school level is still not optimal, especially in areas with limited resources. This low numeracy has a direct impact on the readiness of the younger generation to face economic challenges and technological developments in the future. This is an urgent issue that must be solved in every region of Indonesia, where access to educational technology and innovation is beginning to develop.

The main problem that wants to be solved through this research is how to improve the numeracy

skills of seventh grade junior high school students through interactive learning media and in accordance with the learning characteristics of 21st century students. Although various digital learning media have been widely developed, most of the research still focuses on web-based or e-learning applications that require a stable internet connection, without considering alternative solutions that can be accessed offline. In addition, very few studies have specifically examined the effectiveness of Android-based interactive poster-based media in numeracy learning at the junior high school level. This gap is the main foothold in this study. The importance of the role of mathematics in daily life has not been fully supported by conditions in the field. Based on research Sucipto & Firmansyah (2021) Students' interest in learning mathematics is still low, where mathematics is considered a difficult and tedious subject, so many students do not like it (Kholil & Zulfiani, 2020). In fact, mathematics is a compulsory subject for students. Therefore, in the learning process, the abilities that students have must be a concern. The government has issued Permendikbudristek Number 5 of 2022 concerning Competency Standards for Junior High School Graduates, which serves as the basis for the formation of intelligence, knowledge, personality, ethics, and independent life skills at this level of education. SKL is an ideal reference for junior high school students to master numeracy skills and show responsibility. Numeracy skills are also considered essential to meet the challenges of the 21st century (Han et al., 2017) and become a basic skill in the Industrial Era 5.0 (Nirmalasari et al., 2021). Numeracy, or often called mathematical literacy, is defined as the ability to think using mathematical concepts, factual procedures, and tools to solve a variety of everyday problems in relevant contexts in Indonesia and the world (Asrijanty, 2020). This suggests that there is an urgent need for numeracy skills. In recent years, digital technology has increasingly entered the educational space, which is known to increase student motivation and involvement in the learning process (Gikas & Grant, 2013).

Some previous research has shown that the use of technology-based media, such as mobile learning applications, can improve student motivation and learning outcomes (Lee, 2023). Research by Papakostas et al (2023) mentioned that visual media such as AR that displays images are able to improve understanding of concepts through attractive visualizations. However, there has not been much research that combines the power of poster visualization with Android-based platforms to improve the numeracy skills of junior high school students. Therefore, the approach used in this study is innovative by combining visual, interactive, and mobile learning elements in an integrated manner. Learning media plays a positive role in increasing student learning motivation. Fathurrochman et al. (2021) support that the use of various learning media can help increase learning motivation. Each student has unique characteristics and potential, but these uniquenesses are often not understood by teachers, so students are not able to optimize their abilities. In line with that, M. Astuti et al. (2021) Explain that character learning can be done through character education, which includes understanding or awareness of character, knowledge of character values, the ability to accept lessons, face challenges, and understand oneself. In addition, the problem with the learning method is that it is a teacher-centered approach, so students have fewer opportunities to dig deeper into the lesson.

Many teachers still use conventional learning methods, which are limited to textbooks or learning media that are less varied. Rahmawati & Mukminan (2017) It also agrees that most teachers tend to implement teacher-centered learning and rarely use multimedia in the classroom. This shows that in geography learning activities, teachers usually only rely on one medium, namely textbooks, so they cannot support learning optimally. In line with that, Mariyaningsih & Hidayati (2018) Explaining that innovation is needed in the learning model, method, or media used in the learning process, which is adjusted to the level of education and characteristics of students.

The selection of the right models, methods, and media significantly affects students' ability to understand mathematical concepts, especially in numeracy skills. In line with this, Nurmadiah (2016) Explain that the components in the communication process include messages, message sources, media channels, and message recipients. In the Minimum Competency Assessment (AKM), there are 4 mathematical contents classified as numeracy: Numbers, Measurement and Geometry, Algebra, Data and Uncertainty (Noviantini, 2023). Algebraic material is one of the aspects of numeracy that can be more easily conceptualized with the help of learning media, because visualization and interactivity in the media can help students understand mathematical patterns, relationships, and operations in a more concrete

way (Fitriani & Jailani, 2024). However, the communication process in learning does not always run smoothly. The use of improper, ineffective, or inefficient media can hinder the learning process. Therefore, it is important to pay attention to the role of media as a communication tool in learning so that learning activities are effective and efficient. Moreover Son & Nisa (2021) stating that the media can convey messages faster to students so as to help achieve learning goals.

Posters as a medium are considered visual learning tools that are able to describe or visualize information using words, numbers, and symbols. In line with that, Purwani et al. (2019) explains that visual media is a learning medium designed to convey facts, ideas, and messages clearly and powerfully. The main elements in visual media are images and writing. In the design of teaching materials and learning media, it is important to pay attention to the presentation of facts or ideas through words, numbers, and symbols. Sadiyah & Rezania (2023) It is further stated that posters are a potential learning medium because they combine theories, sketches, drawings, graphics, and other ideas in an attractive design. Thus, it can be concluded that posters are beneficial for students in learning mathematics. In line with the statement, research by Anggraheni & Saifuddin (2021) It also states that poster learning media has an important role in increasing student learning motivation because it is able to present material visually, attractively, and easily understood, so that it can arouse students' interest and active involvement in the learning process. Considering these challenges, as a solution, the use of visual learning media such as posters can be an interesting innovative approach to apply in numeracy learning. Learning that uses learning media can improve students' numeracy skills by encouraging them to learn independently, explore concepts interactively, and develop a deeper understanding through a flexible and structured learning experience (Pambudi, Ardianto, et al., 2024).

Improving numeracy skills is essential to create quality, competent, and competitive human resources. Research by Yunarti & Amanda (2022) About the importance of numeracy skills for students shows that numeracy is not only useful for solving math problems, but it is also beneficial in everyday life, such as helping to increase employment opportunities and creating a safe environment. Therefore, numeracy skills are a top priority that needs to be developed to support daily life (Umbara & Suryadi, 2019). In improving numeracy skills, Higher Order Thinking Skills (HOTS) play an important role in improving numeracy, as it allows students not only to memorize mathematical concepts, but also to analyze, evaluate, and apply their knowledge in a variety of real-life contexts (Pambudi, Muhammad, et al., 2024). Therefore, the first step that teachers must take is to understand and improve their numeracy skills first in order to guide their students in the learning process. And therefore the purpose of this study is to test the effectiveness of Android-based Poster Andro learning media in improving the numeracy skills of seventh grade junior high school students. Specifically, this study wants to find out the extent to which the use of these media can facilitate the understanding of counting concepts, increase learning motivation, and support an independent and flexible learning process. The results of this research are expected to make a positive contribution to the development of innovative learning media that is relevant to the needs of the times, as well as a practical solution for teachers in improving students' numeracy skills. Thus, this research not only makes a theoretical contribution to the development of digital learning media, but also has a direct impact on improving the quality of educational practices at the junior high school level.

METHOD

This study uses a quantitative approach of the PreExperimental Quantitative method, but the research subjects were not randomly selected. The type used in this study is One Group Pretest-Posttest Designs, which is a research design that contains a pre-test before being given treatment and a post-test after being given treatment. The population of this study is grade VII students of State Junior High School in one of Lalat Regencies. The sampling technique in this study uses the purposive sampling technique, which is a sample determination technique with certain considerations (Sugiyono 2018:131). This technique is very suitable for use in this study because the number of samples taken is only 30 students in grades VII-9 with good activity levels and an Android smartphone. Data collection was carried out through pretest and postest. The design of this study explains that the pretest group, the test given before

treatment and the posttest are the tests given after the treatment. This PreExperiment research aims to determine the effectiveness of Andro's poster media on students' numeracy skills. The test instrument to measure numeracy ability is designed in the form of 10 multiple-choice questions. The preparation of this instrument follows structured stages to ensure its validity and relevance to the learning objectives. The stages of preparing the numeracy ability test instrument include:

1) Formulate a conceptual definition related to the numeracy ability to be measured.
2) Establish operational definitions as the basis for concrete measurements.
3) Compile question indicators based on the operational definition.
4) Compile a question grid as a guide for the preparation of question items.
5) Develop description questions that represent students' numeracy skills.
6) Compile assessment rubrics to evaluate students' answers objectively and systematically.
7) Create an answer key that refers to the ideal solution of each question.

The design of this study can be written like this:

O1 X O2

Information:
O1 = Pretest value before treatment.
O2 = Postcatest value after receiving treatment.
X = treatment by applying Andro's learning media poster

Pre-experiments were conducted using a single-sample design, in which subjects were not given the treatment. The sample for the test in the form of a pre-test (O1) aims to determine the cognitive learning outcomes of students. After the pre test results (O1) are obtained, the next step is to give treatment (X) in the form of active learning poster comment activities. Once treatment is given, students will undergo a post-test to measure their level of cognitive learning outcomes. This post-test aims to identify whether there is an improvement in students' cognitive learning outcomes or not. The difference between pre-test (O1) and post-test (O2) was analyzed to determine the rate of increase, with the data analyzed using a t-test. The variables in this study are independent variables and bound variables. An independent variable is a variable that affects or causes a dependent variable to change. In this study, the independent variable (X) was the effectiveness of using the Andro poster learning media. Dependent variables are variables that are influenced or caused by the presence of independent variables. In this study, the ability to calculate is a dependent variable (Y).

Table 1. Research Stages

No.	Research Stage	Activity Description
1.	Preliminary Studies	Review the literature and formulate the focus of the problem.
2.	Preparation of Research Design	Prepare a pre-experimental research design with one pretest-posttest group.
3.	Determination of Research Subjects	Determine the research subject by purposive sampling technique in grade VII students of SMPN 1 Babalan.
4.	Pretest Implementation	Perform initial measurements of counting skills before treatment.
5.	Treatment (Intervention)	Provide learning using Android-based Poster media.
6.	Posttest Implementation	Measuring counting skills after treatment.
7.	Data Collection and Processing	Collecting data on pretest-posttest and questionnaire results, then processing them quantitatively.
8.	Data Analysis and Interpretation	Analyze the data with statistical tests (t-test or gain score) and interpret the results.

The series of stages arranged in this study is in accordance with the basic principles of pre-experimental research, especially the design of one group pretest-posttest. The stages start from a

preliminary study to identify problems and formulate the right research focus, followed by the preparation of a systematic design. The selection of subjects by purposive sampling technique allowed the researcher to deliberately select a group that was relevant to the research objective, namely grade VII students who had difficulties in numeracy skills.

The use of pretest and posttest provides a strong basis to measure the effectiveness of the treatment (intervention) given, in this case the use of Android-based Poster learning media. The process of data collection and analysis carried out quantitatively, including the use of statistical tests such as t-tests or gain scores, supports the inferential validity of the resulting findings. Thus, these stages form a logical, measurable, and appropriate workflow within the methodological framework required in pre-experimental research.

RESULTS AND DISCUSSION

The use of Andro Poster is effective in helping students understand numeracy concepts through visual and contextual approaches. This media combines attractive graphic design with numeracy content that is appropriate to the level of development of junior high school students, so that it can increase their motivation to learn. The Andro poster helps students connect numeracy material with daily life, the material chosen is algebraic material for grade VII CHAPTER IV with the Sub-material of Elements of Form Algebra. This material was selected because it has a high level of relevance in everyday life. Algebra is often used in real life, such as counting the number of items, managing budgets, or solving everyday problems involving mathematical variables and operations. This is in line with constructivist learning theory, where students learn more effectively when the material is relevant to their experience. Before using the Andro poster application, students complete pretest questions packaged in the form of multiple-choice questions with the same level of similarity as the posttest questions. This is to see the effectiveness of Andro's poster in helping students understand numeracy material visually and interactively. Students open the Andro poster application on their smartphones, so that a display like Figure 1 appears. Students click on the start button on the application and there are 2 features, namely material posters, and instructions for use.

Figure 1. The first appearance of the media poster on a smartphone (left) and display of media features andro poster on smartphones (right)

Students access the material poster containing the content of the algebraic form element subchapter, which has summarized the material according to the submaterial TP with an interactive display. The material is made as effective as possible with examples of application in daily life, this is applied because students learn more effectively when the material is relevant to their experience. After students get treatment with Andro's poster media, students are required to complete the postest which contains numeracy quiz questions for continuous algebraic material in accordance with the sub-chapter, the subchapter of algebraic forms which includes 3 posters and the numeracy questions that are done are 10 multiple-choice questions.

Figure 2. Poster display of Sub CHAPTER I elements of algebraic forms, sub CHAPTER II properties of algebraic operations, and Sub CHAPTER III modeling poster with algebraic shapes

The data of the pretest results before being given the treatment of Andro's poster learning media and the data of the postest results after using the Andro poster learning media are as follows.

Table 2. Paired Sample Statistics

	Mean	N	Std. Deviation	Std. Meaningful Error
Prates	60.97	30	6.283	1.147
Post-tests	72.87	30	8.059	1.471

This output displays the descriptive statistical results of the two analyzed samples: pre-test and post-test. The average learning outcome in the pre-test was 60.97, while in the post-test, the average was 8.059. The research sample consisted of 30 students. The standard deviation (std) for the pre-test was 6,283, while for the post-test it was 8,059. In addition, the value of std. The average error was recorded at 1,147 for pre-test and 1,471 for post-test. Because the average learning outcome in the pre-test is 60.97 < the post-test is 72.87, it means that descriptively there is a difference in the average learning outcome between the pre-test and the post-test.

Table 3. Correlation of Paired Samples

			Std. Significance of Deviations	
	N	Correlation	P One Side	Two Sides p
Prates & Pascates	30	.855	<.001	<.001

The above output shows the test results of the correlation or relationship between the two data or the relationship between the pre-test and post-test variables. Based on the above output, it is known that the correlation value of 0.865 indicates a very strong positive relationship between pretest and posttest scores. This means that students with high pretest scores also tend to have high posttest scores. One Side p < .001, Two Sides p < .001. A very small p-value (< 0.001) indicates that the relationship between pretest and posttest scores is statistically significant. p <.001 means that the probability of a relationship

(correlation) between the pretest and posttest values that occurs by chance is less than 0.1%. In other words, we have more than 99.9% confidence that the relationship between pretest and posttest is real, not a result of chance.

Table 4. Paired Sample Test

				95% Confidence Interval of Difference			
Prates	Mean	Std. Deviation	Std. Meaningful Error	Lower	Above	t	Df
Prates & Pascates	-11.900	4.097	.748	-13.430	-10.370	-15.910	29

The average difference between posttest and pretest scores is -11,900, with posttest scores higher than pretest scores (as a negative score indicates a larger posttest). This shows a significant improvement in students' abilities after using learning media. Std. Deviation = 4.097. Standard deviation shows how wide the difference in score (posttest-pretest) is between students. A score of 4,097 indicates that the variation between students is relatively small, indicating fairly consistent results. Mean Error = 0.748. This value indicates the standard error rate of the calculated average difference. A low value (0.748) indicates a very accurate average estimate. Bottom = -13,430, Top = -10,370. The 95% confidence interval indicates that the average difference between the posttest and the pretest is most likely in the range of -13,430 to -10,370. This difference is consistently negative, indicating a significant post-pandemic increase. t = -15,910. This t-statistic value is very high (negative due to the posttest-pretest comparison), showing a significant difference between the pretest and posttest values. df = 29 degrees of freedom calculated from the sum of data pairs minus one (n-1). With 30 students, df is 29. Single-Sided P < 0.001, Two-Sided p < 0.001. A very small p-value (< 0.001) indicates that the mean difference between the pretest and posttest is statistically significant. In educational research, this means that the increase that occurs is almost certainly not due to chance.

Table 5. Effect Size of Paired Samples

		Standardization	Estimated Points	Lower	Above
Prates & Pascates	D Cohen	4.097	-2.905	-3.725	-2.074
	Hedge Correction	4.207	-2.829	-3.627	-2.020

The Standardizer is worth 4,097. This Standardizer is the standard deviation of the score difference (pretest-posttest). This value is used to calculate the effect size. The estimated point is -2.905. Cohen's d value of -2.905 shows that the magnitude of the effect of the intervention (the use of Andro Poster learning media) is very large. In general, Cohen's rule is: 0.2 = small, 0.5 = medium, 0.8 or more = large. A value of -2.905 is well above 0.8, indicating a huge improvement in students' numeracy abilities after using Andro Poster. Based on the magnitude of the effect (correction of Cohen's d and Hedges), the use of Andro Poster learning media effectively improves the numeracy skills of junior high school students in grade VII. The effect is not only statistically significant but also very large practically.

The results of the analysis showed that the use of Andro Poster learning media had a very significant influence on improving the numeracy skills of junior high school students in grade VII. Based on the results of the t-test, there was a significant average difference between the pretest and posttest scores with a p< value of 0.001, which suggests that the improvement in learning outcomes did not occur by chance. In addition, the results of the correlation analysis between pretest and posttest showed a very strong relationship (r = 0.865, p < 0.001), which showed the consistency of the learning effect. The magnitude of the effect calculated using d Cohen (-2,905) and the Hedges correction (-2,829) also showed a very large effect, far exceeding the threshold of high effectiveness (d > 0.8). The results of this study are in line with the findings of the Lestari et al. (2023) which shows that the use of mobile learning

improves the numeracy skills of junior high school students. Similar to research from E. P. Astuti et al. (2024) It shows that the use of ethnomathematics-based learning media has a positive effect on improving students' numeracy skills, in line with teachers' confidence in the effectiveness of the approach in the learning process. In line with the research Abd Samad et al. (2021) The use of mobile learning has been proven to be effective in supporting the learning process, which shows that mobile learning can increase student engagement and facilitate flexible and sustainable access to learning in Malaysia.

Thus, Andro Poster's learning media has proven to be very effective in improving students' numeracy skills, while having a statistically and practically significant impact. Although each learning medium certainly has its drawbacks, the findings of the Lee (2023) which shows the effectiveness of media is only significant in students with visual learning styles. This is likely contextual and not applicable in general, so the potential limitations can be said to be relatively small in wider application.

Although Poster Andro's learning media has proven effective in improving students' numeracy skills, several shortcomings need to be considered. First, this media can only be accessed through devices based on the Android operating system. This is an obstacle for students who do not have Android smartphones or who use devices with other operating systems, such as iOS, thus limiting the accessibility and equitable use of media among all students, especially in areas with limited economy or technological infrastructure.

Second, Andro's poster is designed with a dominant visual approach. Meanwhile, not all students have a visual learning style. For students who are more responsive to auditory-based or kinesthetic learning, these media may be less optimal in improving understanding of concepts. This shows that the success of media use is highly dependent on compatibility with students' individual learning styles. Third, although this media contains interactive elements, the interactivity offered is still limited to digital poster displays and simple navigation. Students' interaction with the media is one-way, i.e., viewing and reading information, without simulations, active animations, or direct feedback. This makes student involvement in the process of critical thinking or more complex problem-solving still less than optimal compared to more dynamic digital media such as educational games or augmented reality-based applications.

Thus, although Andro's posters make a positive contribution to mathematics learning, developers and educators need to consider and overcome these limitations so that this medium can be more inclusive, adaptive, and comprehensive in supporting the student learning process.

Limitations and Recommendations

This research has several limitations. First, media can only be accessed through Android-based devices, which limits affordability for users of other systems. Second, the dominant visual approach is not necessarily suitable for all students' learning styles. Third, the level of interactivity is still limited to basic features. In the future, it is recommended that media development include multiplatform (Android and iOS), integration of audio media and interactive feedback, and design adjustments based on student learning style preferences. Follow-up research may also expand the scope of the subject or use experimental designs with control groups to improve the validity of findings.

CONCLUSION

This study proves that Android-based Poster Andro learning media effectively improve the numeracy skills of junior high school students in grade VII. Through a visual and interactive approach, this media has succeeded in improving the understanding of algebraic concepts, strengthening learning motivation, and facilitating more contextual learning. The statistical test results showed a significant increase in posttest scores compared to the pretest. Posttest scores increased from an average of 60.97 to 72.87 with a p value of < 0.001, showing a significant increase. Cohen's $d = -2.905$, indicating a huge effect of the intervention. The pretest and posttest correlation = 0.865, showing a powerful and consistent relationship between scores.

Thus, Andro Poster can be an alternative innovative learning media that supports students' numeracy literacy, especially in algebraic materials. Despite its limitations, such as being only available on Android and being visually dominant, this media still makes a real contribution to improving the quality of mathematics learning at the junior high school level and deserves further development for a wider

scope. In general, this research makes a practical contribution to the use of digital media in mathematics learning and emphasizes the need for innovation in learning models to answer the challenges of 21st-century education.

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