

THE EFFECT OF FLIPBOOK-ASSISTED E-MODULE TO IMPROVE STUDENTS' MATHEMATICAL UNDERSTANDING ON JUNIOR HIGH SCHOOL

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ABSTRACT

Mathematics education, especially statistics, is crucial for developing students' logical and critical thinking skills. However, eighth-grade students at SMP Negeri 3 Telaga still have a low level of conceptual understanding due to conventional teaching methods and a lack of technology, with an average daily test score of 58.4 and 80% of students not achieving learning completeness. Students struggle to visualize basic concepts such as graph interpretation, measures of central tendency, and data dispersion, necessitating innovations like Flipbook-based e-modules to enhance learning interactivity and effectiveness. This study aims to determine the effect of e-modules using the Flipbook application on the ability to understand mathematical concepts in statistics material in grade VIII at SMP Negeri 3 Telaga. The quantitative research method used a quasi-experimental pretest-posttest control group design, involving 54 eighth-grade students who were randomly divided into an experimental group (26 students) using the Flipbook e-module and a control group (28 students) using printed modules. The results showed a significant increase in the experimental group, with a posttest average of 85.0961 (from a pretest average of 12.6602), compared to the control group with a posttest average of 71.7261 (from a pretest average of 9.0773), with an effect size of 0.9544 indicating a large effect. The data was normally distributed and homogeneous, proving a significant difference between the groups. The results of the study show that the Flipbook-based e-module is more effective than the printed module in improving understanding of statistical concepts, driven by multimedia interactivity and flexible independent learning.

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INTRODUCTION

Education shapes a smart and competitive generation. Mathematics in education is key to developing students' logical, critical, and systematic thinking. In particular, statistics, which is

relevant to everyday life, teaches students to make decisions based on data that has been collected, presented, analyzed, and interpreted (Diyatul Husna et al., 2025). Students' low ability to solve various problems is caused by a lack of understanding of mathematical concepts, especially complex ones such as statistics. Students face difficulties when solving problems because of their weak understanding of concepts, and tend to have difficulty choosing the right formula if they rely on memorization without a deep understanding of the concepts. This problem is commonly found in almost all topics in mathematics (Pauweni et al., 2019). Students can solve difficult problems more effectively if they understand the concepts well. Learning mathematics using animation can influence students to think creatively in order to build mathematical concepts (Kobandaha et al., 2022). Therefore, students should not only memorize formulas but also master the concepts thoroughly.

Statistics is an important part of mathematics that must be studied in secondary school. This subject has many applications in real life, so a good understanding of it is essential. However, most students face difficulties when solving problems related to statistics. In eighth grade, students' understanding of statistics is still low due to a lack of basic understanding, conventional learning methods, and minimal use of technology. Students find it difficult to visualize these concepts and relate them to real-world problems. Therefore, more interactive learning methods that utilize technology are needed to improve students' understanding. As stated by (Kusnadi & Mardiani, 2022), these difficulties are often caused by less interactive learning approaches and the lack of effective digital technology to support students' understanding in solving problems independently.

With the development of technology, one alternative that can be used to improve learning effectiveness is the use of technology-based teaching materials. One innovation that can be applied is the use of e-modules with the Flipbook application. The use of e-modules in learning is an innovative solution that can improve the effectiveness of the teaching and learning process. E-modules using the Flipbook application provide a more interactive and engaging way of learning (Ainy et al., 2024). This application provides features to display interactive and dynamic visual materials, such as animations, videos, and exercises that can be used anywhere and anytime. Therefore, it is hoped that students will gain a better understanding of statistical concepts through the use of these e-modules.

According to interviews with mathematics teachers at SMP Negeri 3 Telaga, during lessons, students' understanding of concepts is still relatively low. Students find it difficult to relate mathematical concepts to problems in questions. This can be proven by looking at the learning outcomes of eighth-grade students at SMP Negeri 3 Telaga through their daily test scores for statistics in the even semester of the 2023/2024 academic year, where out of 30 students in class VIII-A, only 6 or approximately 20% of students met the passing grade of above 70, and 24 students or approximately 80% who did not meet the mastery criteria with scores below 70, with an overall average score of 58.4. This is in line with research by (Rachma et al., 2025) that understanding mathematical concepts has a significant effect on student learning achievement. Students who have difficulty connecting concepts to problems tend to have low scores.

Students' understanding of statistics is still low, and they often have difficulty understanding basic concepts such as graph interpretation, measures of central tendency, and data dispersion (Dewi et al., 2020). Students' low understanding of statistics is a recurring problem at various levels of education. Students often face difficulties in understanding questions, which then affects their ability to understand the basic concepts given in the questions and use the correct formulas (Maharani et al., 2022).

According to (Abdulah et al., 2023), conceptual understanding is the ability of students to master subject matter, apply it in various forms that are easy to understand, and implement these concepts in accordance with the appropriate cognitive structure.

According to Cahani, students are considered to have poor or low understanding of mathematical concepts because they do not meet the criteria for conceptual understanding. However, students are considered to have the ability to understand mathematical concepts if they can understand them well (Izzati et al., 2021).

Meaningless learning is a major factor in why students have difficulty understanding mathematics. The learning that takes place at SMP Negeri 3 Telaga is still conventional, using the expository/lecture method, where learning focuses on the teacher without involving the students, thus failing to build a strong conceptual understanding in students. Therefore, if students who follow lessons by memorizing the formulas or procedures taught by the teacher tend to experience difficulties when faced with new problems (Rafiah, 2020).

The use of e-modules created with the Flipbook PDF Professional application is software used to convert PDF documents into interactive digital books with page-turning effects. This application allows users to add multimedia elements such as videos, audio, links, images, and interactive animations to enhance the reading experience. Flip PDF Professional is often used in the creation of e-modules, digital catalogs, interactive magazines, and digital-based teaching materials (Khairinal et al., 2021).

According to (Rozak et al., 2024), this application allows users to create learning media that can be taken anywhere in an .exe format that is easier to use. The method for creating Flip PDF Professional Software involves installing the software, creating a new project by selecting a PDF or image, modifying the Flipbook with templates, animations, and plugins, adding media such as images, audio, video, and links, and publishing the Flipbook in various storage formats.

This e-module is designed to improve students' critical and analytical thinking skills by helping them understand statistical problems in a way that provides a more interactive, engaging, and accessible learning experience. In addition, the Flipbook application allows for more engaging and interactive presentation of material compared to conventional textbooks. Through the use of the Flipbook application, students can more easily understand statistical concepts through more engaging and interactive visualizations. Furthermore, this e-module also allows students to learn independently at their own pace, giving them the opportunity to learn independently at their own pace, so that they can focus more on understanding material that they find difficult.

By combining concept comprehension strategies in e-modules using the Flipbook application, students are expected to more easily master statistical concepts, become motivated to learn mathematics, and improve their concept comprehension skills. Therefore, the researcher was interested in conducting a study entitled *The Effect of E-Modules Using the Flipbook Application on Statistics Material*. Therefore, the purpose of this study is to determine the effect of e-modules using the Flipbook application on mathematical concept comprehension skills in statistics material in class VIII of SMP Negeri 3 Telaga.

METHOD

The method used in this study was quantitative, using a quasi-experimental approach, with a pretest and posttest control group design. In this design, the two groups were divided randomly. The pretest was conducted to determine the initial conditions and to find out whether there were significant differences between the experimental group and the control group. The following is the design model used by the researcher.

Table 1. *Pretest Posttest Control Group Design*

Sample Selection Technique	Group	Pretest	Treatment	Posttest
Simple Random Sampling	Experiment	Y1	X1	Y2
Simple Random Sampling	Control	Y1	X2	Y2

Description:

X1 = E-Module Learning Treatment Using the Flipbook Application

X2 = Learning using conventional learning methods (without the Flipbook e-module)

Y1 = Pretest

Y2 = Posttest

The population used in this study was eighth-grade students at SMP Negeri 3 Telaga, consisting of three classes with a total population of 86 students. The sample used in this study consisted of two classes, namely class VIII-A as the control class and class VIII-B as the experimental class, which were selected using simple random sampling (Sugiyono, 2013).

The test instrument used in this study consisted of eight essay questions. Data analysis techniques included prerequisite tests (normality and homogeneity tests) and hypothesis testing using t-tests to compare the mean samples of the two groups. After the t-test results were obtained, the analysis continued with Cohen's effect size test to determine the magnitude of the effect, using the following criteria.

Table 2. Effect Size Value

Effect Size Value	Description
0,00 – 0,20	Very low impact
0,21 – 0,50	Low impact
0,51 – 1,00	Moderate impact
>1,00	High impact

Source:(Cohen et al., 2018)

RESULTS AND DISCUSSION

Results

The data in this study are the results of tests on students' understanding of mathematical concepts taught using printed modules in the control class and e-modules using the flipbook application in the experimental class. The e-module using the flipbook application was taught in class VIII-B with 26 students, while the printed module was used in class VIII-A with 28 students. In this case, the test consisted of 8 valid pretest and posttest questions. Examples of e-modules used in this study can be accessed via the Flipbook platform at the following link: <https://online.flipbuilder.com/sofdp/tfzs/>.



Figure 1. E-Module

Next, the prerequisite tests for analysis include normality and homogeneity tests. Testing the normality distribution of data is shown in an effort to identify whether the data collected from the study is normally distributed or not. The normality test applied in this study is the Shapiro-Wilk test with the following results.

Table 3. Testing Normality of Distribution with Shapiro-Wilk

Class	Test Type	$W_{calculate}$	W_{table}	Decision
Experiment	<i>Pretest</i>	0,9600	0,9200	Distributed
	<i>Posttest</i>	0,9591		
Kontrol	<i>Pretest</i>	0,9300	0,9240	Normal
	<i>Posttest</i>	0,9618		

The testing of data normality distribution is shown in an effort to identify whether the data collected from the study is normally distributed or not at a significance level of $\alpha=0.05$. The normality testing criteria in this study is that H_0 is accepted if $W_{calculate} \geq W_{table}$. If H_0 is accepted, it means that the research data is normally distributed.

After the data is normally distributed, a homogeneity of variance test is performed. The purpose of this test is to determine whether the characteristics and abilities of the two classes are homogeneous or not. The following are the results of the homogeneity test:

Table 4. Homogeneity test

Data	Class	n	dk	$F_{calculate}$	F_{table}	Decision
<i>Pretest</i>	Experiment	26	25	0,6550	1,9209	Homogen
	Control	28	27			
<i>Posttest</i>	Experiment	26	25	0,8910	1,9209	Homogen
	Control	28	27			

Based on the results of the data analysis above, it can be concluded that the four data sets meet the assumptions made by the group in a normally distributed and homogeneous population. The results obtained from the homogeneity test show that in the pretest, the experimental class and control class showed an $F_{calculate}$ value $< F_{table}$, where $F_{calculate}$ was 0.6550, while the posttest of the experimental class and control class obtained an $F_{calculate}$ of 0.8910 and an F_{table} of 1.9209. Therefore, when both data are normal and homogeneous, the hypothesis test can be continued. The hypothesis test in this study uses the T-test. The following are the results of the T-test for concept comprehension ability.

Table 5. T-test Results

Data Group	Average Value		Degree of Freedom (df)	$t_{calculate}$	t_{table}	Decision
	<i>Pretest</i>	<i>Posttest</i>				
Experiment	12,6602	85,0961	52	2,6752	1,6750	H_1 accepted
Control	9,0773	71,7261				

It can be concluded that there is a difference in the level of understanding of mathematical concepts between students who use E-Modules with the Flipbook Application and students who use printed modules as the focus of learning. The ability of students to understand concepts taught with E-Modules using the Flipbook Application is higher than the ability of students whose learning uses Printed Modules, where the test results show $t_{calculate} \geq t_{table}$ for the $\alpha = 0.05$ level. With $t_{calculate} = 2.6752 > t_{table} = 1.6750$,

H_1 accepted and H_0 is rejected. The final test results show that students who participated in E-Module learning using the Flipbook Application achieved an average score of 85.096. Meanwhile, learning using Printed Modules achieved an average score of 71.7261.

Table 6. Effect Size Test Results

Data Group	Average	SD_{pooled}	ES	Decision
Experiment	17,3846	2,4582	0,9544	Moderately influential
Control	15,0357			

Based on Table 6, the calculation results obtained an effect size of 0.9544, so it can be concluded that learning with E-Modules using the Flipbook Application has an effect on improving students' mathematical concept comprehension skills, because this value is above the moderate effect size category according to Cohen's interpretation.

Discussions

The use of E-Modules with the Flipbook application has been proven to have an effect on improving mathematical concept comprehension in statistics. There is a difference in concept comprehension between students taught with E-Modules using the Flipbook application in the experimental class and students taught using printed modules in the control class. Based on the results of the study, the initial ability of students in the experimental class with a pretest average score of 12.6602 and the control class with a score of 9.0773 showed that the students' basic ability in understanding concepts was still low before the treatment was given. Meanwhile, the posttest results of the experimental class increased to 85.0961, and the control class to 71.7261.

The findings of this study are in line with the research (Al Farisyi, 2022) showing that e-modules can improve students' understanding of mathematical concepts. The effectiveness test results show that e-modules can improve mathematical concept comprehension skills with an average N-gain of 0.70. Furthermore, a study by (Rindy Ayu Angelia et al., 2024) shows that there is a positive correlation between motivation and student learning outcomes. Thus, it is stated that there is a positive and significant effect of using flipbook digital media on student motivation and learning outcomes in mathematics fraction material. The difference between this study and the researchers' study is whether there is an effect on student learning outcomes, while the researchers focus on students' conceptual understanding.

Similarly, research conducted by (Tati et al., 2024) shows that the use of Flipbook can increase student motivation. The post-test results show that the average score of the experimental class was higher than that of the control class, namely $99.59 > 87.35$, with an increase of 12.24. Research conducted by (Septiani et al., 2023) states that there is an effect on students' interest in learning after the implementation of the Flip PDF Professional-based E-module. This can be seen from the results of the Pearson product-moment correlation coefficient test, which is $0.830 > 0.005$.

Research by (Agrifina et al., 2025) states that there is a significant effect of using flipbook media on the understanding of spatial concepts in mathematics lessons. The results of hypothesis testing using simple linear regression showed that the t-value was greater than the table value, namely $8.969 > 2.056$, indicating an influence, and an R-square value of 0.744 was obtained, meaning that 74.4% of the variables in understanding mathematical spatial concepts were influenced by the use of flipbook media.

Research conducted by Purba, I. N. (2024) shows that e-modules can improve students' mathematical concept comprehension skills. This is also supported by the opinion (Tahir et al., 2022) that one of the abilities that must be possessed by every subject taught, especially in mathematics learning, is conceptual understanding. If students can understand the initial

concepts well and correctly, they will have the ability to develop and master these concepts on their own according to the basic concepts they understand.

Advances in e-book technology have facilitated the integration of print technology with computer technology in the learning process, particularly in the creation of learning modules (Yunus et al., 2023). E-modules, also known as electronic modules, are digital modules consisting of images, text, or both that contain digital electronic material accompanied by simulations. These modules can be used in learning (Akuba et al., 2020). By combining concept comprehension strategies in e-modules using the Flipbook application, students are expected to more easily master statistical concepts, become motivated to learn mathematics, and improve their concept comprehension skills.

CONCLUSION

Based on research conducted at SMP Negeri 3 Telaga, it can be concluded that the application of Flipbook-based E-Modules is significantly more effective in improving students' understanding of mathematical concepts in statistics than the use of printed modules. Data analysis shows that the average posttest score of students in the experimental class using E-Modules reached 85.0961, while the control class using printed modules only obtained an average score of 71.7261. The hypothesis test results with the T-test showed $t_{\text{calculate}} = 2.6752 > t_{\text{table}} = 1.6750$, indicating a significant difference in conceptual understanding between the two groups. In addition, an effect size value of 0.9544 indicates a significant effect of using E-Modules on improving students' conceptual understanding. This E-Module provides a more engaging learning experience by combining multimedia elements such as text, images, audio, and video, making the material easier to digest and less boring. Overall, the results of this study reinforce the opinion that the use of information and communication technology in learning, particularly with Flipbook-based E-Modules, provides greater benefits in improving students' conceptual understanding compared to traditional methods that use printed modules. This shows the great potential of E-Modules in improving the effectiveness of the learning process in today's digital era.

In the application of learning media, it is recommended to consider using Flipbook-based E-Modules in the learning process, especially for complex material, to improve students' understanding of concepts. Future researchers are advised to develop similar studies on different materials.

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