**Research Article**

# Improving Students' Mathematical Representation Ability with E-learning Modules Using the Kvisoft Flipbook Maker Application

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**Abstract.**
This research is motivated by the need to enhance students' mathematical representation skills, supported by the findings of a preliminary study involving eighth-grade students at SMPN 2 Gununghalu, West Bandung Regency. In the context of advancing science and technology, one viable approach is to develop technology-based learning media, one of which is by using the Kvisoft Flipbook Maker application. The purpose of this study was to determine whether e-modules, aided by the Kvisoft Flipbook Maker application, could improve students' mathematical representation skills. The research employed the four-D (4D) research and development method, encompassing four stages: the definition stage, the design stage, the development stage and the dissemination stage. Data collection techniques in this study included both test and non-test methods. The findings from this study revealed an improvement in students' mathematical representation abilities after utilizing e-modules with the help of the kvisoft flipbook maker application. Additionally, the e-modules met the criteria for validity, effectiveness and practicality in the learning process.

**Keywords:** e-learning modules, kvisoft flipbook, students' mathematical representation ability.

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## 1. INTRODUCTION

Mathematics is one of the scientific disciplines that has an important role in life, namely an exact science that is the basis and is interrelated with other sciences. Learning mathematics is very important, because it is not only used in lessons at school but the application of mathematical concepts is needed in everyday life [1]. In the NCTM there are five standards that describe the relationship between mathematical understanding and mathematical competence that students should know and do. The understanding, knowledge and skills that students need to have are included in the standard process,

namely: problem solving, reasoning, communication, connection, and representation abilities [2].

In the process of learning mathematics, the ability to represent is one of the most important things in supporting the success of the learning process. This is in accordance with what is stated in the NCTM "Representations should be treated as essential elements in supporting students' understanding of mathematical concepts and relationships". The term representation refers to processes and products. In other words, for the act of capturing a mathematical concept or being linked in some form to the form itself [3]. Representation is seen as the ability that a person uses to think and communicate mathematical ideas by using sentences, symbols, tables or other media to clarify problems. Because mathematics is a subject that is more in problem solving, students' mathematical representation skills are needed to determine the presentation of the right solution to solve mathematical problems.

A preliminary study was conducted at SMP Negeri 2 Gununghalu to determine the extent of students' mathematical representation abilities in solving a mathematical problem on number pattern material. Based on the analysis of students' answers, students' mathematical representation abilities are in the sufficient category. However, there are still many students who are still wrong in representing the questions given. This is in accordance with previous research, in his research stating as many as 37% of students still have difficulty representing the data known in the problem into mathematical symbols [2].

In connection with the above, we need a learning that allows students to develop and apply concepts to improve mathematical representation skills, namely by selecting the right learning media. One form of learning media that can assist students in practicing mathematical representation skills can be by using a module. However, the use of the print module has drawbacks, namely it cannot show videos, animations, music, is not interactive, is difficult to carry everywhere and requires large printing costs [4]. Therefore, new innovations are needed, namely by modifying the module into a more attractive, practical and can be carried everywhere. The product is an electronic module or what is often referred to as an E-Modul. Safitri, Permata, & Wilujeng (2020) in their research "E-modules or electronic-based modules are useful as conveyors of information contained in the hard disk, compact disk (CD), APK, ex, or web format to help students learn independently" explained that e-module is a learning tool or means to convey information and help students learn independently [5]. E-module is a combination of print media and computer so that it can present information in a structured, interesting and have a high level of interactivity.

The use of learning media with the support of innovation greatly affects the capacity and desire of students to take part in the learning system. Understanding the use of PC media can trigger students to be able to complete practice questions because of the lively presentation of designs, colors, and music. Learning media got a good response from students [6]. The positive impact of learning using interactive teaching materials. So that researchers are interested in developing e-module teaching materials using the kvisoft flipbook maker application [7].

Based on the description above, the selection of appropriate teaching materials is expected to improve students' mathematical representation abilities. So further research is needed on the development of e-modules to improve mathematical representation abilities [8]. The purpose of this study was to develop teaching materials for e-modules based on kvisoft flipbook maker and find out how teachers and students respond to the e-modules to be developed, and how the e-modules affect students' mathematical representation abilities.

## 2. RESEARCH METHOD

The research method used is research and development or commonly known as Research and Development (R&D). The development model in this study uses the development of a 4D model of learning tools, which consists of 4 stages of development, namely define, design, develop, and disseminate.

The types of data used in this research are quantitative data and qualitative data. Qualitative data in the form of an assessment of the quality category of learning media on the number pattern material based on a questionnaire filled out by material experts, media experts, and students. Quantitative data in the form of pretest and posttest scores as well as scores from each criterion point assessment in the Kvisoft Flipbook Maker-based e-module quality questionnaire on number pattern material assessed by material experts, media experts, and students. Then categorized based on the Likert scale criteria.

TABLE 1: Likert scale criteria.

| Score | Information |
|-------|-------------|
| 4 | Very Good |
| 3 | Good |
| 2 | Not enough |
| 1 | Very less |

Sources of data in this study were class VIII students of SMP Negeri 2 Gunung-halu, Mathematics teacher class VIII at SMP Negeri 2 Gununghalu, expert validators, consisting of material experts and media experts.

Data collection in this study was obtained through:

1. Documentation

   This technique is carried out from the data collection stage to the completion of the product made.

2. Validity

   Teaching materials in the form of e-modules based on Kvisoft Flipbook Maker that have been made by researchers, validated by material experts, linguists and media experts.

3. Pretest and Posttest

   The pretest has the aim of knowing the initial abilities of students before being given learning in the form of e-modules which include questions about students' mathematical representation abilities.

4. Questionnaire/Questionnaire

   Questionnaire/Questionnaire is a data collection technique that is carried out by giving a set of written statements or questions to the respondent which is then filled out in a questionnaire sheet

The data obtained from the research instrument at the time of the trial were analyzed using statistical measurements. The total assessment score is obtained by the following formula [9].

$$\underline{x} = \frac{\sum_{i=1}^{n} x_i}{n} \qquad (1)$$

With:

$$x_i = \frac{total\ score}{maximum\ scorel} \times 4 \qquad (2)$$

Keterangan:

$\underline{x}$ : Final average

$x_i$ : The operational test value of each respondent's questionnaire

$n$ : The number of respondents who filled out the questionnaire

Validation data analysis was obtained from the results of the media expert and material expert validation questionnaire. The results of each assessment score obtained,

calculated on average. Based on the data obtained from the average value, a table of criteria for converting scores into statements is then compiled, which can be seen in Table 2.

TABLE 2: Validation criteria.

| Quality Score | Eligibility Criteria | Information |
|---|---|---|
| $3,26 < x \leq 4,00$ | Valid | No repair |
| $2,51 < x \leq 3,26$ | Quite Valid | Pe Partial Repair rbaikan Sebagian |
| $1,76 < x \leq 2,51$ | Less Valid | Partial repair & review of materials |
| $1,00 < x \leq 1,76$ | Invalid | Complete repair |

Analysis of the effectiveness test of the use of mathematical e-modules that have been developed and analyzes students' mathematical representation skills using the n-gain formula. According to Hake, the gain value is formulated [10]:

$$N - Gain = \frac{skor\ posttest - skor\ pretest}{skor\ maksimal - skor\ pretest} \times 100\% \tag{3}$$

The criteria for the gain value according to Hake can be seen in table 3.

TABLE 3: N-Gain value criteria.

| N-Gain | Category |
|---|---|
| $N - gain \geq 0,70$ | High |
| $0,30 < N - gain < 0,70$ | Currently |
| $N - Gain \leq 0,30$ | Low |

The analysis of the practicality test was carried out by calculating the average assessment score from the student response questionnaire and converted into questions to determine the level of practicality of the developed math e-module [11]. The research was conducted at SMP Negeri 2 Gununghalu. Research time from October 6 to October 15, 2021.

## 3. RESULTS AND DISCUSSION

This study uses a 4D development model (four D model) from Thiagarajan, Dorothy S. Sammel and Melvyn S. Sammel. The final details of the results of each research stage are as follows.

1. Define

At the Define stage there are four main steps, namely:

2. Front-end analysis

Based on the results of interviews with mathematics teachers at SMP Negeri 2 Gununghalu, in the learning process teachers use teaching materials or learning resources that are still based on textbooks, interspersed with using the internet. Teachers have never used electronic learning media that should be in the 2013 curriculum, students are introduced to the development of learning technology. The occurrence of the Covid 19 pandemic to date has made electronic learning media very much needed, because it can be learned and accessed easily by students at home. One of them is the electronic module to increase students' interest in learning mathematics.

3. Concept Analysis

At the concept analysis stage, the results obtained include:

Subject matter: Number Pattern

Basic Competence : Making generalizations from patterns in number sequences and object configuration sequences

4. Task Analysis

The researcher conducted an analysis of basic competencies, then detailed the learning indicators. In addition, the researchers also analyzed the main tasks in the form of student worksheets and independent exercises that must be mastered by students in order to achieve basic competencies.

5. Learning Objectives (Specific Instructional Objectives)

Based on the results of this analysis, it was found that several objectives to be achieved in the kvisoft flipbook maker-based e-module, namely: students can determine the next term of a number sequence by generalizing the number pattern into an equation correctly, determining the various number sequences correctly, and Solve problems related to patterns in number sequences correctly.

6. Design

The steps taken at the design stage are:

7. Test Compilation

The preparation of the test begins with compiling a grid of questionnaires that will be submitted to material experts, media experts and students.

8. Media Selection

Based on the previous analysis, it was decided that the chosen learning media was an e-module based on Kvisoft Flipbook Maker on number pattern material. The e-module is presented in a view like reading a book directly because there is an effect of turning pages that can be accessed by students via computers or smart phones.

9. Format Selection

This stage begins with grouping and identifying the various components that will be created and used for kvisoft flipbook maker-based e-modules. The main software used is kvisoft flipbook maker which produces flip-shaped products. Supporting software is Microsoft Word and PDF.

The typeface used in the e-module consists of several types of letters in different and consistent parts and places. The e-module cover uses Times New Roman font, the introduction and content of the material uses Book Antiqua font.

The images used are obtained from the internet and are free source so there are no legal issues related to copyright.

The initial design of the mathematics e-module using the kvisoft flipbook maker on number pattern material which contains competencies that must be achieved by students, basic materials, worksheets, independent exercises, learning evaluations and assistance in using e-modules.

1. Develop

2. Results of making e-modules

The following is a display of the results of the Kvisoft Flipbook Maker-based e-module design in Figures 1 to 4.

1. Product Feasibility Assessment

The material expert conducts an assessment of the material and language in the e-module. The material expert assessment prioritizes the aspects of content quality, language and presentation feasibility. The results of material expert validation can be seen in Table 4.

Validation on media experts prioritizes aspects of appearance or graphics. The results of the media expert validation data analysis can be seen in Table 5.

Based on Table 5 obtained a percentage of 77.5% with good criteria or said to be valid. Referring to these results, the quality of the kvisoft flipbook maker-based e-module is in the range of $2,51 < \underline{x} \leq 3,26$, so it is stated in the "feasible/valid" criteria.
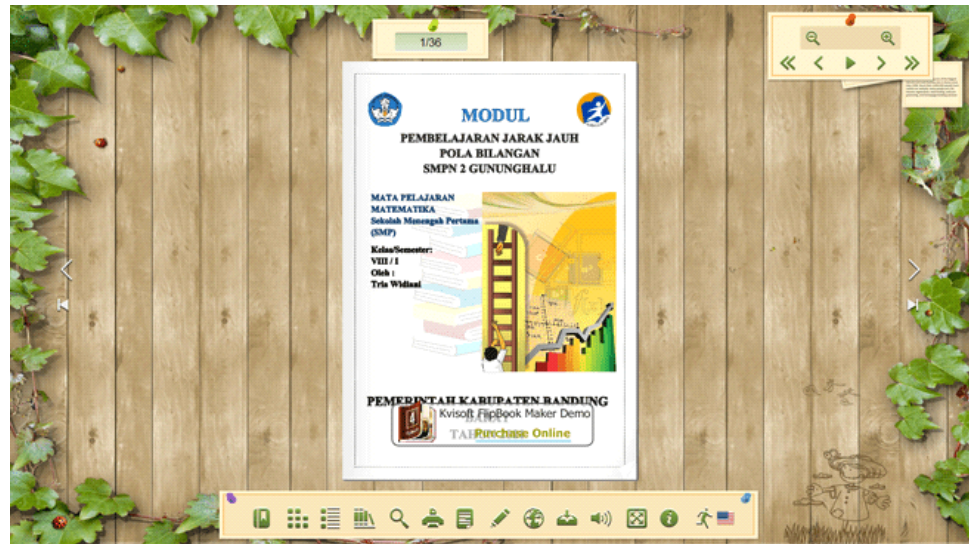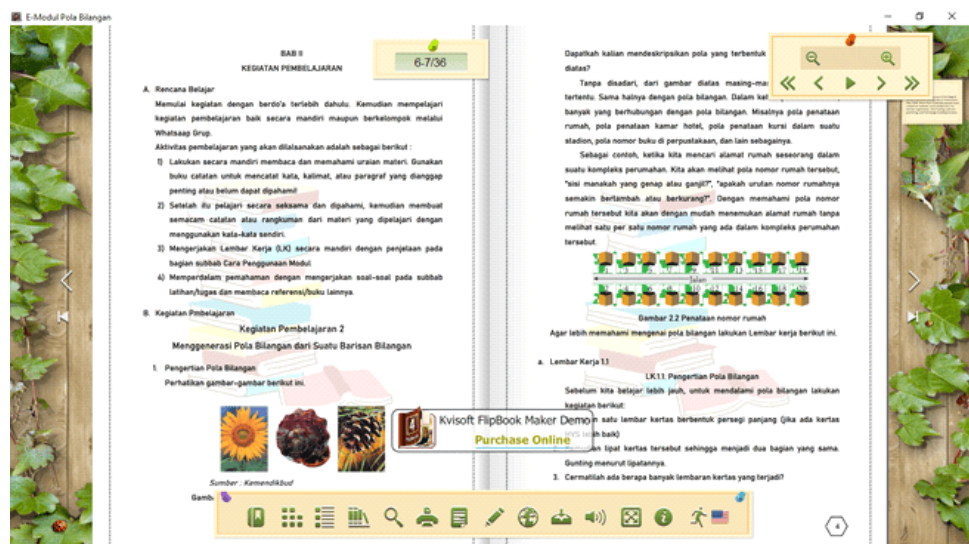
**Figure** 1: Home page display.



**Figure** 2: Learning activity page display.

1. Product Trial Results

The kvisoft flipbook maker-based e-module was tested with a small-scale trial consisting of 12 students of class VIII F and a large sala trial consisting of 31 participants in class VIII F at SMPN 2 Gununghalu. The results of product trials can be seen in Table 6.

2. Effectiveness Trial

The effectiveness test aims to determine the level of effectiveness of the developed product. The analysis of the results of the effectiveness test can be seen in Table 7.
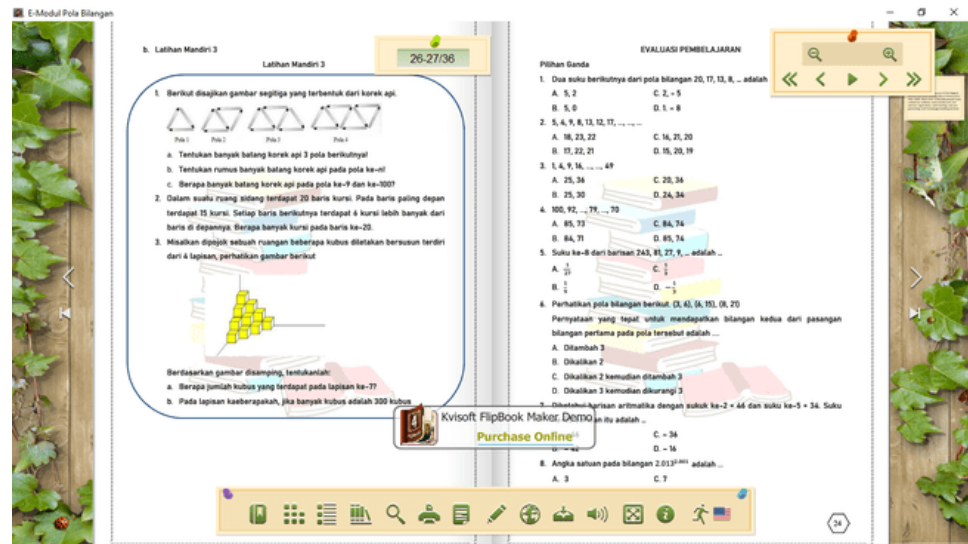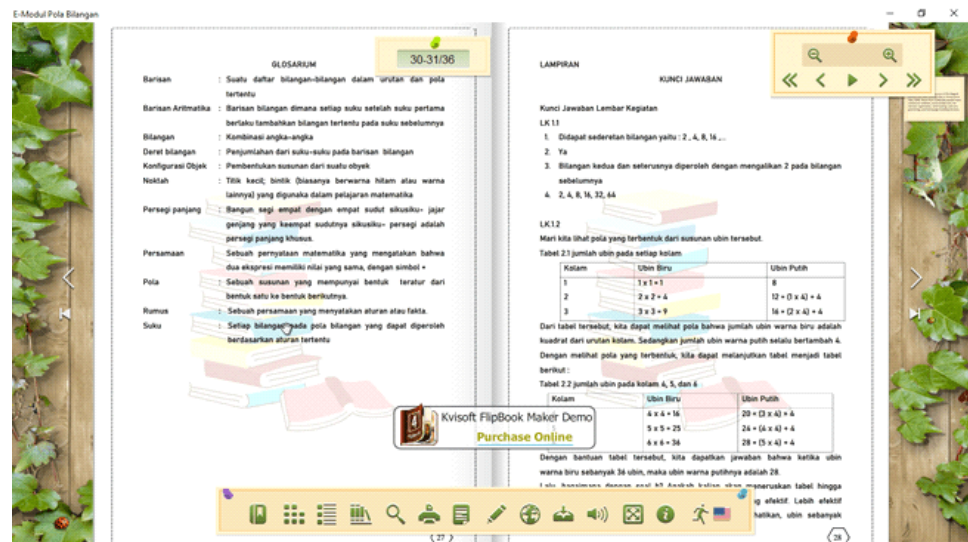
**Figure** 3: Learning evaluation display.



**Figure** 4: Glossary view.

Based on table 7, it can be seen that the results of the acquisition of 37 students in the pretest and posttest, the results of the average increase test (N-gain) showed that the VIII grade students of SMPN 2 Gununghalu experienced an average increase of 0.353 with an average difference of 17.65 with medium criteria. So it can be concluded that the kvisoft flipbook maker-based e-module is effective to use.

3. Dessiminate

The final product is an e-module based on kvisoft flipbook maker in the form of an installer in the form of flipe exe and html form. At this stage, the researcher

TABLE 4: Recapitulation of material validation results.

| No. | Aspect | Score |
|-----|--------|-------|
| 1. | Content eligibility | 38 |
| 2. | Serving eligibility | 35 |
| 3. | Language eligibility | 26 |
| 4. | E-module evaluation aspects | 9 |
| 5. | Realistic assessment | 18 |
| Total score | | 126 |
| Average score | | 2,8 |
| Persentase | | 70% |
| Criteria | | Worthy |

TABLE 5: Recapitulation of media validation results.

| No. | Aspect | Score |
|-----|--------|-------|
| 1. | Graphic eligibility | 62 |
| Average score | | 3.1 |
| Persentase | | 77.5 |
| Criteria | | Worthy |

TABLE 6: Attractiveness and practicality trial results.

| No | Testing | Analysis Results | |
|----|---------|------|--------|
| | | $\overline{x}$ | Kriteria |
| 1 | Small group scale | 3.12 | Attractive and Practical |
| 2 | Large group scale | 2.92 | Attractive and Practical |
| Rata-rata | | 3.02 | Attractive and Practical |

TABLE 7: Product Effectiveness test results.

| No | Test Questions | many | Analysis Results | |
|----|----------------|------|------|--------|
| | | | $\overline{x}_i$ | Not Passed KKM |
| 1 | *Pretest i* | 37 | 50.09 | 19 |
| 2 | *Posttest* | 37 | 67.74 | 8 |
| Average difference | | | 17.65 | |
| Grade N-Gain Value | | | 0.353 | Sedang |

conducted a limited distribution due to the limitations of the researcher. The e-module based on the kvisoft flipbook maker was distributed by researchers only to one mathematics teacher at SMPN 2 Gununghalu as a place of research.

The increase in the ability of students' mathematical representation can be known through the data from the test results of students' mathematical representation abilities.

The average increase data (N-Gain) related to students' mathematical representation abilities are presented in Table 8.

TABLE 8: Data on average increase (n-gain) of mathematical representation ability.

| Category | Score |
|----------|-------|
| Pretest | 50.09 |
| Posttest | 67.74 |
| Average difference | 17.65 |
| Grade N-Gain Value (100%) | 0.353 |
| Criteria | Currently |

Based on the results of the pretest and posttest, it was compared with the N-Gain analysis test to determine the feasibility of developing a Kvisoft flipbook maker-based math e-module on number pattern material to improve students' mathematical representation skills. After analyzing the analysis, the data obtained with an N-Gain score of 0.353 which lies in the range of 0.30 < N-gain < 0.70 so that it obtains the criteria for interpreting the effectiveness of being in mathematics learning. Thus, it can be concluded that the Kvisoft Flipbook Maker-based mathematics e-module is effective to use, which results in an increase in mathematical representation ability. Of course, in line with this, it also has an impact on student learning motivation, this can be seen from the enthusiasm of students in participating in learning in class. Students become more active and ask a lot of questions about the subject matter.

Another finding in this study is about the factors that affect student learning outcomes. Based on the results of interviews with mathematics teachers, he said that students are less enthusiastic in the learning process because mathematics has many formulas, and is considered difficult. In general, the findings that the researcher found are in accordance with the research by Fajri Fu'adah Mazamy, namely an environment that does not support the learning process, inadequate school facilities, and the lack of student desire in learning [12]. This study shows that learning using the e-mathematical module with the help of the Kvisoft flipbook maker application is effective for improving students' mathematical representation.

## 4. CONCLUSION

The e-module product with the basic material of this number pattern has been updated using a stage called 4D, namely define (introduction / definition), design (planning as well as product designer), develop (development and manufacture of a product)

and dessiminate (dissemination of the product that has been said). worthy). Making e-modules using an application called Kvisoft Flipbook Maker. Feasibility of the e-module with an average value of each validator, namely material experts of 2.8, obtained the appropriate criteria with a slight improvement, while the media expert of 3.1 obtained the appropriate criteria without having to be corrected. So that the average result of the assessment from the validation of material experts and media experts is 2.95, it can be concluded that the Kvisoft Flipbook Maker-based math e-module has obtained the "feasible/valid" criteria for later testing.

Regarding the practicality and attractiveness of the e-module, students received a response with a score of 3.12 including the attractive criteria, while for large-scale trials the score was 2.92 with interesting criteria. At the time of testing the effectiveness category using the N-gain test, there was an increase of 0.35 for most people who were categorized as moderate.

The results of increasing students' mathematical representation abilities after using e-modules based on kvisoft flipbook maker were given to students in grades VIII E and F at SMP Negeri 2 Gununghalu giving effective results. This can be seen from the increase in student learning outcomes who were tested through pretest and posttest. By using the analysis test, the n-gain score data was 0.353 in the medium category. So it can be concluded that the use of e-modules assisted by kvisoft flipbook maker is effective to use, so that it has an impact on increasing students' mathematical representation abilities.

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