Journal of Educational Research and Evaluation
Volume 6, Issue 1, 2022, pp. 80-87
P-ISSN: 2597-422x E-ISSN: 2549-2675
Open Access: https://doi.org/10.23887/jere.v6i1.38785

The Effectiveness of Using Electronic Modules in Mathematics Subjects in the Material of Constructing Flat Sided Space

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ARTICLE INFO

Article history:
Received August 22, 2021
Revised August 23, 2021
Accepted January 05, 2022
Available online February 25, 2022

Kata Kunci :
E-modul, Matematika, Sumber belajar

Keywords:
E-modules, Mathematics, Learning resources

ABSTRAK

Perkembangan teknologi saat ini mendorong berkembangnya banyak modul elektronik yang mempengaruhi proses pembelajaran. Permasalahan pembelajaran matematika yang diperoleh terletak pada hasil belajar yang belum optimal, salah satu penyebabnya adalah kurangnya sumber belajar dan keterbatasan waktu belajar. Penelitian ini bertujuan untuk menganalisis keefektifan modul elektronik terhadap hasil belajar kognitif materi bidang samping. Pendekatan penelitian yang digunakan adalah kuantitatif. Jenis penelitian yang digunakan adalah penelitian pra eksperimen. Desain yang digunakan dalam penelitian ini adalah One Group Pretest-Posttest. Subyek penelitian ini adalah siswa kelas VIII yang berjumlah 32 siswa yang terdiri dari 14 laki-laki dan 18 perempuan. Metode pengumpulan data dengan observasi, wawancara, dan tes. Instrumen tes yang digunakan adalah tes objektif dengan 10 butir soal. Analisis peningkatan hasil belajar dianalisis dengan menggunakan rumus N-Gain. N-Gain digunakan untuk meningkatkan hasil belajar. Berdasarkan analisis N-gain, hasil belajar siswa menunjukkan nilai 0,61 atau secara persentase 61% dengan kategori cukup praktis. Disimpulkan bahwa pembelajaran dengan menggunakan modul matematika elektronik cukup efektif dalam meningkatkan hasil belajar matematika siswa. E-modul dapat membantu siswa dalam belajar.

ABSTRACT

Current technological developments encourage the development of many electronic modules that affect the learning process. The problem of learning mathematics obtained lies in learning outcomes that are not optimal, one of the causes is the lack of learning resources and limited study time. This study aimed to analyze the effectiveness of the electronic module on cognitive learning outcomes in the side-plane material. The research approach used is quantitative. The type of research used is pre-experimental research. The design used in this research is One Group Pretest-Posttest. The subjects of this study were class VIII students, who collected 32 students consisting of 14 boys and 18 girls. Methods of data collection by observation, interviews, and tests. The test instrument used was an objective test with 10 items. The analysis of improving learning outcomes was analyzed using the N-Gain formula. N-Gain is used to improve learning outcomes. Based on the N-gain analysis, student learning outcomes show a value of 0.61 or, in percentage, 61%, with a reasonably practical category. It was concluded that learning using the electronic mathematics module was quite effective in improving students' mathematics learning outcomes. E-modules can help students in learning.

1. INTRODUCTION

Learning is a process of interaction between subjects, objects and learning resources. Structured learning is a form of teacher activity programmed in an instructional design, to make students learn actively. Learning like this will make students have a good learning experience and learning becomes more meaningful (Barnard et al., 2021; Nugraheni et al., 2021; Tamboto et al., 2021). Meaningful learning is learning that provides experience and is able to develop students' knowledge which can later be applied in everyday life. (Angela, 2014; Kostiainen et al., 2018; Soekisno, 2015). This learning principle is also applied in learning mathematics. Mathematics learning should be emphasized more as an educational vehicle to develop all the potential of students including reasoning skills, creativity, problem solving abilities, communication skills, hard and independent work habits, honest, disciplined, have good social attitudes and various basic skills needed in social life. (Bano et al., 2018; Demitra & Sarjoko, 2018; Hassan et al., 2016; Hwang et al., 2021). Therefore, learning mathematics needs to consider the important components of supporting learning, especially learning resources so that the learning objectives are achieved.

Mathematics learning that is able to achieve its learning objectives is the expectation of teachers and students when carrying out the learning process (Mullis et al., 2012; Swanson et al., 2021). However, currently the mathematics learning activities carried out are still conventional both in the use of methods and learning media. (Rakoczy et al., 2019; Setiyani et al., 2020; Simon & Cox, 2019). As in learning

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mathematics at SMP Negeri 2 Banyuresmi, students only get material from the teacher through lectures with the help of teaching materials such as printed books whose sample samples are not relevant to the lives of students. Students are only limited to memorizing mathematical concepts but do not understand what the material is being studied and how it is applied. The weakness of this printed book itself is that it is less practical to carry because it is relatively large and heavy, the text can only be arranged in a linear fashion, it cannot be completed with videos in its presentation, it is only in the form of pictures. Students lack the ability and willingness to explore teaching materials. This is in line with research which says that many students have difficulty understanding the material and are less motivated to learn to use printed books. (Asrial et al., 2019; Fonda & Sumargiyani, 2018; Wahyu Istuningsih et al., 2018). Another problem faced by students is the limited time to study at school, while the mathematical concepts that must be known are quite a lot. Of course, this if left unchecked will greatly affect the learning outcomes of students. The wider impact is on educational goals.

One of the learning resources that have an important role in learning mathematics is learning media (Ambarwati, 2019; Rahmani & Widyasari, 2018). Learning media is everything that is used to convey messages and can stimulate thoughts, feelings, attention, and willingness to learn so that it can encourage the learning process (Arfinanti, 2018; Argarini & Sulistyorini, 2018; Ridha Yoni Astika et al., 2020). There are two important roles of media in the teaching and learning process, namely: Media as teaching aids and Media as learning resources that are used by students independently, so that learning media have various benefits that can be used during the teaching and learning process. (Khairunnisa & Ilmi, 2020; Munir, 2018). One of the learning media used to help students understand the material more easily is the learning module. The learning module is able to have a positive influence on the cognitive level of students in understanding the material and causes an increase in learning activities (Logan et al., 2021; Rasmussen et al., 2020). Modules can help students understand concepts both in self-study activities or in group learning which will make learning more meaningful. (Maghfiroh & Hardini, 2021; Simamora et al., 2019). It can be said that the existence of a children's learning module really helps the learning process. To achieve this goal, the modules developed must be in accordance with the material, curriculum, and user characteristics (Solihudin JH, 2018).

One solution that can be used is the use of electronic modules or e-modules. E-modules make learning easier, and can create independent learning that can also be used according to the user's comfort conditions (Asrial et al., 2019; Wahyu Istuningsih et al., 2018). The existence of e-modules gives students the flexibility to learn independently without being bound by time and place (Elvarita et al., 2020; Wijayanti et al., 2016). So that it allows students to improve their abilities and learning outcomes. Several findings in previous studies state that the application of e-modules can provide comfort to students so that it has an effect on increasing understanding of a material. (Fonda & Sumargiyani, 2018; Perdana et al., 2017; Rasmussen et al., 2020). Teaching materials using e-modules can have a positive impact on student learning outcomes because access and absorption of learning materials becomes easier. The advantage of the module is that students have the opportunity to learn independently (Astra et al., 2020; Matsun et al., 2019). Learning becomes more interesting because it can be learned outside the classroom and outside learning hours, has the opportunity to express ways of learning according to their abilities and interests, the opportunity to test their own abilities by working on the practice questions presented in the module.

The findings of previous studies also state that e-modules have a very positive impact on learning outcomes, student independence (Elvarita et al., 2020; Wijayanti et al., 2016). E-modules can also increase students' learning enthusiasm (Astra et al., 2020; Matsun et al., 2019). The relevance of this research lies in the use of electronic modules with a contextual approach. The advantages of the developed E-module are that the e-module prioritizes easy access for students and the presentation of material accompanied by contextual examples to make it easier for students to learn abstract mathematical concepts from flat-sided building material. This study aims to analyze the effectiveness of the use of electronic modules on the learning outcomes of mathematics subjects in the flat-sided building material at SMP Negeri 2 Banyuresmi.

2. METHODS

This research is qualitative research using descriptive qualitative method. The data collection technique used by the researcher in this study was a direct survey, interview, and observation technique. The resulting data is in the form of a description in the form of a narrative text, namely an outline description of the data that has been collected. The focus in this study is to describe the needs of mathematics learning media. The place of this research was carried out in one of the State Junior High Schools in Garut Regency. Samples were obtained by purposive sampling technique. The research subjects were 23 students of class VIII at the school. This research is research with a quantitative approach. The type of research used is pre-Experimental. Pre-experimental design is used to reveal cause-and-effect relationships by involving only

one group of subjects, so there is no strict control over the variables. The design used in this study is the One Group Pretest-Posttest. Research with this design has a research flow, namely before being given treatment, the class is given an initial test (pretest) to find out the learning outcomes of students. After being given a pretest, the class was then given treatment, namely by being given an electronic module that was used online. Then after that the class was given a final test (posttest) to find out whether or not there was an increase in student learning outcomes after the use of the electronic module.

This research was conducted at SMP Negeri 2 Banyuresmi. The target of this research is class VIII students. The number of samples for this study was 32 students with 14 males and 18 females from class VIII-b. Class VIII students have the criteria for the age of 12-14 years. This age range falls into the category of early teens and students should be able to do independent learning. The learning abilities of students are different, some are quick to understand the subject matter and some are taking a long time to understand it. The data collection methods used were interviews, observations, questionnaires and tests. The instrument grid is presented in Table 1.

Table 1. Pretest and Posttest Instrument Grid

Basic competencies	Indicator	Cognitive Level
Distinguish and determine the surface area and volume of flat shapes (cube, cuboid, prism, and pyramid)	Understand the definitions and characteristics of cubes and blocks	C2
	Knowing the nets of cubes and blocks	C2
	Applying the formula for the surface area of a cube and a cuboid	C3
	Apply the volume formulas for cubes and cubes	C3
	Understand the definitions and characteristics of prisms and pyramids	C2
	Knowing the nets of prisms and pyramids	C2
	Applying the formula for the surface area of prisms and pyramids	C3
	Applying the volume formulas for prisms and pyramids	C3
Solve problems related to surface area and volume of flat shapes (cube, cuboid, prime and pyramid)	Solve contextual problems related to cubes, blocks, prisms and pyramids	C4

The main data obtained from the effectiveness test is the type of quantitative data. Quantitative data were obtained from the students' pretest and posttest learning outcomes. However, in testing the effectiveness of this electronic module product can also obtain qualitative data from the results of observations. Observations were made to see the results of observations of student activities. The data analysis technique carried out in the first stage is using a qualitative descriptive approach, namely describing the electronic module product after it is implemented in the form of a finished product and testing the level of product feasibility. The second stage uses a quantitative descriptive, which describes the effectiveness of the product to be implemented on competency standards, understands the concepts and ideas of social change material. Categories Interpretation of Effectiveness of N-Gain using a 4 scale (Arikunto, 2011).

3. RESULT AND DISCUSSION

Results

The module that was tested for its effectiveness in this study was an electronic module for the subject of flat-sided geometry. The effectiveness of the module is seen from the impact that arises from the use of the module by students on their learning outcomes. Assessment of learning outcomes for students aims to find out whether learning activities have been running effectively, the effectiveness of students can be seen in the ability of students to achieve the learning objectives that have been determined. The pretest was given with the aim of knowing the mastery of the initial concept before being given treatment with the electronic module, while the posttest was given with the aim of knowing the mastery of the concept after being given treatment in the form of learning using the electronic module. The effectiveness test is used to see the level of success in learning activities using an electronic module that has been developed. The

electronic module can be said to be effective if the electronic module can have an impact on improving student learning outcomes after using the electronic module compared to before using the mathematical electronic module on flat-sided space-building materials.

The electronic module that has been developed as a learning medium before being used by students has been tested for feasibility to material experts, media experts, and learning village experts with very feasible criteria. Data on the effectiveness of the use of electronic modules can be analyzed through the pretest and posttest scores as well as the completeness of learning outcomes. The minimum completeness criteria (KKM) for mathematics in class VIII is 70. The KKM achievement value is 70, out of 32 students only 4 people achieved the KKM score on the pretest. Meanwhile, at the time of the posttest, as many as 31 students got scores that reached or exceeded the KKM score and 1 student got a score below the KKM score. If it is seen that there is a significant increase in the value of students who reach the KKM between the pretest and the posttest. The data on the average learning outcomes of students and the magnitude of the increase in learning outcomes indicated by the N-Gain value can be seen in Table 2.

Table 2. Average Learning Outcomes and N-Gain Score

Number of students	Average value		Big Boost	N-gain	The highest score		Lowest Value	
	Pretest	*Post test*			*Pretest*	*Post test*	*Pretest*	*Post test*
32	48,75	79,06	30,31	0,61	70	100	30	60

Based on table 3, it shows that the results of learning mathematics in the material of building a flat side space before using the electronic module get an average value of 48.75. While the average value of student learning outcomes after using the electronic module is 79.06. Thus, if we look at the average pretest and posttest scores of students, it can be seen that there is an increase in the value of 30.31. Based on the N-gain analysis, the students' learning outcomes showed a value of 0.61 or in the percentage it was written 61%. Based on table 2, the N-Gain value of 61% is categorized as quite effective, which means that learning by using the electronic module of mathematics in the flat-sided building material is quite able to improve students' mathematics learning outcomes.

Discussion

The results of the study show that the developed electronic module is effectively used to improve mathematics learning outcomes. Several factors cause the effectiveness of the use of electronic modules, namely electronic modules that have been validated by material experts, media experts, and learning village experts and are declared quite feasible and effective to be used in learning so that they can improve learning outcomes. Second, the electronic module is structured with contextual examples in a language that is easier to understand so that students are motivated to learn. Third, the electronic module is structured based on basic competencies, indicators, materials, concept understanding, summaries, practice questions, and self-reflection so that students can learn and measure their respective abilities. The electronic module allows students to optimize their way of learning independently, build concepts to be studied and develop reasoning power so that students can master the competencies that must be achieved in learning (Asmi et al., 2018; Elvarita et al., 2020; Matsun et al., 2019).

In addition, this is influenced by First, the effectiveness of the use of the electronic mathematics module is seen from the learning outcomes of students during the learning process. The existence of an electronic module makes it easier for students to obtain information about the material provided. This is caused by the electronic module whose content and language are easier to understand, there are pictures and videos and are designed with an attractive appearance, so that it can help students more easily understand the material (Istuningsih et al., 2018; Purnamasari et al., 2020). In general, learning using e-modules is independent learning in which the teacher acts as a facilitator while students build their own knowledge (Hamid et al., 2021; Rahmah et al., 2021; Solihudin, 2018). The use of media in the learning process can make it easier for students to participate in learning, electronic modules also help students to be more focused, active, and think critically in participating in learning (Aprilia & Suryadarma, 2020; Asrial et al., 2020; Fonda & Sumargiyani, 2018). This is said to be effective because learning carried out with learning media can make learning less boring and fun so that students' interest and motivation to learn also increase.

Second, the effectiveness of the use of e-modules is shown by students being able to learn independently because all the material studied has been provided in the form of pictures, paragraphs and even videos that are packaged according to the characteristics of the students. Learning material delivered

using media is more effective than learning without using media (Asrial et al., 2021; Linda et al., 2018; Perdana et al., 2017). This will motivate students to learn more independently and the learning process can be focused on students (Komikesari et al., 2020; Seruni et al., 2020). Third, the effectiveness of the e-module on students' learning outcomes is shown by the increase in students' mathematics learning outcomes after using the developed mathematics e-module. This is because the module used for learning is equipped with pictures and video explanations of the material which of course makes students not bored when studying independently. The e-module is equipped with a navigation system that allows the display or loading of images, audio, and video, as well as formative evaluation. Students who like to take lessons will find it easier to accept the information provided (Asrial et al., 2019; Wahyu Istuningsih et al., 2018; Wijayanti et al., 2016). Therefore, the e-modules developed must be made as attractive as possible so that students are interested in following the learning process so that it has an impact on improving learning outcomes.

The findings of previous studies also state that E-modules can make it easier for students to learn (Asrial et al., 2019; Wahyu Istuningsih et al., 2018). Other research also states that E-modules can attract students' attention (Elvarita et al., 2020; Wijayanti et al., 2016). From this discussion, it can be understood that the resulting electronic module is effectively used to improve mathematics learning outcomes. The use of e-modules in learning mathematics can help students understand the material, so that they can improve their learning outcomes. This e-module can be used by students to study anytime and anywhere so that it supports independent learning and is a solution for the limited time to learn mathematics at school. From the results of the research conducted, it can be seen that electronic modules are needed to help facilitate learning activities so that they can have a positive impact, especially in creating an interesting, fun, effective and efficient learning process. This study can be used as an evaluation in improving student mathematics learning outcomes in the future, so that improving the quality of education can be carried out optimally.

4. CONCLUSION

The electronic module that was developed was effectively used by students in learning mathematics in the material for building flat-sided spaces. This is evidenced by the increased student learning outcomes after using the developed electronic module. In its application, students who use electronic modules can better understand the material, the learning process is not boring, and has a positive impact, especially in creating an effective, efficient, and interesting learning process in addition to being a supporting medium for the learning process.

5. ACKNOWLEDGEMENT

We would like to thank the Principal of SMP Negeri 2 Banyuresmia for the research permit granted to obtain data at the school he leads. We would also like to thank the Mathematics Teacher, and class VIII students at SMP Negeri 2 Banyuresmi who have contributed during the learning process using the electronic mathematics module in the material for building flat-sided spaces

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