Developing E-Module Based on Etnomathematics to Improve Students' Creative Thinking Skill

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ABSTRACT.
Electronic modules (E-module) are needed to support independent learning and provide character values to students during the Covid 19 pandemic. However, currently, the number is still minimal. This study aims to develop an e-module based on ethnomathematics that is effective and meets the valid and practical criteria. The research method used is development research using the ADDIE method, which consists of the Analysis, Design, Development, Implementation, and Evaluation stages. The research subjects were class VIII Junior High School students in the Purworejo area. They collect data using validation sheets, student response sheets, and tests of creative thinking skills. The results showed that an ethnomathematics-based e-module had been produced. The e-module was developed with five stages of development, namely the analysis stage, including material and needs analysis. The next stage is the development stage which includes the design of the e-module followed by the preparation of research instruments and validation of the e-module. The next stage is testing for product finalization. At this stage, the quality of the e-module based on the validator's assessment is in the valid category, and the evaluation by students is in the practical category. Then, to see whether E-modules can improve students' creative thinking skills, a Gain test is carried out; these results show that ethnomathematics-based e-modules can improve students' creative thinking skills. Thus the final product of this e-module is effectively used for junior high school students and can be used as a learning resource that can have a potential effect.

Keywords: *Etnomathematics, E-Module, Education technology*

1. INTRODUCTION

Mathematics is one of the branches of science that is considered to play an important role in forming quality human resources because mathematics is a means of thinking to examine things logically and systematically. The progress of developed countries until now has become the domain of 60% -80% depending on mathematics [1]. There is a need to improve the quality of education in Indonesia, one of which is improving mathematics learning outcomes in schools. The quality of learning can be seen from the results of the assessment, a good assessment system will encourage teachers to determine the right strategy and can improve student learning outcomes. The success of the learning process cannot be separated from the ability of teachers to develop learning modules, explore new ideas, and utilize technological advances that are oriented towards increasing student intensity effectively in the learning process [2].

The learning process consists of several main elements, one of which is learning materials. The learning materials used are modules. The module is one of the learning materials that have the nature of helping and encouraging students to be able to teach themselves (self-instructional) and not depend on other media [3]. Modules are developed according to the desired needs and adapted to 21st-century learning, so mathematics learning must reflect four things, namely communication skills, collaboration skills, critical thinking and problem-solving skills, and creativity and innovation skills" [4]. Through 21st century learning, at least teachers are able to develop knowledge skills, critical

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thinking, problem-solving, creativity, independence, communication, and student collaboration. The learning process carried out by the teacher is conventional learning where the teacher positions himself as an object of learning (teacher-centered), it is necessary to change the conventional learning to be more optimal so that students are able to solve mathematical problems.

Module development must be adapted to the development of 21st-century learning, which is required to be technology-based to balance the demands of the millennial era, with the aim that students are familiar with 21st-century life skills. E-module is an electronic version of a module and can be read on a computer or electronic book reader, and designed with the necessary software [5].

The need for an attitude of respect and incorporation of cultural knowledge into the practice of life, so that the community cannot be separated from the original Indonesian culture which is full of noble values. The way to teach culture to students is through learning mathematics. One form of learning approach that links local culture to learning mathematics is ethnomathematics.

Ethnomathematics is mathematics that grows and develops in a certain culture as an alternative to developing mathematics learning tools which so far still tend to be conventional and less contextual [6]. Effective math teaching requires an understanding of what students have known previously and need to learn and then challenge and support them to learn it well" [7]. Based on this, learning mathematics at school must begin with something concrete or real and approach the lives, knowledge, and experiences of students as a beginning in learning. The focus on ethnomathematical-based learning can be implemented into the formal mathematics curriculum to overcome students' learning difficulties in mathematics. Ethnomathematics has begun to be integrated into the school mathematics curriculum with the initial assumption of preserving the culture's values that are increasingly being swallowed up by the times [2].

Learning mathematics using ethnomathematics-based e-modules contains four ethnomathematical characteristics, namely the existence of cultural products, realistic activities, and the discovery of mathematical concepts [8]. The physical object in the form of a mosque building is used as a context in starting learning, meaning that all problems related to the context of the cultural heritage of the Sunan Geseng Mosque building as a cultural product can be used in studying geometric concepts [9]. Then the form of activity in the e-module focuses on finding the concept of the surface area of the Sunan Geseng Mosque building. Here, students can explore and learn the concept of flat shapes, including cubes, blocks, prisms, and pyramids. The knowledge about the cultural heritage of the Sunan Geseng Mosque contained in this e-module includes history, philosophy, values, and cultural forms adapted to the material in the syllabus. The history and philosophy of cultural heritage and its cultural forms are shown in the material contained in the e-module as a context for starting learning [10].

Students are also required to use all their abilities in solving math problems given as evaluations. The learning process must meet the indicators of creative thinking that are adapted to the characteristics of ethnomathematics so that students can be said to think creatively. The indicators used are fluency, flexibility, elaboration, and originality.

2. METHOD

This research is development research. The development of learning tools in this study refers to the ADDIE development model, namely Analysis, Design, Development, Implementation, and Evaluation [7]. The analysis phase includes needs analysis and material analysis. The design stage is designing and preparing teaching materials to be developed. The development stage is modifying the prototype of teaching materials to produce teaching materials. This development stage consists of validating teaching materials from several experts. The implementation phase consists of testing teaching materials. While the evaluation stage is the final stage of ADDIE development to provide value to the resulting product [3].

The subjects in this study were students of class VIII in junior high school, the limited trial was followed by 6 students and the wide trial was attended by 32 students. The instruments used to collect data in this study can be classified into three types. Each is used to meet the criteria of validity, practicality, and effectiveness to measure the increase in students' creative thinking skills. The instruments are:

2.1. Module validation

Three experts carried out the module validation sheet to determine the validity of the developed teaching materials, which consisted of material expert validation, cultural expert, and media expert. In this sheet, the researcher uses a Likert scale presented according to the assessment criteria. The validation sheet for teaching materials contains indicators that include components of the feasibility of content, language, design, and learning approach.

2.2. Student response questionnaire

Assessment to measure student responses using a questionnaire instrument with a Likert scale. The questionnaire is a list of statements/questions given to other people willing to answer according to user requests [11]. Questionnaires were given to students after learning using ethnomathematics-based e-modules. Indicators of student responses are more to the readability of the module content and practicality in its use.

2.3. Test essay

The test is carried out by giving questions in the form of descriptions to students before and after learning. In this study, the test was divided into two, namely pre-test and post-test. The pre-test questions are to determine students' abilities before being given e-modules, while the post-test questions are to measure students' abilities after being given ethnomathematics-based e-module learning with reference to creative thinking indicators. To see the significance of whether the module is able to provide potential effects related to increasing creative thinking, data analysis is carried out using the Gain test.

3. RESULTS AND DISCUSSION

3.1. Analysis Stage

At this stage, the researcher conducted a needs analysis and material analysis. Based on the results of observations of the problems faced by teachers and students when learning to build a flat side space, the researchers obtained the following information: (1) students were less active during class learning, causing unidirectional learning where the teacher provided more information and explained the material, while students only record what the teacher writes in front of them, (2) the teacher finds it difficult to convey the material on the flat side of the space so that relevant alternative teaching materials can be used in learning, (3) the low creative thinking ability of students, this can be seen from the results student work in solving a problem is still the same as a teacher or book, so the ability to produce various ways of solving is still lacking.

Based on the analysis of the material on the flat side, it was obtained information that the most difficult learning achievement for students to achieve was the application of the flat side in everyday life. Students have difficulty, especially in the concepts of surface area and volume. In addition, the difficulties experienced by students result in low motivation to learn mathematics and have an impact on student learning outcomes, including students' creative thinking abilities. the learning process tends to be monotonous where students only receive information from the teacher, so learning mathematics is less meaningful. It is necessary to develop teaching materials that facilitate students in improving students creative thinking skills. The analysis shows that it is necessary to make improvements to the learning resources and methods. One of the efforts that can be made by teachers is the development of an ethnomathematics-based e-module. The purpose of this learning process is to make it more effective so that students are more active in learning and can improve students creative thinking skills.

3.2. Design Stage

At this stage, the researchers designed the teaching materials and the developed instruments. The teaching materials developed include the steps for preparing teaching materials, syllabus, and creative thinking ability test questions. The research instrument that has been designed consists of a validation sheet of teaching materials and a student response questionnaire sheet. The results of the design of the development of this teaching material are the first draft of the teaching materials. Then it will then be developed and validated by experts who have competence in the field of mathematics.

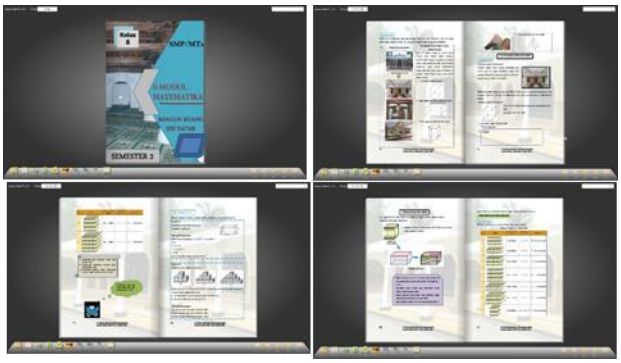

FIGURE 1. Ethnomathematics-based e-module display

3.3. Development Stage

At this stage of development, the researcher modifies the prototype to produce effective teaching materials. The development phase consists of e-module validation and testing. Competent experts carry out validation. The expert assessment aims to obtain suggestions and criticisms used as input for revising the e-module so that draft II is produced, which can be categorized as suitable for use in field trials. The development of draft II was tested in a large field to obtain input in the form of suggestions, responses, input, and comments from students to revise or improve draft II.

In addition to the development of the spatial e-module, an instrument for students' creative thinking abilities was developed in this study. The indicators of creative thinking ability are described as follows: (1) the ability to generate many relevant ideas and answers; (2) the ability to provide uniform ideas but different directions of thought; (3) the ability to produce new, unique expressions; and (4) the ability to elaborate and expand on ideas.

To determine whether an e-module is valid or not, a validator (expert) performs validation of learning tools. The validator who validated the e-module developed in this study consisted of 3 mathematics lecturers. The suggestions

from these experts are used as the basis for improving the e-module. After the learning tools are validated and declared feasible to be tested, the learning tools are tested in a large class. The field trials are aimed at finding the practicality and effectiveness of e-modules.

3.4. Implementation Stage

At this stage, teaching materials are designed and developed according to the criteria and implemented in limited trials and broad trials. A little trial with six students obtained a practicality test with a mean of 3.13 with a percentage of 78% with practice criteria. At the same time, the wide trial, which 32 students followed, obtained an average of 3.05 with a percentage of 77% with practical criteria. The effectiveness test is carried out by giving pre-test and post-test questions by showing the comparison of values as follows: At this stage, teaching materials are designed and developed according to the criteria and implemented in limited trials and broad trials. A little trial with six students obtained a practicality test with a mean of 3.13 with a percentage of 78% with practice criteria. At the same time, the wide trial, which 32 students followed, obtained an average of 3.05 with a percentage of 77% with practical criteria. The effectiveness test is carried out by giving pre-test and post-test questions by showing the comparison of values as follows:

TABLE 1. Gain test analysis recapitulation

Data	Student scores	
	Pre-test	***Post-test***
Total students	32	32
Highest score	77,08	97,92
Lowest score	50,00	72,92
Average	66,12	80,27
∑ Students have finished	5	31
∑ Student not finished	27	1
Percentage	16%	97%

Based on table 1. the overall mastery of student learning outcomes from the pre-test and post-test analysis has increased by 18%, so it can be concluded that the module is very effective.

3.5. Evaluation Stage

This stage is the final stage of development research to provide value to the resulting product. This stage is given at the end of the program to determine its effect on student learning outcomes. At this stage, students are given post-test questions after they are given an ethnomathematics-based e-module. E-module can potentially impact student learning so that they can be used as an effective learning resource.

Overall, from the stages that have been carried out, the developed e-module has a potential effect because it can quantitatively provide an increase from before and after treatment. The indicators of creative thinking that have been designed can be fulfilled after the implementation of learning. This condition is caused by student learning activities which are greatly helped by productive learning resources [12][13]. The products developed are, of course, following clear stages to support mathematics learning activities and provide meaningful learning opportunities because students are given a context that follows their culture to preserve the identity of the Indonesian nation.

CONCLUSION

Based on the results obtained, it can be concluded that the ethnomathematics-based e-module on the flat-sided geometry material developed has met the valid and practical criteria. Then the e-module after evaluating the results of the pretest and posttest adjusted with creative thinking indicators shows a very positive potential so that the module can also be said to be effective in improving students' creative thinking skills. Overall, it can be concluded that the ethnomathematics-based e-module is effectively used as a learning resource that has the potential to improve the creative thinking skills of junior high school students.

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