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E-MODULE CONTAINING ETHNOMATHEMATICS TO IMPROVE MATHEMATICAL PROBLEM-SOLVING ABILITY

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ABSTRACT

Problem solving ability is very important in learning mathematics. However, the problem-solving ability of grade VII students of SMP Negeri 4 Busungbiu is still low. Various research results related to the use of ethnomathematics in mathematics learning are effective in improving problem solving abilities. The purpose of this study is to produce an E-Module containing ethnomathematics that is valid for improving problem solving abilities. This study is preliminary research which is the initial step of design research. The subjects of the study were grade VII mathematics teachers of SMP Negeri 4 Busungbiu. The instruments used to collect data were documentation, observation, and validation sheets. Furthermore, the data were analyzed descriptively. The results of the study showed that the E-Module containing ethnomathematics has valid quality for improving problem solving abilities with the following characteristics: (1) learning achievement, (2) learning objectives, (3) concept maps, (4) ethnomathematics, (5) interaction, and (6) discovery.

Keywords: E-module, ethnomathematics, problem solving, design research

1. INTRODUCTION

According to Zulkarnaen (2022), one of the negative impacts of the globalization era is that the younger generation prioritizes mastery of scientific aspects, intelligence, and pays less attention to character education, so that many young generations now forget their culture and local wisdom. Through character education that is oriented towards the global diversity dimension, it is hoped that students will become a young generation who are able to maintain their noble culture, locality and identity, and remain open-minded in interacting with other cultures, so that they can foster a sense of mutual respect and the possibility of forming a positive noble culture that does not conflict with the noble culture of the nation/local wisdom in the midst of the onslaught of globalization like today. Integrating culture and local wisdom in education is very important to do in order to ward off the impact of globalization which is very rapid in the fields of education, technology, and science. The integration of culture and local wisdom in the mathematics learning process is often known as ethnomathematics. This is in line with the opinion of Suharta, Sudiarta, and Puja Astawa (2017), who said that the relationship between mathematics and culture is called ethnomathematics. Ethnomathematics (ethnomathematics) etymologically comes from the word "ethno" which means

something that refers to the socio-cultural context, including language, jargon, codes of behavior, myths, and symbols. While "mathema" means explaining, knowing, understanding, and carrying out activities such as coding, measuring, classifying, concluding, and modeling. The suffix "tics" comes from the word techne which means technique (Rosa & Orey, 2011).

In general, ethnomathematics is a learning process that studies mathematics or mathematical ideas by connecting them to everyday culture and society. According to D'Ambrosio (2001), ethnomathematics is the implementation of mathematical concepts in everyday life. Mathematics learning that is connected to local wisdom and cultural values of students' daily lives will certainly be able to attract students' interest in learning. In addition, mathematics learning that is related to local culture can also introduce students to local wisdom in their environment and create a meaningful learning process.

In mathematics learning, problem-solving skills are very important. Problem-solving skills are one of the skill processes that students need to have in the mathematics learning process (Purnamayanti, Suharta, and Puja Astawa, 2023). This is in line with the standards for the mathematics learning process set by the National Council of Teachers of Mathematics (NCTM), where there are five key aspects that students must have, namely problem-solving skills, reasoning and proof, mathematical communication, connecting concepts, and representation (NCTM, 2000).

The mathematics learning achievement of Indonesian students is relatively low. This can be seen from the results of PISA (Program for International Student Assessment) in 2022, obtaining results below the international average, namely an average score of 366, while the international average is 472 (OECD, 2023).

Based on the results of interviews with grade VII mathematics teachers of SMP Negeri 4 Busungbiu, the low learning outcomes were due to students being unable to solve the problems given. Students tend to have difficulty connecting contextual problems to mathematical concepts. The teaching materials used by teachers are also less able to train problem-solving skills. Teaching materials tend to only train students' basic abilities.

The results of Edi Supriyadi's research, et al. (2024) showed that the integration of Sundanese Gamelan ethnomathematics into junior high school mathematics E-Modules significantly increased students' understanding and interest in the subject. According to Nanda Putri Pertiwi, et al. (2024), the use of website-based E-Modules using the STEM approach with the Problem-Based Contextual Learning model with virtual experiments using PhET is effective in improving students' critical thinking skills. Based on the results of Rahmawati's research, et al., (2022), it was concluded that the Socrates-based linear algebra E-Modules were declared very valid. Furthermore, further research can be conducted related to the use of Socrates-based linear algebra E-Modules in learning to determine the effectiveness of using E- Modules. The results of the study by Petrus, Ly, et al. (2024) showed that the development of a flipbook-based E-Module for social studies learning in buying and selling activities as one of the fulfillments of the needs of grade IV students of SD Katholik Don Bosko 1 Kupang has a quality achievement qualification obtained from the calculation of the average level of product validity of 84.75% with a very valid qualification, a level of media practicality of 87.95% with a very practical qualification, and a level of media effectiveness of 85% with a very high/effective qualification.

The integration of ethnomathematics in mathematics learning can be expressed in the form of creating an E-Module containing ethnomathematics. E-Modules are digital teaching tools that can be run independently by students by utilizing information and communication technology. A module is a tool or means of evaluation designed to contain materials, methods, limitations, and

evaluation methods that are designed systematically and attractively to achieve the expected competencies according to their level of complexity (Depdiknas, 2008).

The results of the study by Puja Astawa, Adi Wira Nata Putra, Suharta (2022) show that the ethnomathematics elements contained in the Balinese flute are related to measurement and measurement techniques, mathematical sequences, and geometric concepts. Research conducted by Sari, Fahmita; Nuraziza Rahmah, A. Rezky Pratiwi, Nurjannah (2022) which proves that the arrangement of wood found in the Tongle-Tongke mangrove forest area contains mathematical elements, namely: 1) the concept of parallel, non-parallel, diagonal and perpendicular lines; 2) the concept of flat shapes of triangles, squares, rectangles, parallelograms, trapezoids, circles, hexagons; and 3) the concept of rectangular pyramids, hexagonal pyramids, triangular prisms, cuboids and cubes. Then, research conducted by Turmuzi, Muhammad; Suharta, Puja Astawa, Suparta (2024) which proves that ethnomathematics-based learning improves students' mathematical communication skills.

Based on the above, the purpose of this study is to develop a valid ethnomathematics- based E-Module to improve the mathematical problem-solving abilities of Class VII students".

The ethnomathematics-based E-Module is a digitalized mathematics module that is packaged more interactively that raises cultural problems and local wisdom in the local area.

2. RESEARCH METHOD

This type of research is design research that refers to the Plomp development model. According to (Plomp, 2013; Suharta, 2016), design research consists of three stages, namely: 1) Preliminary Research, 2) Prototyping, and 3) Assessment. In this case, the research carried out was limited to preliminary research at SMP Negeri 4 Busungbiu, Buleleng-Bali. The research time was carried out in the odd semester of the 2024/2025 Academic Year.

The subjects of the research were the grade VII mathematics teachers of SMP Negeri 4 Busungbiu who were determined purposively. The research instruments used to collect data in this study were documentation, observation, and validation sheets. The quality of the E-Module containing ethnomathematics in this study was seen from the validity aspect, namely content and construct validity. The data collected were then analyzed descriptively.

3. RESEARCH RESULTS AND DISCUSSION

Based on the research method as described previously, an E-Module containing Ethnomathematics was obtained to improve the mathematical problem-solving ability of Grade VI students on the subject of comparison. The comparison material consists of comparisons of value and comparisons of inverse values. The learning objectives of the comparison material for grade VII students are "to build students' understanding related to the concept of comparison of value and inverse value, understand ratios and change them into simple forms, so that they can use them to determine the scale, proportion, and rate of change in solving contextual problems". The structure of the E-Module containing ethnomathematics is as follows.

a. Module Identity
b. Learning outcomes
c. Learning objectives
d. Concept Map
e. Activity 1: Comparison concept, Ethnomathematics Ratio Concept in Balinese Architecture (Asta Kosala Kosali), Let's practice

f. Activity 2: Comparison of value, Ethnomathematics, , let's practice
g. Activity 3: Comparison of inverse value, ethnomathematics, let's practice.
h. Activity 4: scale, ethnomathematics, let's practice
i. Activity 5: Rate of change of units, ethnomathematics, let's practice.

The following is an example of ethnomathematics integrated into the E-Module.

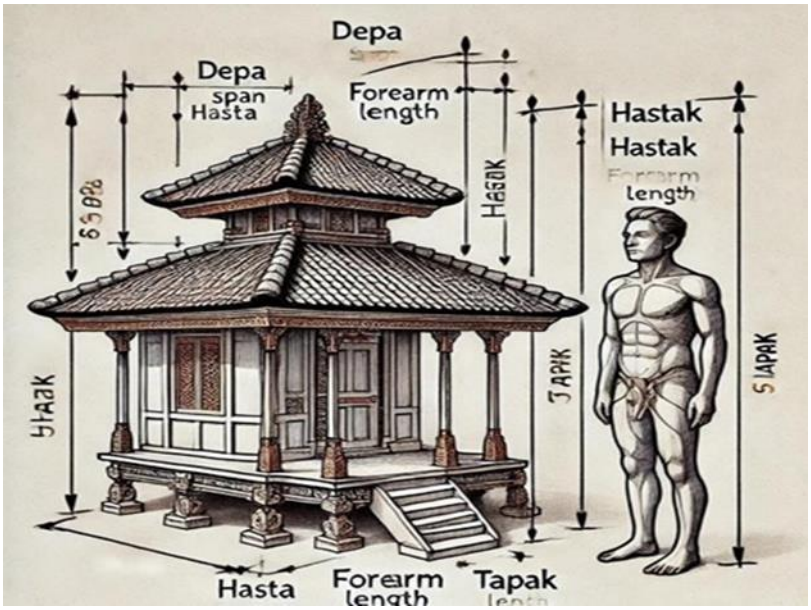

Figure 1: Ethnomathematics

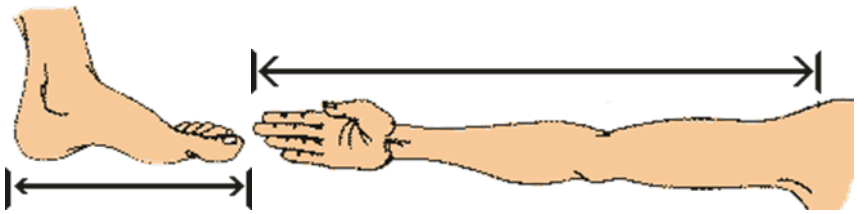

Figure 2a: *Tapak* **Figure 2b: *Depa***

From the validity aspect, this e-module has met the validity of content and construct. Content validity means that the learning material is in accordance with the demands of the Independent Curriculum, while construct validity means that there is consistency with each other.

The characteristics of the E-Module containing ethnomathematics to improve problem-solving skills are: (1) learning outcomes, (2) learning objectives, (3) concept maps, (4) ethnomathematics, (5) interaction, and (6) discovery

a. Learning outcomes are learning competencies that must be achieved by students at the end of each phase.
b. Learning objectives are the direction or target to be achieved by the learning process. Learning objectives are formulated by referring to learning outcomes.
c. A concept map is a schematic depiction that states the relationship between one concept and another so as to explain a person's conceptual understanding. The components of a concept map are concepts, propositions, conjunctions, and arrows.

d. Ethnomathematics consists of the words ethno and mathematics. Ethno includes all things as cultural identity such as language, jargon, code, symbols, beliefs, myths, ways, food, clothing, houses, and customs. Mathematics is something that is close to cultural perspectives such as counting, classifying, measuring, sorting, and modeling or patterning. For example, in the ethnomathematics of traditional Balinese houses, the concept of comparative value can be found in the proportional relationship between the size of the Balinese traditional house building and the size of the human body. The length and width of the room are often adjusted to body measurement units such as fathoms (arm span), hasta (length of the lower arm), or footprints (length of the sole of the foot). For example, if the length of a room must be 5 cubits, then the width of the room is adjusted to 3 cubits. If the length is increased to 10 cubits, then the width must also increase proportionally to 6 cubits,
e. Interaction, students are given the opportunity to interact with E-Modules, as well as with teachers and other students so that student activities are optimal.
f. Discovery, students are given the opportunity to discover new mathematical knowledge, both in the form of principles and concepts.

4. CONCLUSION

Based on the results and discussion above, it can be concluded that the E-Module containing ethnomathematics produced is of valid quality. The characteristics of the E-Module containing ethnomathematics are: (1) learning achievement, (2) learning objectives, (3) concept maps, (4) ethnomathematics, (5) interaction, and (6) discovery. This E-Module has the potential to be used for other materials and to integrate other types of ethnomathematics as an effort to improve mathematical problem-solving skills.

It is recommended that the E-Module be further developed through a trial cycle process so that an E-Module is obtained that is of valid, practical and effective quality. In other words, the application of the E-Module containing ethnomathematics can improve problem-solving skills for grade VII students.

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