The 2nd International Conference on Mathematics Education and Technology (ICOMET) 2023
ISSN 2986-8513 | pp. 344-349 (2023)
Publisher: University of Islam Malang

DEVELOPMENT OF A LEARNING MODULE BASED ON ARFACT ETHNOMATHEMATICS ON FLAT BUILT MATERIALS

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ABSTRACT

This study aimed to develop learning modules and determine the feasibility of using Arfak ethnomathematics-based learning modules on flat-shaped material. The module trial was carried out on class VII A students at SMP Negeri 10 Manokwari in the 2022/2023 academic year. Module development is carried out using the ADDIE development model, which consists of five stages: analysis, design, development, implementation, and evaluation. The instruments used in this study were validation sheets, student response questionnaires and learning achievement tests. The data in this study were analyzed by grouping data based on variables from the respondents, tabulating data based on the results of the instruments that had been obtained and calculating according to the formula. Module validity analysis obtained an average content validation value of 87% and an average design validation value of 92%, both of which met the very valid category. The implementation results obtained an average value of 95% for the student response questionnaire, fulfilling practical criteria. Analysis of the effectiveness based on the learning outcomes test obtained a complete percentage of 87.67% fulfilling the good category, and the average score of the learning outcomes test for 15 students was 89. Based on the results obtained, it can be concluded that the developed module is feasible to use because it satisfies valid, practical, and effective criteria and can help improve students' mathematical connection abilities and improve students' literacy and numeracy skills.

Keywords: Ethnomathematics artifact, valid, practical, effective, feasible

1.Introduction

Education is an effort to provide knowledge by involving the process of personality development, critical thinking skills, social skills and ethical values (Sujana, 2019). Mathematics is an academic field that can help students hone critical thinking skills. Mathematics comes fromLanguageLatin mathematica (Greek mathematice) means to investigate. According to Maryati (Maryati, Iyam dan Nanang Pritiana, 2017)mathematics is a deductive scientific discipline, because it requires theorems, properties and postulates to obtain the truth. Mathematics learning is a means for critical, analytical, analytical and systematic thinking which can be an innovation in everyday life (Asrawati, Nur dan Mulyati, 2018).

Learningmathematicsseeks to develop students' abilities to apply mathematical ideas, think, solve problems, exchange ideas and appreciate everything related to mathematics. This happens because every concept in mathematics is connected to one another (Tasni, N., & Susanti, E, 2017). The process of forming students' mathematical experience and knowledge can develop well so that the goals that have been set can be achieved. To achieve the goals that have been set, students are required to actively participate in the learning process, have independence, responsibility and creativity and there is a connection between mathematics and students' lives.

Based on observations made by researchers, there are several problems that make it difficult for students to understand mathematics learning, namely the lack of students' ability to understand mathematics and difficulty solving problems related to mathematics. Students often experience difficulties in studying and solving mathematics learning problems because their mathematical connection abilities are weak so they are unable to think productively in creating creative ideas to solve mathematics problems (Tasni, N., Saputra, A., & Adohar, O, 2020). Improving students' mathematical abilities can be done by integrating culture in mathematics learning. Culture integrated into mathematics learning can help connect mathematics with students' daily lives.

Students' culture and civilization can show relationshipsbetweenlearning and students' lives.

There are many cultures and civilizations that have been associated with learning mathematics. The culture of the Arfak tribe is one of the cultures in Indonesia that is related to mathematics learning. The Arfak tribe is one of the tribes spread across the bird's head of Papua, namely West Papua. The Arfak tribe is divided into four categories, namely the Meyah tribe, Hatam tribe, Soub tribe and Moire tribe (Djoko, 1998:10). The Arfak tribal community or commonly called the Arfak people is the name for residents in the mountains inland of Mount Arfak. However, due to technological developments in social civilization, the Arfak people who usually live in inland areas now live in the Manokwari City area. Until now, the Arfak people themselves have dominated the Manokwari area and its surroundings (Ronsumbre, 2020)

PersonArfak inhabits the Arfak mountain area with unspoiled forests. The Arfak people have a place to live which is usually called a millipede house. A millipede house is a house with many main pillars as the foundation of the house which are spread under the house and become the main support of the building. Millipede houses generally have a size of 8×6 square meters. The height of the stage is measured from the ground, 1 - 15 meters and the height from the floor to the roof of the house is around 4.5 - 5 meters. The house poles have a distance of 30 centimeters. The walls of a millipede's house are made from bark that is widened and tied tightly, then wrapped with small sticks. This is what makes millipede houses look like boxes (Haryanto, T. N., & Subanji, S. R, 2017). The roof of a millipede's house is triangular in shape and made from linked thatch/straw or sago leaves. The millipede house, which is made in the shape of a box and has a triangular roof, shows the existence of mathematics in the culture of the Arfak tribe. The Arfak people who live in the interior of Papua have learned mathematics in real life through the construction of millipede houses as their homes.

Albanese(2019) explained that ethnomathematics is a field in science that focuses on the relationship between mathematics and culture. Ethnomathematics is a program that brings together mathematical ideas and methods that are practiced in various social groups in society. According to Davidson (in Jati, 2019) explains that ethnomathematics is a technique for studying mathematics from various cultural contexts. Ethnomathematics is mathematics applied by certain cultural groups, such as certain classes of society, groups of workers/farmers, children, professional classes and others.

The relationship between mathematics and cultural artifacts can be one of the teaching materials in mathematics learning. The use of teaching materials that apply ethnomathematics can result in the learning process becoming more meaningful for students in constructing their own knowledge. The application of ethnomathematics in mathematics learning has a positive impact on students, because students can learn and feel the benefits of learning directly. Based on research by Aristya (Aristya, Della N., and Anizar Rahayu, 2018), it shows that the use of ethnomathematics-based mathematics teaching materials helps students improve their ability to solve problems.

According to Mastur (Mastur & Triyono, 2014) learningwith an ethnomathematics approach, students can be actively involved in looking for local culture related to geometry and teachers can use appropriate teaching aids related to culture so that they can increase students' learning motivation. Using an ethnomathematics approach can help students understand mathematical concepts in a real way according to the students' local culture. Mathematics learning based on local culture can be an approach that can be an alternative and change in mathematics learning and develop learning according to the local culture of society. The development of ethnomathematics-based learning tools can provide solutions for mathematics teachers in carrying out learning innovations (Marsigit, M., Setiana, D. S., & Hardiarti, S, 2018).

Modules are a form of printed teaching material that can be used to help teachers and students in learning (Ismu, 2015). Modules canmadeas a medium for independent learning by students. Through guided instructions in the module, it can help students study learning material independently both at home and at school. A module is a form of teaching material that is packaged completely and systematically, containing a set of learning plans and is designed to help students master specific learning (Lestari, 2018).

This module can be used as a bridge between mathematics and existing culturearoundlearners. The development of ethnomathematics-based modules can help students understand mathematics easily and pleasantly (Sriwanti, Putri Utami dan Sukmawarti, 2022). By learning mathematics based on ethnomathematics, students can learn directly

from examples in their culture. Modules can be a means to help students improve their mathematical abilities and can be a means to help students connect mathematics and their culture. This can also help students improve literacy and numeracy skills related to current learning goals.

2. Research Methods

This researchistype of research and development using the research and development (R&D) method. The development carried out in this research was the development of an ethnomathematics-based learning module for the Arfak tribe on Bangun Datar material. Module development is carried out in accordance with the development of the ADDIE model, which consists of 5 stages, namely analyze, design, development, implementation and evaluation (Rayanto & Sugianto, 2020).

The trial subjects for the module developed were students in class VII A of SMP Negeri 10 Manokwari and were carried out in the odd semester of the 2022/2023 academic year. The analysis techniques used in this research are validity analysis, practicality analysis and effectiveness analysis.

3. Results and Discussion

Results and DiscussionThis explains the results of the development research that has been carried out. Discussion of development research, namely:

a. Validity Analysis

The validity test aims to determine the level of validity of the module. This validation was obtained by converting the scores obtained using a Likert scale. Validity analysis is divided into 2, namely as follows:

1) Content Validation

The recapitulation of content validation results is presented as follows:

Table 1. Recapitulation of Content Validation Results

No	Assessment Aspects	Validation Results	Categories
1	Eligibility of content	87%	Very valid
2	Feasibility of presentation	87%	Very valid
3	*Problem based learning*	87%	Very valid
4	Arfak's ethnomathematical approach	88%	Very valid
Overall Average		87%	Very valid

Based on the recapitulation presented in Table 1. Recapitulation of content validation results, the content validation results are 87%, the presentation feasibility validation results are 87%, the problem based learning validation results are 87%, the Arfak ethnomathematics approach validation results are 88 % and the average value of the whole aspect 87%. The results of this validation show that the module developed is valid and suitable for use.

2) Design Validation

A recapitulation of design validation results is presented in the following table:

Table 2. Recapitulation of Design Validation Results

No	Assessment Aspects	Validation Results	Categories
1	Eligibility of content	89%	Very valid
2	Organization	91%	Very valid
3	Attractiveness	93%	Very valid
4	Letter shapes and sizes	93%	Very valid
5	Space (blank space)	92%	Very valid
6	Consistency	93%	Very valid

No	Assessment Aspects	Validation Results	Categories
Overall average		92%	Very valid

In Table 2, it can be seen that the validation results of the six design validation aspects meet the very valid category. The validation results for each aspect of the assessment include, the validity percentage for content suitability aspect is 89%, the validity percentage for the organizational aspects is 91%, the validity percentage for attractiveness is 93%, the validity percentage for the shape and size of letters is 93%, the percentage of validity for space (blank space) is 92% and the percentage of consistency validity is 93%. The average value of all aspects obtained was 92%, fulfilling the very valid category. This shows that the module design developed is valid and the module is suitable for use.

The research results show that the ethnomathematics approach can be used as a learning approach that helps students understand the learning material. Module validity is obtained by conducting module validity analysis which is divided into two, namely content validation and design validation. The results of content validation obtained a validity percentage value of 87% and design validation obtained a percentage value of 92%. Both meet the very valid category. Ethnomathematics can help students gain contextual learning experiences by searching for and finding mathematical content related to cultural contexts in their lives (Nur, A. S.,Waluya, S. B., Rochmad, R., & Wardono, W, 2020)(Nur, 2020).

b. Practicality Analysis

ImplementationThe module was implemented with the aim of finding out the practicality of using the module developed by researchers. The following is a recapitulation of the results of the student response questionnaire:

Table 3. Recapitulation of Student Response Questionnaire

No	Assessment Aspects	Rating results	Categories
1	Interest	94%	Very practical
2	Material	98%	Very practical
3	Language	93%	Very practical
4	Expediency	96%	Very practical
Overall average		95%	Very Practical

Based on Table 3, the average score obtained from the overall student response questionnaire score is 96%, which is included in the practical category. Media in ethnomathematics-based learning has a very positive impact on students in improving the learning process (Wirawan, Nurgaha & Novaliyosi, 2023). Mathematics learning using an ethnomathematics approach can be an innovative solution to improve students' problem solving abilities and can be effectively used to develop cultural love of character through mathematical problem solving abilities (Rahmawati, Laila, Zaenuri & Isti Hidayah, 2023).

c. Effectiveness Analysis

The evaluation carried out by researchers aims to determine the effectiveness of using the module. The learning module developed can be said to be effective if the completeness of the learning outcomes obtained by students reaches the school's minimum completeness criteria (KKM) 70.

Table 4. Recapitulation of Student Learning Results Tests

No	Initials	Score Obtained
1	AT	96
2	BS	68
3	B.M	96
4	DM	82

5	GT	88
6	HS	96
7	HB	96
8	J.D	68
9	KM	96
10	RW	92
11	MJ	92
12	M.F	88
13	PM	92
14	R	96
15	YH	88
Average		89
Percentage of Total Completeness		87.67%

Based on Table 4, the summary shows that the learning outcomes of the 15 students who took part in the learning activities obtained an overall average score of 89. A total of 13 students obtained a score above 70 fulfilling the complete category and 2 students obtained a score of 68 fulfills the incomplete criteria. The percentage of completeness reached the good category with a percentage score of 87.67%. This shows that the module developed is effectively used in learning.

Mathematics learning using the Problem based Learning model which is integrated with ethnomathematics is effectively used to improve problem solving abilities and love of culture (Geni, P. R. L. & Hidayah, 2017). Ethnomathematics-based mathematics learning can be a solution that makes mathematics learning more meaningful and contextual and helps students understand mathematics in an interesting, fun and innovative way that can help improve students' mathematical literacy skills (Surat, 2018)

4. Conclusion

DevelopmentThe module is implemented according to the ADDIE development model. The ADDIE Development Model is a development model which consists of five stages, namely analysis, design, development, implementation and evaluation. The module developed is suitable for use because it meets the criteria of being valid, practical and effective according to research data.

The mathematics learning module, which is integrated with Arfak cultural values, can help students understand mathematical connections, which can improve literacy and numeracy skills in the mathematics learning process, especially in Flat Building materials.

5. Thank You

SayingThe author would like to thank both parents and all parties who have helped the author complete this writing.

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