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Innovative Learning Media: Ethnomathematics-based Modules for Third-Grade of Elementary School Students

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ABSTRAK

Rendahnya hasil belajar pada materi sifat-sifat bangun datar bagi kelas tiga sekolah dasar diindikasikan karena ketidaktersediaan modul yang memadai. Sementara, siswa kelas tiga lebih mudah belajar matematika melalui situs budaya sebagai bentuk etnomatematika. Penelitian ini bertujuan untuk mengembangkan modul berbasis etnomatematika yang valid, praktis, dan efektif dalam meningkatkan hasil belajar siswa kelas tiga pada materi sifat-sifat bangun datar. Penelitian ini menggunakan metode research and development melalui tahapan analysis, design, development, implementation, and evaluation *(ADDIE). Subjek penelitian ini adalah sebanyak 22 siswa kelas tiga sekolah dasar. Kevalidan modul diukur melalui penilaian validator menggunakan angket validasi. Kepraktisan modul diukur dengan menggunakan angket respon siswa. Keefektifan diukur dengan membandingkan nilai pre-test dan post-test. Teknik pengumpulan data menggunakan teknik kuesioner dan tes. Hasil validitas diperoleh nilai rata-rata sebesar 1 pada interval 0,80-1,00 dengan kriteria sangat valid. Kepraktisan diperoleh nilai sebesar 94% pada interval 85,01%-100% dengan kriteria sangat praktis. Keefektifan mendapatkan nilai signifikansi sebesar 0.000<0.05 yang berarti dapat meningkatkan hasil belajar siswa. Dengan demikian, implikasi dari hasil penelitian pengembangan ini adalah memberi model atau contoh modul berbasis etnomatematika yang valid, praktis, dan efektif untuk meningkatkan hasil belajar siswa kelas tiga pada materi sifat-sifat bangun datar.*

ABSTRACT

Low learning outcomes on the properties of flat shapes for grade three elementary school students are indicated due to the unavailability of adequate modules. Meanwhile, third-grade students find it easier to learn math through cultural sites as a form of ethnomathematics. This study aims to develop an ethnomathematics-based module that is valid, practical, and effective in improving the learning outcomes of third-grade students on the material properties of flat shapes. This study uses the research and development method through the stages of analysis, design, development, implementation, and evaluation (ADDIE). The subjects of this study were 22 third-grade elementary school students. The validity of the module was measured through validator assessment using a validation questionnaire. The practicality of the module was measured using a student response questionnaire. Effectiveness was measured by comparing pre-test and post-test scores. Data collection techniques used questionnaires and tests. The validity results obtained an average value of 1 in the interval 0.80-1,00 with very valid criteria. Practicality obtained a value of 94% in the interval 85.01%-100% with very practical criteria. Effectiveness obtained a significance value of 0.000<0.05, which can improve student learning outcomes. Hence, the implication of the results of this development research is to provide a model or example of valid, practical, and effective ethnomathematics-based modules to improve the learning outcomes of third-grade students on the properties of flat shapes material.

1. INTRODUCTION

Modules are teaching materials that are needed in the practice of teaching and learning mathematics for elementary school students. This is because the module contains information that is arranged systematically and can be adapted to the learning needs of students (Ambayon, 2020; Triyanto & Aryani, 2022). The learning needs in question is that elementary school students need modules because

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they can help them learn more independently and be disciplined in setting their own learning pace (Cortes et al., 2022; Triyanto & Aryani, 2022). In this case, the module has the main characteristic, which is self-learned; in other words, the module can train students to carry out the learning process independently and reduce the dominance of teachers in teaching and learning mathematics (Cortes et al., 2022; Oco, 2022). Meanwhile, mathematics has characteristics relevant to the module; namely, mathematics requires meaningful systematic steps to translate conceptual and procedural knowledge (Monteleone et al., 2018; Wittmann, 2021). Therefore, international associations, such as the National Council of Teachers of Mathematics (NCTM), and national associations, such as the Indonesia Mathematics Educators Society (IMES), including the Indonesian government, agree that modules as elementary school students need written teaching materials to cover the gaps and at the same time optimize learning outcomes in the practice of teaching and learning mathematics (Cai et al., 2017; Musser et al., 2011).

Researchers have noted that modules can improve mathematics learning outcomes for primary school students in teaching and learning mathematics (Beltran, 2021; Triyanto & Aryani, 2022). In this case, generally, the existence of modules can improve students' mathematics performance because modules contain more detailed and specific mathematics material than mathematics textbooks (Beltran, 2021; Oco, 2022). Through modules, students can also explore mathematical material to understand the mathematical knowledge to be taught more easily (Cortes et al., 2022; Natividad, 2021). Students also feel that using math modules can make learning more flexible because students who do not understand the material can repeat certain steps to build knowledge independently (Ambayon, 2020; Leon, 2023). Modules can also make teaching and learning mathematics more efficient so that mathematics learning outcomes change for the better (Beltran, 2021; Cortes et al., 2022). Thus, the availability of modules in the practice of teaching and learning mathematics is needed for elementary school students to improve mathematics learning outcomes.

Based on a preliminary study in one of the primary schools in East Java, namely Sekolah Dasar Negeri (SDN) Candinegoro, it was found that teachers did not use modules in the practice of teaching and learning mathematics. Selain itu, secara khusus learning outcome matematika rendah pada materi properties of flat shapes. In this case, 18 out of 22 students scored below the minimum completion criteria of 70 on the properties of flat shapes material. While mathematics learning on the properties of flat shapes material is not carried out with modules, teachers only use textbooks the school provides. The textbooks used are not specific and appropriate for building conceptual and procedural mathematical knowledge. The results of this preliminary study reinforce the findings of previous experts that the low mathematics learning outcomes of students on the properties of flat shapes material are generally caused by the use of textbooks and teacher dominance with the lecture method (Lestari et al., 2023; Schoevers et al., 2020). Meanwhile, factor analysis of the unsuccessful achievement of mathematics learning outcomes shows that students still have difficulties in learning the basic concepts of flat shapes, especially in terms of mentioning the properties and real examples of flat shapes (Fouze & Amit, 2021; Hwang et al., 2020).

Experts offer that, in addition to the need to provide modules, mathematics learning outcomes can be further optimized by linking mathematics materials to their cultural environment, namely through ethnomathematics (Fouze & Amit, 2021, 2023). Concerning the properties of flat shapes material, linking ethnomathematics with the properties of flat shapes material means building mathematical knowledge through tools and cultural elements around students that can represent the characteristics of flat shapes as two-dimensional shapes (Hwang et al., 2020; Navarro et al., 2022). In this case, the ethnomathematics-based learning activities are observation and analysis of flat shapes found in sculptures, artifacts, or cultural architecture around students (Hwang et al., 2020; Prahmana & D'Ambrosio, 2020). Using ethnomathematics in mathematics learning has also been confirmed to improve mathematics learning outcomes on the properties of flat shapes (Fouze & Amit, 2021; Machaba & Dhlamini, 2021). This improvement in learning outcomes is indicated because (1) Ethnomathematics presents mathematics learning needs that are suitable and relevant to the environment and culture around students (Cortes & Orey, 2020; Fouze & Amit, 2021); (2) Ethnomathematics creates a more enjoyable and meaningful learning environment for students (Johnson et al., 2022; Utami et al., 2021); (3) Ethnomathematics can further improve students' focus and attention while learning in class (Cortes & Orey, 2020; Fouze & Amit, 2021).

Previous studies have been conducted to develop or implement ethnomathematics-based modules related to improving mathematics learning outcomes of elementary school students. Study developing mathematics modules integrated with temple cultural sites to improve mathematics learning achievement for fourth-grade elementary school students (Triwahyuningtyas et al., 2020). Another study is to implement ethnomathematics-based modules equipped with miniature media of Osing traditional houses to improve learning outcomes of third-grade students on flat-shaped material (Lestari et al., 2023). Study developing and implementing ethnomathematics-based modules with a realistic mathematics

education approach on cube and cuboid material to improve the mathematical literacy achievement of fifth-grade students (Yuliana et al., 2023). Module development study on flat shapes based on ethnomathematics of Lombok culture to improve mathematical literacy of elementary school students (Khair et al., 2023). Another study developed ethnomathematics-based modules to facilitate students' learning process on flat shapes for fourth-grade students (Febriyanti & Ain, 2021). Implementation of a realistic mathematics education (RME) module based on Bengkulu ethnomathematics to improve learning outcomes of fourth grade students (Andriani et al., 2023). Study on the development and implementation of ethnomathematics-based geometry modules to measure the improvement of learning outcomes of fifth grade students (Florentino et al., 2022). Development of ethnomathematics-based modules of Dayak Culture with integration of Joyful Learning approach to improve learning outcomes of fourth grade students (Priyani, 2021). In this case, existing studies still focus on developing or applying ethnomathematics-based modules to improve mathematics learning outcomes of elementary school students, but no one has specifically developed ethnomathematics-based modules for properties of flat shapes material for grade three elementary schools.

Based on the review of experts' opinions, the urgency of developing ethnomathematics-based modules for the material properties of flat shapes for grade three elementary schools can be synthesized. Ethnomathematics-based modules can provide a more real picture of flat shapes so students can better mention the properties of flat shapes (Triwahyuningtyas et al., 2020; Umbara et al., 2021). Exploratory ethnomathematics activities, such as exploring the culture of the Temple of Heaven can contribute to introducing students to the elements of flat shapes (Zhang et al., 2021). Ethnomathematics-based modules that utilize the cultural environment can help students understand mathematics material more easily and meaningfully (Shahbari & Daher, 2020; Triwahyuningtyas et al., 2022). Learning mathematics by involving ethnomathematics as a cultural element has also been proven to positively impact students' mathematics learning outcomes (Fouze & Amit, 2021; Utami et al., 2021). Thus, it can be claimed that there is an urgency to develop ethnomathematics-based modules for properties of flat shapes for grade three elementary schools. This is due to at least three things, including (1) The availability of ethnomathematics-based modules on the properties of flat shapes material for grade three elementary schools; (2) The need for students to understand more simply and easily on the properties of flat shapes material; (3) The need to improve mathematics learning outcomes on the properties of flat shapes material.

Product development is emphasized on three measurable aspects: validity, practicality, and effectiveness. Validity is to justify the feasibility of using the product in terms of expert assessment. Practicality to justify student responses regarding product use. Effectiveness to justify improving the research problem after the target is subjected to the developed product test (Andriah & Amir, 2021; Nabila & Amir, 2022; Wulandari & Amir, 2021). The novelty of this study lies in its focus on developing ethnomathematics-based modules specifically designed for third-grade students. Thus, this research aims to develop ethnomathematics-based modules for properties of flat shapes material for third-grade elementary school students with validity, practicality, and effectiveness. In more detail, the objectives of this study are (1) to measure the validity of ethnomathematics-based modules developed based on expert assessments; (2) to measure the practicality of ethnomathematics-based modules developed based on the responses of third-grade elementary school students; (3) to measure the effectiveness of ethnomathematics-based modules developed based on the improvement of mathematics learning outcomes for the properties of flat shapes material.

2. METHOD

The method in this study uses research and development (R&D). In this study, researchers will develop ethnomathematics-based modules for third-grade elementary school students. The module was developed using the ADDIE development model adapted from (Peterson, 2003). ADDIE stands for five development stages: analysis, design, development, implementation, and evaluation. The stages in the ADDIE development model that were carried out are further presented in Figure 1.

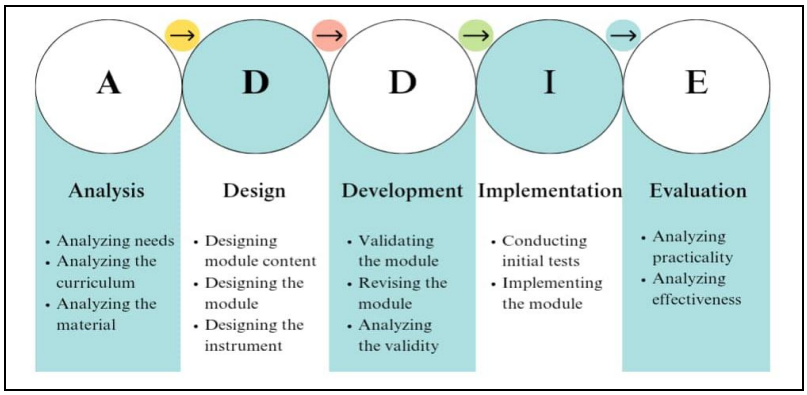


Figure 1. Stages of Ethnomathematics-Based Modules Development with ADDIE Model

Figure 1 shows the five stages of developing ethnomathematics-based modules using the ADDIE model. (1) The analysis stage consists of needs, curriculum, and material analysis. Needs analysis aims to analyze what products are most likely to be developed and used by students. Curriculum analysis is conducted to examine core competencies, basic competencies, and indicators. Material analysis was conducted to analyze the material topics that will be used in the ethnomathematics-based modules; (2) The design stage, at this stage, aims to design ethnomathematics-based modules through module design activities of content content, module layout, and instruments. The design module content content includes activities to design ethnomathematics-based activities and select images that are based on the material. Designing module layout has cover design, color selection, font type, and module background selection. Designing instruments includes making validation instruments and student response questionnaires; (3) The development stage, experts measure the validity of ethnomathematics-based modules. After the module is validated, revision activities are carried out based on expert suggestions; (4) Implementation stage, at this stage, the ethnomathematics-based modules were implemented to 22 third-grade students of SDN Candinegoro. The implementation process was carried out by giving pre-test questions and conducting mathematics learning using ethnomathematics-based modules; (5) The evaluation stage is carried out to measure the practicality of the module using student response questionnaires and measure the module's effectiveness using post-test questions.

The research data were obtained using data collection techniques in the form of questionnaires and tests. The questionnaire data collection technique aims to measure the validity and practicality of the module, while the test data collection technique aims to measure the module's effectiveness. Meanwhile, the instruments used in data collection include validation instruments, student response questionnaires, and pre-post tests. The validation instrument is addressed to the validator to assess the validity of ethnomathematics-based modules (Florentino et al., 2022; Triwahyuningtyas et al., 2022). The material validation outline includes content, language, and presentation feasibility, while the module validation grid includes ethnomathematics content, module content, and module design is show in Table 1. The student response questionnaire outlines several questions about ethnomathematics-based modules' function or ease of use is show in Table 2. Pre-test and post-test questions totaling 10 questions were made based on basic competencies and indicators regarding properties of flat shapes is show in Table 3.

Table 1. Outline of Material and Media Expert Validation Instruments

	Assessment Aspect	Indicators	Question Numbers
Material Expert	Content feasibility	Suitability of math material with basic competencies Mathematics materials are presented according to students' developmental level	1,2,8
	Language feasibility	Clarity of language used Consistency of word/term usage	10,11,12,13,14
	Presentation feasibility	Image suitability with material Clear and attractive images	16,17
Modul Expert	Ethnomathematics content	Appropriateness of using ethnomathematics elements in the module	15,9
	Module content	There are basic competencies, indicators, and learning objectives Contains instructions for using the module	3,4,5,6,7,

Assessment Aspect	Indicators	Question Numbers
Modul design	Varied learning activities Evaluation questions are available Appropriateness of the print field and margins Appropriateness of font and spacing The cover is attractive and clear and illustrates the content of the material Module background suitability	1,2,3,4,5,6, 7,8,9,10,1 1,12,13

Table 2. Outline of Student Pre-Test and Post-Test

Basic Competencies	Indicators	Question Types	Question Numbers
3.12 Analyze various flat shapes based on their properties	3.12.1 Analyze the properties of quadrilateral flat shapes on real objects (C4) 3.12.2 Analyze the properties of quadrilateral flat shapes on real objects (C4)	Multiple-choice and short-answer	1,2,3,4, 5,6,7
4.12 Classify various flat shapes based on their properties	4.12.1 Classify triangular and quadrilateral flat shapes based on their properties (C3)	Fill in the blank	8,9,10

Table 3. Outline of Student Response Questionnaire

Assessment Aspects	Indicators	Question Numbers
Functions	Ease of use of the Ethnomathematics module The effect of the ethnomathematics module on student understanding Interest in using the ethnomathematics module Satisfaction with the ethnomathematics module	1,2,3,4,5,6,7,8,9,10,11,12 ,13,14,15

Data analysis was carried out by conducting tests to measure the module's validity, practicality, and effectiveness. Module validity measurement is calculated using Aiken's formula V (Aiken, 1985). The calculation results obtained from the Aiken V formula are then translated into the module validity criteria table is show in Table 4. Quantitative descriptive statistical analysis was conducted to measure the practicality and effectiveness of the module. The practicality of the module is obtained by calculating the percentage of the average value obtained from the student response questionnaire. Based on the percentage of values obtained, then translated into the module practicality criteria table is show Table 5. The module's effectiveness was obtained by comparing the pre-test and post-test scores using the dependent t-test formula.

Table 4. Table of Module Validity Criteria

Validity Criteria	Validity Levels
$0.80 \leq V \leq 1$	Highly Valid Product
$0.60 \leq V \leq 0.80$	Valid Product
$0.40 \leq V \leq 0.60$	Moderately Valid Product
$0.20 \leq V \leq 0.40$	Invalid Product
$0.00 \leq V \leq 0.20$	Highly Invalid Product

Table 5. Table of Module Practicality Criteria

Practicality Criteria	Practicality Levels
85.01% - 100%	Highly Practical Product
70.01% - 85%	Quite Practical Product
50.01% - 70%	Less Practical Product
01.00% -50%	Impractical Product

3. RESULT AND DISCUSSION

Result

Ethnomathematics-based modules for properties of flat shapes have been developed using the ADDIE development model. The development of ethnomathematics-based modules begins with the analysis stage, including needs, curriculum, and material analysis. The results of the needs analysis show that teachers do not use modules and do not relate to culture when teaching and learning mathematics in the classroom. Teachers only use math textbooks that the school has provided. This textbook certainly does not make students self-learners and does not relate to the culture around students, making students feel bored and difficult to understand the concept of flat shapes and their properties, which is thought to result in low learning outcomes properties of flat shapes.

Thus, the learning process in the classroom does not yet support the process of self-learning and the need to learn mathematics based on the surrounding culture. Dermo Temple is the culture around students that can be related to the properties of flat shapes material. Dermo Temple is located near SDN Candinegoro and has the characteristics to build students' knowledge about the properties of flat shapes. Therefore, students need a culture-based module to learn mathematics in the classroom. This is under the 2013 curriculum used at SDN Candinegoro. Although using the 2013 curriculum, the government is currently emphasizing implementing education based on national culture to achieve educational goals. Meanwhile, material analysis was conducted to identify the basic competencies that will be applied to ethnomathematics-based modules, namely basic competencies 3.12 and 4.12 regarding properties of flat shapes.

The results of the design stage resulted in the design of ethnomathematics-based activities, as exemplified in Figure 2. The ethnomathematics-based activity consists of five parts. The first activity, "Let's Get to Know Culture", explains the cultural objects involved in the module. The second activity, "Let's Observe", invites students to observe images of cultural objects to find flat shapes and formulate their properties. The third activity, "Let's Reason", aims to process information from observations. The fourth activity, "Let's Dig for Information", aims to dig up additional information and connect the information with the observations. The fifth activity, "Conclusion" contains conclusions from all activities that have been carried out. A validation instrument is also made at this design stage, which will be used in the validation process after the product is finished. Examples of learning activities in the module is show in Figure 2.

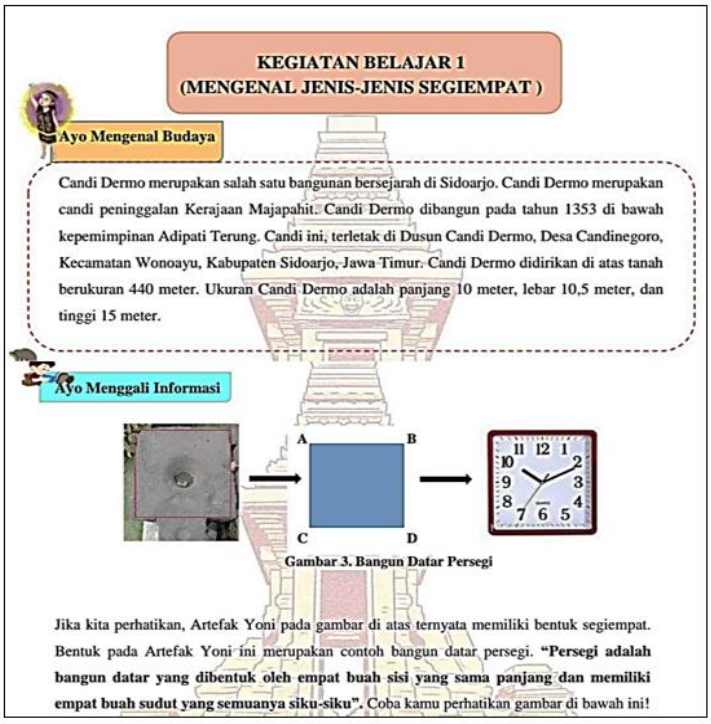


Figure 2. Examples of Learning Activities in the Module

Module Validity Result

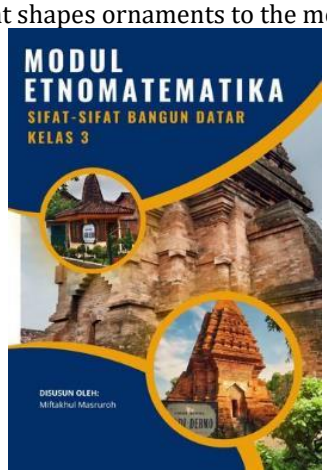
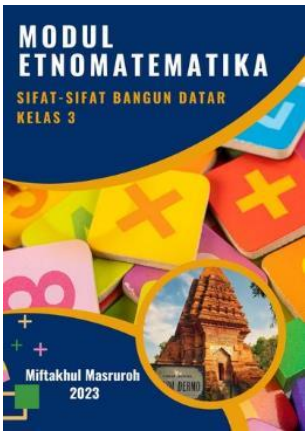
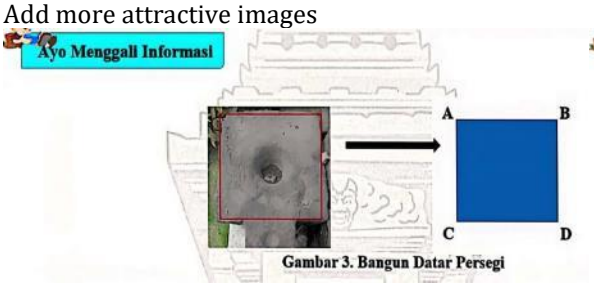
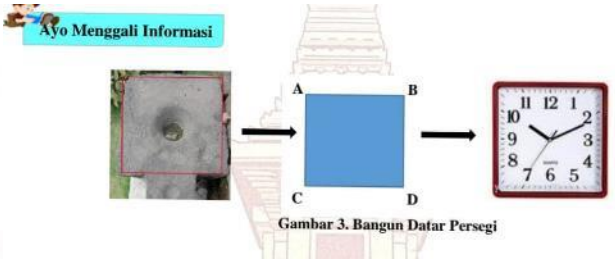
The validity of the module is measured based on the assessment results by experts at the development stage. Measurement of the validity of ethnomathematics-based modules is carried out by material and module experts. The results of the validity measurement state that the ethnomathematics-based modules are very valid and suitable for use is show in Table 6.

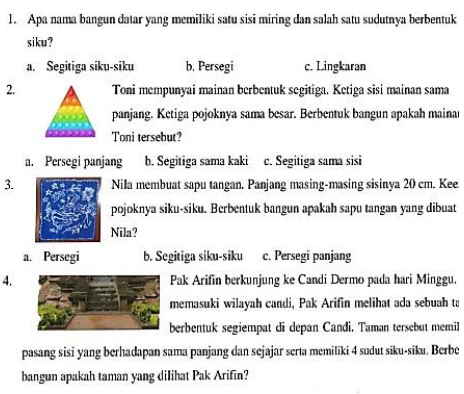
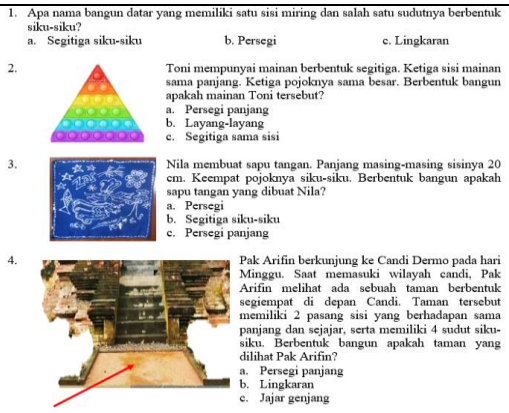
Table 6. Material Expert And Module Expert Validation Results

	Assessment Aspects	Scores	Validity Criteria
Material Expert	Content feasibility	1	Highly valid product
	Language feasibility	1	Highly valid product
	Presentation feasibility	1	Highly valid product
Modul Expert	Ethnomathematics content	1	Highly valid product
	Module content	1	Highly valid product
	Module design	0,8	Valid Product

Results of the validation of ethnomathematics-based modules in Table 6 show that the content feasibility aspect, language feasibility, presentation feasibility, ethnomathematics content, and module content get a score of 1, which means the module is very valid in terms of the module content, while from the layout aspect, the module gets a score that is in the valid category. From these results, it can be concluded that the ethnomathematics-based module properties of flat shapes for third-grade elementary school students are highly valid and suitable for use. However, the expert still suggested making some minor revisions for product perfection. Some improvement suggestions from the expert are adding flat shapes ornament on the cover, adding more attractive images, and Arranging layouts to improve readability. The results of the product revision can be seen in Table 7.

Table 7. Product Revision

Comments	
Before Revisions	**After Revisions**
Adding flat shapes ornaments to the module cover	
	
Add more attractive images	
	
Arrange layouts to improve readability	

Comments	
Before Revisions	**After Revisions**
	

1. Apa nama bangun datar yang memiliki satu sisi miring dan salah satu sudutnya berbentuk siku?
   a. Segitiga siku-siku b. Persegi c. Lingkaran
2. Toni mempunyai mainan berbentuk segitiga. Ketiga sisi mainan sama panjang. Ketiga pojoknya sama besar. Berbentuk bangun apakah mainan Toni tersebut?
   a. Persegi panjang b. Segitiga sama kaki c. Segitiga sama sisi
3. Nila membuat sapu tangan. Panjang masing-masing sisinya 20 cm. Kee pojoknya siku-siku. Berbentuk bangun apakah sapu tangan yang dibuat Nila?
   a. Persegi b. Segitiga siku-siku c. Persegi panjang
4. Pak Arifin berkunjung ke Candi Dermo pada hari Minggu. memasuki wilayah candi, Pak Arifin melihat ada sebuah ta berbentuk segiempat di depan Candi. Taman tersebut memil pasang sisi yang berhadapan sama panjang dan sejajar serta memiliki 4 sudut siku-siku. Berbe bangun apakah taman yang dilihat Pak Arifin?

1. Apa nama bangun datar yang memiliki satu sisi miring dan salah satu sudutnya berbentuk siku-siku?
   a. Segitiga siku-siku b. Persegi c. Lingkaran
2. Toni mempunyai mainan berbentuk segitiga. Ketiga sisi mainan sama panjang. Ketiga pojoknya sama besar. Berbentuk bangun apakah mainan Toni tersebut?
   a. Persegi panjang
   b. Layang-layang
   c. Segitiga sama sisi
3. Nila membuat sapu tangan. Panjang masing-masing sisinya 20 cm. Keempat pojoknya siku-siku. Berbentuk bangun apakah sapu tangan yang dibuat Nila?
   a. Persegi
   b. Segitiga siku-siku
   c. Persegi panjang
4. Pak Arifin berkunjung ke Candi Dermo pada hari Minggu. Saat memasuki wilayah candi, Pak Arifin melihat ada sebuah taman berbentuk segiempat di depan Candi. Taman tersebut memiliki 2 pasang sisi yang berhadapan sama panjang dan sejajar, serta memiliki 4 sudut siku-siku. Berbentuk bangun apakah taman yang dilihat Pak Arifin?
   a. Persegi panjang
   b. Lingkaran
   c. Jajar genjang

Module Practicality

The implementation stage is the initial activity in measuring the practicality of the module. The revised module was then implemented on third-grade students of SDN Candinegoro. Students were given a questionnaire containing several questions to measure the practicality of the module. Based on the results of the implementation of 22 students of SDN Candinegoro, it can be seen that the ethnomathematics-based module is very practical when used by students. The results of the practicality measurement can be seen in Table 8.

Table 8. Practicality of Ethnomathematics-Based Modules

Assessment Aspects	Scores (%)	Practicality Criteria
Function	94%	Highly Practical Product

Practicality results in Table 8 showed a value of 94% with very practical criteria. In this case, students gave a good response while using ethnomathematics-based modules. Students feel satisfied with using ethnomathematics-based modules. Most students agree that learning math using ethnomathematics-based modules makes math learning more fun. In addition, the use of cultural elements of Dermo Temple is also considered interesting by students. Students also feel that the material properties of flat shapes on ethnomathematics-based modules become simpler and easier to understand.

Module Effectiveness

The effectiveness of ethnomathematics-based modules is measured at the evaluation stage. Previously, students were given post-test questions to determine changes in student learning outcomes after learning with ethnomathematics-based modules. Data on pre-test and post-test scores were obtained, and then a normality assessment was carried out to determine the test statistics to be used. Data analysis was carried out using the SPSS application. The type of normality assessment used is the Shapiro-Wilk test because the amount of data is less than 50. The results of the data normality assessment are presented in Table 9.

Table 9. Normality Test Results with Shapiro-Wilk

	Statistic	df	Sig.
Pre-test	0.961	22	0.515
Post-test	0.913	22	0.054

In Tabel 9, the normality test result for the pre-test score is 0.515 and the post-test score is 0.054. The pre-test and post-test data are classified as normally distributed from these results because the significance value is greater than 0.05. When the data is normally distributed, the type of test statistics used is a parametric statistical test. The type of parametric statistics used to determine the effectiveness of the module based on pre-test and post-test scores is the dependent t-test statistic. The results of the dependent t-test are presented in Table 10.

Table 10. Effectiveness Test Results Based on Pre-Test And Post-Test Scores

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Pre-Post test	-32.5000	16.6769	3.5555	-39.8941	-25.1059	-9.141	21	0.000

The results of measuring the effectiveness of using ethnomathematics-based modules in Table 10 produce a significance value (2-tailed) 0.000 smaller than 0.05, which means there are differences in learning outcomes before and after using ethnomathematics-based modules. In detail, student learning outcomes before using ethnomathematics-based modules are at an average value of 47.29, while student learning outcomes after using ethnomathematics-based modules are at an average of 79.79. The difference in the average score shows that students can reach the minimum completeness criteria on the properties of flat shapes material. So, it can be concluded that the use of ethnomathematics-based modules is proven effective because it can improve student learning outcomes on the properties of flat shapes.

Discussion

The development research results produced ethnomathematics-based modules that are valid, practical, and efficient in improving student learning outcomes for the properties of flat shapes material. The stages carried out in developing ethnomathematics-based modules include the stages of analysis, design, development, implementation, and evaluation. The analysis stage describes the needs of students for the availability of ethnomathematics-based modules in the implementation of mathematics learning in the classroom. The results of the module need analysis are based on the low student learning outcomes on the properties of flat shapes material. Ethnomathematics-based modules contain contextualized mathematical ideas that can help students to construct knowledge through meaningful learning (Hariastuti et al., 2022; Prahmana & D'Ambrosio, 2020). The design of ethnomathematics-based modules contains several ethnomathematics-based activities. The formulated ethnomathematics-based activities aim to create self-learned. In this case, the activities are packaged in the form of observation, identification, reasoning, and tracing of cultural objects to find the concept of the material being taught (Faiziyah et al., 2021; Orey & Rosa, 2020). The application of ethnomathematics-based learning activities can increase student activeness in the learning process (Cortes & Orey, 2020; Prahmana & D'Ambrosio, 2020).

The development of ethnomathematics-based modules meets the validity aspect to be used to improve learning outcomes for third-grade elementary school students. The validity measurement results show that the ethnomathematics-based module properties of flat shapes are included in the valid to very valid criteria. The results of other studies related to the development of ethnomathematics-based modules show similar results; namely, the ethnomathematics-based modules developed get a valid value based on expert assessment because the material in the module has been compiled completely and under the basic competencies (Khair et al., 2023; Triwahyuningtyas et al., 2020). Ethnomathematics-based modules are said to be valid because they contain material that is in accordance with basic competencies, use language that is easy to understand, and are in accordance with the character of students and their environment (Madrazo & Dio, 2020; Sri Rezeki et al., 2021)**.** The valid ethnomathematics-based properties of flat shapes module show that this module can be used in learning mathematics because it contains activities, material content, and a series of evaluations that can be used to measure students' mathematics achievement (Khair et al., 2023; Oco, 2022).

Ethnomathematics-based modules are also considered practical based on the assessment of student responses. The practicality measurement results show that the properties of flat shapes module based on ethnomathematics are included in the very practical category with a value of 94%. Similar research results show the results of the practicality assessment by students in the range of 90% are included in the very practical category because students feel satisfied when using the module (S Rezeki et al., 2020; Triwahyuningtyas et al., 2022). The practicality of the module shows that ethnomathematics-based modules make it easier for students to learn the material properties of flat shapes. Some other studies also stated that the practicality of ethnomathematics-based learning makes mathematics simpler to help students improve their learning quality (Janiola & Santos, 2021; Lestari et al., 2023). In addition, conducting ethnomathematics-based learning activities can strengthen students' curiosity and desire to learn mathematics (Fouze & Amit, 2021; Iswara et al., 2022).

The effectiveness of ethnomathematics-based modules can be seen from the improvement of mathematics learning outcomes on the properties of flat shapes material. The ethnomathematics-based properties of flat shapes math module effectively improve the learning outcomes of third-grade students because it presents many real examples related to flat shapes and provides opportunities for students to carry out identification and exploration activities related to flat shapes (Fouze & Amit, 2021; Khair et al., 2023). The findings show that third-grade elementary school students can distinguish flat shapes based on their properties after learning the ethnomathematics module. Students can also categorize objects based on their properties. The results of other studies related to the application of ethnomathematics-based modules state that learning that uses an ethnomathematics approach has a higher potential to improve student learning outcomes (Sri Rezeki et al., 2021; Triwahyuningtyas et al., 2020). The main reason is that ethnomathematics-based modules can make it easier for students to understand the material (Busrah & Pathuddin, 2021; Sri Rezeki et al., 2021).

The findings in this study show that the use of ethnomathematics elements in mathematics learning modules has advantages over conventional mathematics modules. Ethnomathematics makes the properties of flat-shaped material more relevant to the cultural environment around students (Fouze & Amit, 2021; Shahbari & Daher, 2020). Ethnomathematics, in particular, can facilitate students' active interaction with their social and cultural environment in building geometry knowledge (Fouze & Amit, 2021; Hwang et al., 2020). In addition, ethnomathematics-based modules can also present an interesting and enjoyable learning environment so that students have a high desire to learn mathematics materials (Hariastuti et al., 2022; Sri Rezeki et al., 2021). Similar research on ethnomathematics-based modules has confirmed that learning mathematics based on ethnomathematics can majorly develop mathematical ideas and concepts (Lestari et al., 2023; Machaba & Dhlamini, 2021). Thus, the results of this development research can have implications in mathematics science, especially in elementary school education, namely increasing the availability and model of ethnomathematics-based modules that are valid, practical, and effective to be able to improve the mathematics learning outcomes of third-grade elementary school students, especially on the material properties of flat shapes. Ethnomathematics-based modules can also be an alternative for teachers and other researchers to use and develop mathematics modules for properties of flat shapes based on the cultural environment to make mathematics material simpler and easier, meanwhile making students self-learners so that student learning outcomes also increase.

Although the development results in this study are declared valid, practical, and effective for constructing student understanding of the properties of flat shapes material, this ethnomathematics-based module has limitations in the development scope. This research is limited to the properties of flat-shaped material using ethnomathematics objects that explore only one form of culture. Based on these limitations, the researcher suggests that further research on developing ethnomathematics-based modules should explore other cultural forms and be integrated with different mathematics materials. In addition, the research subjects involved in the development process should be more and more extensive so that the modules developed are more reliably tested (Andriah & Amir, 2021; Nabila & Amir, 2022).

4. CONCLUSION

The development of ethnomathematics-based modules on the properties of flat shapes integrated with cultural sites is valid, practical, and effective in improving the learning outcomes of third-grade students. The validity of ethnomathematics-based modules shows that the modules are feasible and suitable for third-grade elementary school students' use. The practicality of ethnomathematics-based modules shows students' positive responses when and after learning the material properties of flat shapes using the module. The effectiveness of ethnomathematics-based modules is evidenced by the difference in learning outcomes on the properties of flat shapes material by third-grade students in a more positive direction. Overall, developing and implementing ethnomathematics-based modules provides a real picture of flat shapes so that third-grade elementary school students can recognize the properties of flat shapes in a more meaningful and self-learner nature.

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