

## Miniature Media Characterized by Ethnomathematics in Improving Mathematics Abilities for Third Grade Elementary Schools

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### Abstrak

Rendahnya minat selama proses pembelajaran matematika di sekolah dasar mengakibatkan hasil belajar siswa menurun, apalagi penggunaan metode pembelajaran yang kurang tepat yang umumnya hanya memfokuskan siswa pada latihan soal tentu membuat siswa cepat merasa bosan dan menganggap matematika bukan pelajaran yang menyenangkan. Pembelajaran dan hasil belajar siswa dalam mata pelajaran matematika dipengaruhi oleh beberapa faktor, diantaranya adalah media pembelajaran. Media pembelajaran yang dirancang menarik dan sesuai dengan kebutuhan dan karakteristik siswa dapat mempengaruhi perhatian siswa untuk aktif dalam proses pembelajaran, terlebih lagi Matematika sangat erat kaitannya dengan kehidupan sehari-hari, terutama yang berkaitan dengan perhitungan (penjumlahan, pengurangan, perkalian dan pembagian). Tujuan penelitian ini adalah menganalisis validitas media miniatur berkarakter etnomatematika, menganalisis kepraktisan media miniatur berkarakter etnomatematika dan menganalisis keefektifan media miniatur berkarakter etnomatematika dalam meningkatkan kemampuan memahami materi bangunan rumah susun kelas III SD siswa. Penelitian pengembangan ini menggunakan one group pre-test post-test design. Subyek dalam penelitian ini terdiri dari 1 ahli media, 1 ahli materi, 1 praktisi, dan 13 siswa kelas III SD. Hasil penelitian dianalisis dengan menggunakan statistik deskriptif dan hipotesis diuji dengan teknik uji-t berkorelasi. Hasil penelitian menunjukkan bahwa media miniatur berkarakter etnomatematika valid, praktis dan efektif dalam meningkatkan kemampuan memahami materi bangun datar siswa kelas III Sekolah Dasar.

**Kata Kunci:** Ability, Elementary School, Ethnomathematics, Miniature Media.

### Abstract

The low interest during the learning process of Mathematics in elementary schools' results in decreased student learning outcomes, moreover the use of inappropriate learning methods which generally only focus students on practicing problems certainly makes students quickly feel bored and consider Mathematics not a fun lesson. Learning and student learning outcomes in Mathematics are influenced by several factors, including learning media. Learning media that is designed to be interesting and in accordance with the needs and characteristics of students can affect student attention to be active in the learning process, moreover Mathematics is closely related to everyday life, especially those related to calculations (addition, subtraction, multiplication and division). The purpose of this study was to analyze the validity of miniature media characterized by ethnomathematics, analyze the practicality of miniature media characterized by ethnomathematics and analyze the effectiveness of miniature media characterized by ethnomathematics in improving the ability to understand flat building material for grade III elementary school students. This development research uses a one group pre-test post-test design. The subjects in this study consisted of 1 media expert, 1 material expert, 1 practitioner, and 13 third grade elementary school students. The results were analyzed using descriptive statistics and the hypothesis was tested using the correlated t-test technique. The results showed that the miniature media characterized by ethnomathematics was valid, practical and effective in improving the ability to understand flat shape material for third grade elementary school students.

**Keywords:** Elementary School, Ethnomathematics, Miniature Media.

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## 1. INTRODUCTION

Mathematics in human daily life has a very important role in helping activities related to calculations. Mathematics can help explain the world by revealing basic knowledge. Mathematics reveals various basic knowledge through activities that include information, surveys, observations from science, inference, reasoning, evidence, and numerical simulations of natural events, human behavior, and social systems. Mathematics helps us think analytically and have better, clearer reasoning skills, accelerates our thinking, encourages practicality, and can be applied in everyday life (Algani, 2022; Pathoni et al., 2021). Mathematical representation plays an important role as a mediator between mathematical beliefs and arithmetic problem solving (Muzaki & Masjudin, 2019; Yuanita et al., 2018). Mathematics is said to be a tool to improve transferable skills such as critical and logical thinking skills. Mathematics for those who study it can improve investigative abilities, and creativity in problem solving (Cresswell & Speelman, 2020; Hidayat et al., 2020). Mathematics is a subject that is taught to students at every level of education. Students are educated to gain competence in managing and utilizing information in everyday life. The purpose of learning mathematics is to equip the ability to think logically, systematically, analytically, creatively, and critically, as well as the ability to work together. This can certainly help students survive in ever-changing and competitive circumstances in the future (Ginanjari, 2019; Kurniani Ningsih et al., 2021). The existence of Mathematics at the education level, especially in elementary schools, is still a subject that is less attractive to students even though Mathematics is very important as a provision and capital needed by children in navigating a tough life in the future. But in reality, mathematics is still a frightening specter for students (Lubis et al., 2021; Trimahesri & Hardini, 2019). This is reinforced by several previous studies such as those conducted that was found that most students obtained Mathematics scores below the Minimum Completeness Criteria (KKM), because in the Mathematics learning process most students seemed very passive and did not pay attention to the teacher when explaining the material so that there was no reciprocity in the learning process (Diniyah et al., 2018; Dwijanto et al., 2019). In addition, in the learning process students do not have the will to be able or try to learn, especially if there is no assignment at home then students will not study.

Not only that, based on research conducted in learning the Mathematics learning process in class, most students sit quietly and only a few students are actively involved in paying attention to the teacher when explaining (Permatasari, 2021). Departing from this research, the lack of interest in learning mathematics among students is basically caused by the delivery of inappropriate material and learning strategies, a sense of giving up easily, and students' lack of understanding of the material presented (Albay, 2019; Imam et al., 2018). Based on the facts in the field, many students experience learning difficulties and are not interested in learning mathematics, as well as their lack of understanding in learning mathematics (Aguilar, 2021). Mathematics is considered an abstract science that makes many people find it difficult to pass the subject (Makondo & Makondo, 2020). Moreover, if the learning process of mathematics is only focused on practicing problems, it will cause mathematics learning to be rigid. Most students get low scores in mathematics because in the mathematics learning process students are very passive and do not pay attention to the teacher when explaining the material so that there is no reciprocity in the learning process. The mathematics learning process that occurs is teacher-centered learning (Hasanah et al., 2019; Rofi'ah et al., 2021). Rigid and theoretical learning of Mathematics if not overcome will continue to be a subject that is disliked by students. Mathematics can be related to students' daily lives and activities. Unfortunately, there are some inadequate supporting aspects such as teachers' lack of knowledge between new concepts of mathematics and previously learned mathematical structures. The presence of anxiety and negative feelings

towards mathematics, as well as their educational background, school management system, lack of school infrastructure, and lack of a regular school assessment system are the main causes of mathematics learning difficulties (Acharya, 2017; Iswara et al., 2022). Math learning difficulties can be defined as difficulties in capturing or absorbing material in the learning process. If this is allowed to continue, it can interfere with students' interest in learning mathematics. As a result, mathematics will continue to be the subject most avoided by students (Arifah et al., 2019; Kurniani Ningsih et al., 2021; Permatasari, 2021). The decline in interest in learning mathematics causes less than optimal learning outcomes in mathematics, which can be seen from the results of formative assessments that show that learning objectives have not been achieved or produce low learning achievements (Commodari & La Rosa, 2021; Yeh et al., 2019). A way that is considered to be used to increase students' interest in mathematics is to choose the right learning approach. Learning strategies and methods as well as the availability of sufficient materials and facilities are factors in supporting mathematics learning (Azmidar et al., 2017; Sulistyaningsih et al., 2018).

Reflecting on everyday life, many things can be used as media in learning mathematics, be it the environment, habits, and culture of the local community. The learning approach that is carried out by linking one's own culture with mathematics and involving the needs and lives of the community is called ethnomathematics. Ethnomathematics is a new approach that has the potential to be developed into contextualized learning while introducing local culture to students and breaking the assumption that math learning is too abstract, rigid and theoretical (Fajriyah, 2018; Iraratu et al., 2021). However, the existence of ethnomathematics is still unfamiliar to teachers and students, so an intermediary is needed to introduce ethnomathematics in the learning process. The solution to the above problem is to create a miniature media with ethnomathematics characteristics to present the original form of a culture that can be related to mathematics, especially in flat building material based on the structure of the miniature. Miniature media in the form of concrete media is certainly in accordance with the developmental stage of elementary school children who need concrete media in finding their own concepts and knowledge so that using miniature media characterized by ethnomathematics can adjust to the developmental stage and needs of students. Thus the Mathematics learning process will be more interesting and in accordance with everyday life. This development research aims to analyze the validity of miniature media characterized by ethnomathematics, analyze the practicality of miniature media characterized by ethnomathematics and analyze the effectiveness of miniature media characterized by ethnomathematics in improving the ability to understand flat building material for third grade elementary school students as well as one of the steps in preserving culture in the world of education.

## 2. METHOD

This research is a Research and Development study with the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The essence of using the ADDIE model uses a systems approach, namely dividing the planning process into several steps in a logical sequence to produce a systematic development stage (Cahyadi, 2019; Edi & Rosnawati, 2021). This research used the one-group pretest-posttest research design. The research design was used to determine the effectiveness of miniature media characterized by ethnomathematics in improving the ability to understand flat shape material for third-grade elementary school students. The study involved 13 students from 3<sup>rd</sup>-grade basic school student at SD 5 Batungsel, Tabanan Bali, Indonesia, 2 experts (materials experts and learning media experts), and 1 practitioner/teacher.

This research was carried out in several stages, namely: (1) The analysis phase carried out needs analysis, analysis of student characteristics, analysis of curriculum, and analysis of content or media; (2) The design stage is carried out by making a media design based on the results of the analysis carried out previously; (3) The development stage is assessed by experts, media validation by experts, and practitioners' responses (teachers and students) are collected, which are then repaired if necessary; (4) the implementation phase is carried out by implementing the media in the learning process; (5) The evaluation stage is carried out formative evaluation and summative evaluation. The data collection method used in the expert test, practitioner test, individual trial and small group trial was a questionnaire the following is a lattice of instruments used in collecting research data presented in Table 1, Table 2, Table 3, and Table 4.

**Table 1. Material Expert Instrument Lattice**

No	Aspect	Indicator	Item Number
1	Curriculum	The suitability of the material with the basic competencies	1
		Suitability of material with learning indicators	2
		The suitability of the material with the learning objectives	3
2	Material/ Content	Coverage of material on the media	4
		The suitability of the material with the media	5
		Material is easy to understand	6
		The suitability of the material to reality	7
		Cultural elements in the material	8
		Suitability of material to the cognitive level of students	9
3	Presentation	The orderliness of the presentation of the material	10
		Integration of material with media	11

**Table 2. Media expert instrument grids**

No	Aspect	Indicator	Item Number
<b>A Miniature Media Characterized by Ethnomathematics</b>			
1	Materials	Material quality	1
		Durability material	2
		Coloring	3
		Integration of components in the media	4
2	Physical	Selection of media form	5
		The suitability of the shape of components with the original	6
3	Usage	Media safety	7
<b>B Booklet Supporting Miniatures Characterized by Ethnomathematics</b>			
4	Language	Language suitability with student characteristics	8
		Effective and efficient use of language	9
		Integration of miniature with booklet	10
5	Integration	Clarity of miniature media in the booklet	11

**Table 3.** Practicality Test Instrument Grids and Student Responses

No	Aspect	Indicator	Item Number
1	Curriculum	The suitability of the material in the media with the basic competencies	1
		The suitability of the material on media with learning indicators	2
		The suitability of the material on media with learning objectives	3
		Clarity of material in the media	4
2	Material	The material presented is easy to understand	5
		The suitability of the material with the media	6
3	Use of Media	Media application	7
4	Media Display	Media attractiveness	8
		Media attracts students interest	9
		Media attracts students attention	10
5	Attractiveness	Media motivates student learning	11

In order to collect research data on the effectiveness of miniature media characterized by ethnomathematics which was carried out at SD Negeri 5 Batungsel in class III with a total of 13 students using the test method in the form of multiple choice of 20 questions. After going through the item validity test, there are 15 valid items. So that in this study using 15 items for the effectiveness test. The instrument grids are presented in the [Table 4](#).

**Table 4.** Effectiveness Test Instrument Grids

No	Basic Competencies	Indicator of Competency Achievement	Kognitive Dimension	Item Number	Total Item	
3.12	Analyze various flat shapes based on their properties.	3.12.1	Relate various flat shapes based on their properties	C4	1,3,6,7	4
		3.12.2	Finding various flat shapes through concrete objects.	C4	2, 4	2
		3.12.3	Comparing various flat shapes based on their properties through concrete objects.	C5	5,8, 11	3
		3.12.4	Selecting various flat shapes on concrete objects based on their properties.	C5	9, 10, 14	3
		3.12.5	Connecting various flat shapes through concrete objects.	C6	12, 13, 15.	3
<b>Total</b>					<b>15</b>	

After the data is collected, it is analyze using descriptive data analysis techniques, both qualitative descriptive and quantitative descriptive. Qualitative descriptive analysis was used to obtain an overview of miniature media with ethnomathematics characteristics.

Quantitative descriptive analysis is used to analyze data in the form of numbers obtained from questionnaires and effectiveness tests. In testing the research hypothesis regarding the improvement of the ability to understand flat shapes material using the correlated t-test with the help of IBM SPSS 23.0 for windows.

### **3. RESULT AND DISCUSSION**

#### **Results**

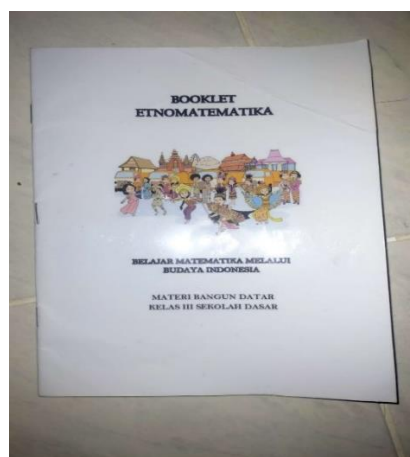
Miniature media with ethnomathematics characteristics is designed to answer the problems of teaching mathematics in 3rd elementary schools. This miniature media with ethnomathematics characteristics is equipped with an ethnomathematics booklet to make it easier for teachers and students to apply media to the learning process. Media is made in the form of concrete media by displaying the original form of an object with a smaller size. This media contains the types of flat shapes that are components of the miniature. This miniature media with ethnomathematics characteristics focuses on flat building materials found in one of the traditional houses in Indonesia, namely the traditional house of the Osing Tribe. This miniature traditional house of the Osing Tribe contains several types of flat shapes, such as square, rectangle, triangle, and parallelogram. The ethnomathematics booklet contains material on the meaning of ethnomathematics, the history of the Osing Tribe, the Osing traditional houses, ethnomathematics in the Osing traditional houses, and instructions for using media. Display of miniature media characterized by ethnomathematics and ethnomathematics booklets can be seen in [Figures 1](#), [Figure 2](#), and [Figure 3](#).



**Figure 1.** Media Start-up Display



**Figure 2.** Media Display After Combining with Flat Shapes



**Figure 3.** Ethnomathematics Booklet Display

The results of validity testing and practitioner response tests, individual trials, and small group trials were carried out by 2 experts, namely 1 material expert and 1 learning media expert, which can be seen in [Table 5](#). This test was conducted to determine the practicality of the media

**Table 5.** Media Validity and Practicality Test Results

No.	Subject	Mean	Qualification
1	Learning Content Expert Test	4.73	Very good
2	Learning Media Expert Test	4.18	Good
3	Practitioner Expert Test	4.64	Very good
4	Individual Trial	4.64	Very good
5	Small Group Trial	4.68	Very good

Base on [Table 5](#), the results of the practicality test of ethno-media show that practitioners/teachers respond very well to ethno-mathematics-characterized miniature media. The average value obtained was 4.64 which was in the range 4.22 – 5. Based on individual tests using 3 students with different abilities, namely students with high, medium, and low abilities, obtained a mean of 4.64 which was in the range of 4.22 – 5. Based on the five scale conversion guidelines which mean that students respond very well to miniature media with ethnomathematics characteristics. Meanwhile, based on small group trials using 6 students with different abilities, was obtained a mean of 4.68, which is in the range of 4.22 – 5. Based on the scale of five conversion guidelines, meaning that students responded very well to miniature media with ethnomathematics characteristics. If the practitioner's assessment is combined with the students, it shows that this media has a very good response with an average value of 4.65. The result of t-test is show in [Table 6](#).

**Table 6.** The Result of T-Test

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	Sig(2-tailed df)
				Lower	Upper		
Pair 1 Pre-test - Post-test	-36.915	4.4167	1.225	-39.584	-34.246	-30.135	12 0.000

Base on [Table 6](#), the result of the ability to understand flat shape material for third-grade elementary school students pre-test and post-test, it is found that the student ability to understand the flat shape material was significantly increasing ( $P < 0.05$ ).

## **Discussion**

This research produces concrete media in the form of miniature media with ethnomathematics characteristics equipped with an ethnomathematics booklet as a guide to using the media. Miniature media that presents cultural elements in the process of learning Mathematics is a very interesting thing because in general students only know Mathematics which is concentrated on numbers. Media that is attractively designed and uses safe materials to be used by students and teachers can certainly be used repeatedly. Miniature media is a concrete media that makes it easy for students to be actively involved in the learning process, because miniature media not only provides opportunities for students to observe, but miniature media can provide opportunities for students to listen, understand and interact with media in finding their own concepts ([Imawati et al., 2021](#); [Kusumaningrum & I., 2022](#); [Setyawan, 2020](#)). Miniature media characterized by ethnomathematics in the form of concrete media is very important for us at the age of elementary school children. It helps in delivering material while learning so that the learning process becomes more effective and students can think actively and independently ([Devi, 2019](#); [Singh & Hashim, 2020](#)).

The process of developing miniature media characterized by ethnomathematics has previously gone through the stages of the ADDIE development model to create quality products. The ADDIE development model which has a structured and systematic sequence of steps certainly makes the media output in accordance with the wants and needs ([Darmawan & Yuwaningsih, 2021](#); [Khotimah et al., 2020](#)). The media development process first passed the analysis stage carried out at SD Negeri 5 Batungsel which included: (a) analysis of teacher and student needs; (b) analysis of student characteristics; (c) content analysis; and (d) competency analysis. After the analysis is carried out, it is continued at the design stage by making the media design and realizing the media. Furthermore, the finished media is tested for validity and practicality. Based on the test results, if there are suggestions for improvement, before the media is implemented, the media is revised first. After the media is revised, it is then applied to the learning process to determine the effectiveness of the media. Throughout the process of these stages, evaluations are always carried out in order to create quality products. Referring to these systematic research steps will produce media that are valid and suitable for use in the learning process.

Based on the results of the media validity research, it can be seen that the miniature media with ethnomathematics characteristics obtained a very good validity value. This condition is supported by media that has been adjusted to the curriculum, material, characteristics, and needs of teachers and students. The acquisition of media validity is based on the assessment of material experts and media experts. Material experts provide an assessment in terms of curriculum aspects, material aspects, and presentation aspects. In contrast to media experts, the assessment given is based on material aspects, physical aspects, usage aspects, linguistic aspects and aspects of the integration of miniature media with ethnomathematics booklets. Based on these two assessments, it is strongly supported that the media is very valid and can be applied to the learning process. Miniature media characterized by ethnomathematics have been developed in accordance with the developmental stages of elementary school students. Students in the lower grades are encouraged to learn Mathematics using concrete media to make it easier for students to understand mathematical representations and make it easier for students to observe, learn, and convey the knowledge they gain, thus providing opportunities for students to be actively involved in the learning process ([Kusumaningrum & I., 2022](#); [Suarjana et al., 2017](#)). Miniature media with



ethnomathematics characteristics in the form of concrete media can provide opportunities for students to be active in discovering their knowledge through interaction with these media so that miniature media with ethnomathematics characteristics are appropriate for use in the mathematics learning process. This is in line with research which states that media that have good qualifications in the Mathematics learning process are media that can provide direct learning experiences which result in the learning process becoming more alive by optimally utilizing things related to students' lives as learning media (Destrinelli et al., 2018).

In addition, the development of media that resembles the original form of an object even with different sizes will make it easier for students to see the forms presented in the media. Miniature media equipped with an ethnomathematics booklet containing an understanding of ethnomathematics, the history of the Osing Tribe, the Osing tribe's traditional house, ethnomathematics in the Osing tribe's traditional house, and instructions for using the media will make it easier for students and teachers to use the media without having to be accompanied by researchers. In addition to validity, miniature media with ethnomathematics characteristics also have practicality value. The acquisition of media practicality is based on an assessment from practitioner experts, individual trials and small group trials conducted at SD Negeri 5 Batungsel. Based on this assessment, it is stated that the miniature media characterized by ethnomathematics has very good practicality criteria. This is seen from the curriculum aspect, material aspect, media usage aspect, media display aspect, and media attractiveness aspect. The media can be said to be practical if the media can help facilitate the learning process so that it can provide opportunities for students to understand the material easily and can arouse their enthusiasm for learning (Sulfemi, 2019; Wiryanto, 2020). Media that has excellent practicality should be able to deliver students to achieve learning objectives so that the learning process becomes optimal (Febrianti, 2019; Mutawariyah & Mizan, 2021). This can be seen in the use of miniature media with ethnomathematics characteristics that make it easier for students to understand the material so that learning objectives can be achieved.

For teachers and students, this miniature media characterized by ethnomathematics is considered a unique media because culture can bring up mathematical concepts, especially if it uses cultures that are still rarely known by students so that students not only gain knowledge related to mathematics but can also get to know various types of cultures in Indonesia. This is a very good step in creating an interesting Mathematics learning process in the form of introducing Indonesian culture. In addition to being valid and practical, the effectiveness of the miniature media characterized by ethnomathematics was also measured in the learning process. Based on the use of the one group pre-test post-test design in the effectiveness test, it was found that the media was able to improve students' mathematics learning outcomes, especially in the material of flat buildings in grade three elementary schools. This is supported by the acquisition of students' math scores when given a pre-test, which is before the media is implemented in the learning process, the results show that students' scores vary greatly but many are below the Minimum Completeness Criteria value. After the media is applied in the learning process, students' ability to understand flat building material is again measured by giving a post-test. The results of the post-test received much better scores than before. So the use of miniature media in the learning process has a significant effect on the ability to understand flat building material of third grade students.

In the learning process, using miniature media characterized by ethnomathematics can be used in a varied manner to find the concept of flat shapes based on the abilities of each student. Media designed according to their original form can present a more real learning process so that students do not need to imagine the shapes of various flat shapes. The use of miniature media characterized by ethnomathematics which is complemented by an ethnomathematics booklet can help students understand the basic concepts of mathematics

which are abstract to become real through direct interaction with the flat shapes contained in the miniature components so that it can produce a maximum learning process and affect student learning outcomes.

#### 4. CONCLUSION

Miniature media with ethnomathematics characteristics is a learning media in the form of concrete media. This media is very valid to be used in the learning process. In addition, miniature media with ethnomathematics characteristics get very good responses from teachers and students in the learning process so the media is suitable for use. Miniature media with ethnomathematics characteristics is effective for use in improving the ability to understand flat shape material for third-grade elementary school students. Using this media shows better results in terms of the ability to understand flat shape material for third grade elementary schools.

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