

The New Way Improve Mathematical Literacy

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The New Way Improve Mathematical Literacy: Ethnomathematics Module with Realistic Mathematics Education

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ABSTRACT

Mathematical literacy is the basis for students to fully understand learning in the 21st century era. The low mathematical literacy ability of students in elementary schools reduces the quality of education and participation of students in everyday life. Therefore, it is necessary to develop learning modules to improve student literacy, using an ethnomathematics-based teaching module with the RME approach is one solution. This research is development research (RnD) with a 4D model (define, design, develop, disseminate) to develop teaching modules that can improve students' literacy skills. The research subjects were students and teachers of fifth grade in elementary schools in the Petanahan District. Data collection techniques are observation, interviews, questionnaires, documentation, and tests. The data were processed by qualitative descriptive analysis and quantitative analysis. The results showed that the validation was in the very good category, namely linguists 93.8%, material experts 94%, and design experts 92%. The level of practicality according to student responses is 87.65% very good category. The effect of the teaching module on mathematical literacy can be seen from the level of significance which is $0.000 < 0.05$ which means it has an effect by paying attention to the average literacy score of the experimental class $65.585 > 50.5882$, the teaching module has a positive effect on improving the mathematical literacy of fifth-grade students in elementary school. So, the ethnomathematics-based teaching module with a realistic mathematics education approach to improve mathematical literacy is valid, practical, and effective.



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1. INTRODUCTION

Literacy¹² is a basic ability that must be possessed by students (Sumirattana, Makanong, & Thipkong, 2017). Mathematical literacy is as important as literacy skills (Geiger, Goos, & Forgasz, 2015) that students in the 21st century¹³ need to have to keep up with the times (Geiger et al., 2015; Rizki & Priatna, 2019). This is because mathematical literacy is the ability of students to process and utilize mathematical knowledge in everyday life (OECD, 2018; Stacey, 2011; Stacey & Turner, 2015). Someone who has mathematical literacy skills tends to be able to solve everyday problems easily (Genc & Erbas, 2019; Rahmawati, Usodo, & Fitriana, 2021). Students with literacy at a high level can solve to generalize problems (Suryapuspitarini, Wardono, & Kartono, 2018). Mathematical literacy is one of the benchmarks for determining the success of education in elementary schools (Saleh, Prahmana, Isa, & Murni, 2018).

However, many students do not like mathematics (Syafitri, Putra, & Noviana, 2020).² Based on the results of the 2018 PISA study released by the OECD, the average mathematical literacy score in Indonesia reached 379 with an OECD average score of 489 (OECD, 2019). Based on the results of PISA, Indonesia always ranks in the bottom 10 in terms of the assessment of mathematical literacy. Literacy assessment in Indonesia is carried out through the Minimum Competency Assessment (AKM).

The results of the Minimum Competency Assessment (AKM) show the low numeracy literacy of elementary school students in the Petanahan District. This can be seen from the results of the AKM that 70% of elementary schools in the Petanahan sub-district have numeric literacy below the minimum competency. Some of the results of numeracy literacy in SD Petanahan District are as follows.

Table 1. Result of Minimum Competency Assesment

School	School Grade	Description
SDN Grujugan	1,59	Below the minimum competence
SDN 1 Kritig	1,61	Below the minimum competence

This shows the low mathematical literacy of elementary school students (Mahdiansyah & Rahmawati, 2014). The low literacy ability of elementary school students is found in the results of research (Putra, Agmadya, & Syahrilfuddin, 2021). Most students consider Mathematics a difficult subject so there is less interest in learning (Rahmatullah, Riyadi, & Indriati, 2021; Syafitri et al., 2020). Many factors hinder the students' low mathematical literacy.

The impact of the covid-19 pandemic is that learning is not effective, especially in elementary schools (Bozkurt, Jung, Xiao, & Vladimirschi, 2020). Learning activities are carried out using blended learning (Mali & Lim, 2021). Teachers as educators have a role as facilitators, namely facilitating learning so that learning goes according to goals (Ideswal, Yahya, & Alkadri, 2020). The facilitator must be able to create innovative learning modules which in their application can make students enthusiastic about learning independently (Fachrur, Rika, & Rahayu, 2021).

Teaching modules are interesting learning resources, easy to understand, and include certain material (Tjiptiany, As'ari, & Muksar, 2016) that can help students to become literate. Teaching modules can help students learn and solve problems independently (Syahril, Asrial, Kurniawan, & Piyana, 2019). Teaching modules can generate desire and generate motivation for students (Ferdianto, Setiyani, & Nurulfatwa, 2019) and activate students (Logan, Johnson, & Worsham, 2021). So in learning the teaching module can be used by students to learn independently.⁴

However, the results of observations show that the low mathematical literacy of students is caused by the unavailability of adequate learning resources. In the public elementary school in the Petanahan sub-district, there are no special learning resources to improve students' mathematical literacy. Improving literacy skills begins with increasing interest in reading (Mahdiansyah &

Rahmawati, 2014; Verschaffel, Schukajlow, Star, & Van Dooren, 2020). Learning resources that can help increase interest in literacy are modules (Khikmiyah, 2016).

The solution to overcome this is by developing an ethnomathematics-based teaching module with a realistic mathematics approach. Ethnomathematics is ethnomathematics related to mathematical practices (mathematical practices), mathematical ideas (mathematical ideas), and mathematical knowledge (mathematical knowledge) from a socio-cultural group of people (Dominikus, 2018). Ethnomathematics-based teaching module with a Realistic approach to Mathematics Education is proven to be able to achieve 21st-century learning goals (Johnson & Corey, 2020). Learning ethnomathematics can improve students' logical thinking skills in high school (Patri & Heswari, 2021). Ethnomathematics improves the quality of learning because the context is commonly found by students in their daily lives (Astriandini & Kristanto, 2021; Muhtadi, Sukirwan, Warsito, & Prahmana, 2017). Geometry concepts taught through culture (ethnomathematics) can improve the quality of learning in Teladan Maluku Elementary School (Laurens, 2016). Other researchers (Abdullah, 2017; Supiyati, Hanum, & Jailani, 2019; N. W. Utami, Sayuti, & Jailani, 2019) state that there is mathematics in a community culture that can be applied in learning. Experts have proven that there is a link between mathematics and culture that can optimize learning.

In addition to using ethnomathematics, the realistic mathematics education approach can also improve mathematical literacy (Nurkamilah, Nugraha, & Sunendar, 2018). (Fahmy, Wardono, & Masrukan, 2018) there is a positive effect of realistic learning on mathematical literacy. It is also supported by research (Handun, Habudin, & Rachmiati, 2020) which states that realistic mathematics learning has a positive influence on the mathematical literacy of elementary school students. In the learning process using realistic mathematics education, students are more active and have energy and motivation to learn, which has a good impact on increasing learning achievement (Mulbar & Zaki, 2018). Based on some of the studies above, shows that students' mathematical literacy skills in elementary schools can be improved through realistic mathematics learning models.

Based on these results, an ethnomathematics-based teaching module was developed with a realistic mathematics education approach to improve the mathematical literacy skills of fifth-grade elementary school students. Therefore, this study will examine the validity, practicality, and effectiveness of the teaching module.

2. METHODS

This research is a development research (RnD). In this development research, an ethnomathematics-based teaching module was developed with a realistic mathematics education approach to improve the mathematical literacy skills of fifth grade elementary school students with a 4D model (Define, Design, Develop, Desiminate). The 4D model was developed by S. Thiagarajan in (Sugiyono, 2019).

The object of this research is an ethnomathematics-based teaching module to improve students' mathematical literacy. The subjects in this study were teachers and fifth grade elementary school students in Petanahan sub-district as many as 65 students. The research was carried out for 3 months, namely March, April, May of the 2021/2022 academic year. Data collection techniques used in this study are through observation, interviews, questionnaires and tests. The research instrument used consisted of interviews, questionnaires, observations and mathematical literacy tests on multiple choice questions.

The following is a summary of the data collection techniques, instruments and subjects used in this study, which can be seen in the product table. A posttest was conducted to measure mathematical literacy through multiple choice questions.

Table 2. Summary of the Data Collection Techniques, Instruments and Subjects

Number	Aspect	Data Collection Technique	Instrument	Subject
1	Needs Analysis	Interviews and Observations	Interviews and observations guide	Teacher and Student
2	Validity	Questionnaires	Material, language, and design expert validation sheet	Lecture and Teacher
3	Practicality	Questionnaires	Practicality test sheet	Teacher and Student
4	Effectiveness	Test	Multiple choice question	Student

The data analysis technique used is descriptive data analysis to calculate the percentage value of the validation questionnaire and practicality and attractiveness tests and inferential analysis to measure the effectiveness of the implementation of teaching modules through posttest mathematical literacy test results data. The analysis of the validity of the material, media and language experts was carried out by calculating the number of answer scores obtained from the questionnaire, calculating the percentage value with the following formula.

$$\text{Level of Validity} = \frac{\sum \text{all of questionnaire answer}}{\sum \text{all of questionnaire}} \times 100 \quad (1)$$

Furthermore, the interpretation of the value is carried out using the following criteria

81%- 100%	: Very valid
61% - 80%	: Valid
41% - 60%	: Quite valid
21% - 40%	: Not valid
0 - 20%	: In valid

The analysis of practicality and attractiveness tests also goes through the stages of calculating the number of answer scores obtained from the questionnaire, calculating the percentage value with the formula 2. The results of this analysis are the percentage of the overall response of each student related to the treatment of the independent variables. From this percentage, the level of practicalness can then be categorized based on its level. The criteria for the level of practicality can be seen in table 3.

$$P = \frac{\sum \text{all of questionnaire answer}}{(\text{number of questionnaire items} \times \text{highest score} \times \text{number of respondents})} \quad (2)$$

Table 3. Criteria Practicality for of Student Responses

Score (%)	Practicality
0-20	Very Inpractical
21-40	Inpractical
41-60	Less Practical
61-80	Practical
81-100	Very Practical

Inferential data analysis to test the effectiveness of teaching modules. The inferential test used is the t-test using SPSS-23 software. The results of the effectiveness test aim to determine whether the nomathematics-based teaching module is effective for improving mathematical literacy or not, with a significance level of 0.05.

3. FINDINGS AND DISCUSSION

Findings

The research was conducted in a public elementary school in the Petanahan sub-district. The research was conducted in 4 stages, namely define, design, develop, and decimate. This phase includes a needs analysis consisting of the initial analysis, student analysis, task analysis, concept analysis, and setting learning objectives using an ethnomathematical-based teaching module with an RME approach. The data in the following activities were obtained by observation, interviews, and document analysis. The results showed that when learning mathematics, namely (1) students tend to be passive in learning mathematics; (2) LKS learning resources and BSE teaching materials; (3) learning resources used during mathematics learning according to students have not been linked to the activities of the surrounding community or objects around them; (4) students learn by receiving teacher explanations and practice questions.

For this reason, it is necessary to develop an ethnomathematics-based teaching module to improve the fifthgrade mathematics literacy of students. The design stage is carried out by designing and making teaching modules and instruments related to teaching modules. The topic chosen is the material for building cubes and blocks. The teaching module consists of a cover, identity sheet, preface, table of contents, instructions for use, learning objectives, material, summary, practice questions, competency test, glossary, answer key, bibliography and author biodata.

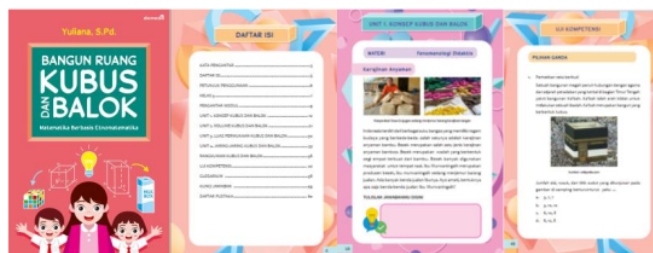


Figure 1. Ethnomathematics-based Teaching Module Display

After doing the next design stage, namely development, namely validation by experts. Experts are lecturers and teachers in elementary schools. The results of expert validation are in table 5

Table 4. Linguistics, Material and Design Expert Validation Results

Validator	Precentage	Category	Description
Linguistics	93.8%	Very good	Dapat diimpelemtasikan
Material	94%	Very good	Dapat diimpelemtasikan
Design	92%	Very good	Dapat diimpelemtasikan

After validation, the practicality test was carried out by applying it to a limited group. The average questionnaire score of 22 respondents was 3.506. If it is percentage using formula 1, then it produces a value of 87.65%. Based on table 3, the average percentage value of the questionnaire response scores of all students entered the very practical criteria.

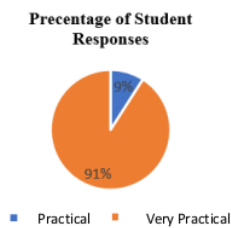


Figure 2. *Percentage of student responses*

The majority response, namely 91% of students, to the application of ethnomathematics-based teaching modules is very practical. This shows that the teaching module has been implemented properly according to the stages. The learning module is considered to have excellent practicality by students.

The Disseminate stage consists of three stages, namely validation testing, packaging, and diffusion and adoption. Validation testing is done by implementing an ethnomathematics-based teaching module with an RME approach to the real target. The target is the fifth-grade elementary school students in Petanahan District. Validation testing is used to test the effectiveness of the teaching module on the real population. The effectiveness test was conducted at the Petanahan sub-district elementary school. The research sample was 17 students at SDN Tanjungsari as the control class and 26 students at SDN Jogomertan 1 as the experimental class. The research sample was selected by random sampling.

Data processing is done by using SPSS-23 software. The results of the effectiveness test with a significance level of 0.05 are in the table 6.

Table 5. Summary of Effectiveness Test Results

Test	Class	Average	Type of test	Result	Decision	Conclusion
Normality	Experiment	65.5385	Kolmogorov-smirnov	0.02	H_0 accepted	Normally distributed
	Control	50.5882		0.02	H_0 accepted	Normally distributed
Homogeneity			Levene	0,620	H_0 accepted	Homogenous
Hypothesis			T-test	0.000	H_0 rejected	Any differences

Hypothesis testing between the experimental and control classes with the assumption of homogeneous data has a significance level of 0.000. The significance level of the t-test is $0.000 < 0.05$, so H_0 rejected, which means that the experimental and control class data have differences in the value of mathematical literacy. This means that the experimental and control classes have different literacy abilities. Judging from the average of the experimental class has an average of 65.5385 > 50.5882 the average of the experimental class. So it can be concluded that the ethnomathematics-based teaching module is effectively used to improve the mathematical literacy skills of fifth-grade students in elementary schools.

Discussion

This research produces an ethnomathematics-based teaching module with a realistic mathematics education approach to improve students' mathematical literacy. The development aims to develop students' mathematical literacy. The development of teaching modules is based on the findings of the needs analysis, namely the characteristics of elementary school-age students at the concrete operational stage (Saleh et al., 2018). Students show that students interest in learning

mathematics is also lacking (Fauzi & Arisetyawan, 2020). Moreover, 21st-century learning must be student-centered (Keiler, 2018) this requires students to learn independently.

The prototype of teaching modules assessed by experts shows that the development of ethnomathematics-based teaching modules with the RME approach to improving mathematical literacy is declared valid and feasible to use. This can be seen from the assessment of several aspects in terms of language, material, and design (Dasaprawira, Zulkardi, & Susanti, 2019; Feriyanto & Putri, 2020). Aspects assessed in language validation by the validator are sentence clarity, communicative, dialogical and interactive, conformity with the development of students, conformity with language rules, and suitability of using icons, symbols, and terms (Hadiyanti et al., 2021; Priyonggo, Wardono, & Asih, 2021). Aspects assessed in material validation by validators are KD suitability, material accuracy, material up-to-date, encouraging curiosity, and RME principles (Ulandari, Amry, & Saragih, 2019). Design validation is assessed from aspects of module size, cover design, content design, presentation support, learning presentation, and coherence and sequence of thought patterns that are adjusted to the development of students (T. N. Utami, Jatmiko, & Suherman, 2018).

The results of product trials to measure the practicality of their teaching modules convey that teaching modules can be used easily, are easy to understand, and have interesting pictures according to their characteristics (Schoevers, Leseman, & Kroesbergen, 2020). The positive response to the teaching module is also because there is a cultural touch (ethnomathematics) in material that is easy to find in everyday life (Aikenhead, 2017; Fachrur et al., 2021; Wulandari, Darma, & Susiaty, 2019). Moreover, students have new learning resources that attract students to learn (Kurniasari, Rakhmawati, & Fakhri, 2018) teaching modules can also be used independently by students (Feriyanto & Putri, 2020). The results of the practicality test showed very good results.

The results of the effectiveness test were carried out by experimenting with students. The effectiveness test was carried out after the validity test and practicality test so that the ethnomathematics-based teaching module was suitable for use in learning. The results of the effectiveness test show that the ethnomathematics-based teaching module with a realistic mathematics education approach has a positive effect on students' mathematical literacy (Agusdianita & Karjiyati, 2021; Handun et al., 2020; Johnson & Corey, 2020; Kurniasari et al., 2018; Laurens, 2016; Sumiyati, Netriwati, & Rakhmawati, 2018). Recommendations that can be considered are the benefits obtained from ethnomathematics-based teaching modules that can be made independently because the culture around us can be used as material for meaningful learning (Nuh & Dardiri, 2016; Sumirattana et al., 2017; Syahril et al., 2019). Flexibility in teaching modules so that teaching modules can be used at home or school.

4. CONCLUSION

Based on the research and development results, it can be concluded that the ethnomathematics-based teaching module with a realistic mathematics education approach to improve mathematical literacy is valid, practical, and effective. With a validation percentage in the very good category, namely linguistic experts at 93.8%, material experts at 94%, and design experts at 92%. The level of practicality according to student responses is 87.65% very good category. The effect of the teaching module on mathematical literacy can be seen from the significance level of $0.000 < 0.05$ which means it has an effect by paying attention to the average literacy score of the experimental class $65.585 > 50.5882$, the teaching module has a positive effect on improving the mathematical literacy of students in elementary schools.

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