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Development of Mathematical Literacy Problems Using Bengkulu Context

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ABSTRACT
The implementation of the Minimum Competency Assessment (AKM) in 2021 created confusion among students and teachers, especially in secondary schools in Bengkulu City due to the limited number of problems that refer to the AKM. The purpose of this study was to generate mathematical literacy problems using the Bengkulu context validly and practically and determine student responses in solving problems. This study involved 26 students from two junior high schools in Bengkulu City. The research design was used in development research. Data were analyzed descriptively through tests, interviews, and documentation. The research resulted in mathematical literacy problems using the Bengkulu context that were valid and practical in improving students' mathematical literacy skills.

Keywords: *Bengkulu context, Development, Mathematical literacy.*

1. INTRODUCTION

The demand for learning in the 21st Century according to [1] is learning that integrates literacy skills, knowledge skills, skills and attitudes, and mastery of technology. Literacy ability is one of the demands of learning outcomes, one of which is in secondary schools. This is indicated by the application of the Minimum Completeness Assessment (AKM) which is applied in Indonesia as a benchmark for high school graduates. Literacy is the ability to read and write [2, 3, 4]. Furthermore, according to [5] literacy is an individual's capacity to identify and understand the role of mathematics in the real world. By this, [6] suggests that the concept of mathematical literacy is closely related to other concepts.

Regarding the mastery of student literacy in Indonesia, it still needs to be attended to. One of them is the results of the student literacy ability survey conducted by PISA in 2018 showing the average score in the mathematics of Indonesian students only reached a score of 379 out of 600 with a maximum score of 72 out of 78 participating countries [7]. Examines the literacy level achieved by Indonesian students from 2000 to 2009 the level of literacy achievement of Indonesian students when viewed from the scores achieved only reached a value below 400 with the highest cognitive abilities on average only reaching levels 3 and 4 [8].

Several factors are causing the low scientific literacy skills of Indonesian students that were put forward by researchers related to the results of the Indonesian PISA. Among them: (a). Selection of textbooks, (b). Misconceptions, (c). Learning is not contextual, (d). Low reading ability, and (e). The learning environment and climate are not conducive [9]. Furthermore, [10] states that the instrument in measuring literacy is also a problem in itself. The use of mathematical modeling (contextual problem-taking) with terms that are not familiar in Indonesia, becomes a problem. The process of associating with mathematical concepts is hampered.

Based on these problems, teachers need to facilitate students in improving literacy skills. In this case, the teacher can develop mathematical literacy problems for students through contextual problems such as the cultural environment, history, or problems related to the student environment. [11] mention that problems related to culture inevitably surround the learning process of mathematics, even all forms of mathematics. Following this, the role of ethnomathematics also supports mathematical

literacy by facilitating students to be able to construct mathematical concepts as part of mathematical literacy based on students' knowledge of their socio-cultural environment [12]. Based on these problems, in developing mathematical literacy problems, it is important to use the cultural context in the problem, or the social environment that surrounds students. In this study, mathematical literacy problems were developed using the Bengkulu context. The context chosen is the culture of the Bengkulu people (Tabot), history in Bengkulu (BungKarno's house), and Bengkulu's special food, namely (Kue Tat). Through contextual problems that are close to students, it is hoped that students can make it easier to mathematize the problems given.

2. METHODS

The type of research conducted is development research. The focus of the product developed is the mathematical literacy problem using the Bengkulu context. In the problem development stage, two main stages can be carried out, namely the preliminary stage and the formative evaluation stage [13]. The problem development stage is focused on the formative evaluation stage [14] with three stages, namely: (1) self-evaluation, (2) prototyping consisting of expert review, one-to-one, and small group, and (3) field test. In this study, the stages in the prototyping stage are limited to expert reviews and small groups. at the self-evaluation stage, the researcher assessed the suitability of the grid and basic competencies with the Bengkulu context. Next, an expert review was carried out by 2 experts to validate the problems based on the content, construct, and language. The results of the validity are used as a reference for revision and then the small group stage is carried out. At this stage, a trial was conducted on six eighth-grade students of SMP N 6 Bengkulu City. The test results at the small group stage describe the practicality of the problems in terms of readability according to students. The prototype was revised and then continued with the field test stage. The results of this stage are used as a reference in describing students' literacy skills. The test was carried out in the eighth grade of SMP N 11 Bengkulu City with a total of 26 students.

The data collection instruments in this study consisted of (1) validity sheets, (2) practicality sheets, and (3) mathematical literacy test problems using the Bengkulu context. The data analysis technique was carried out to analyze the validity aspects of the problems using the Aiken validity index with the problem criteria being said to be valid if the Aiken index was more than 0.5. The formula for calculating validity based on the [15] formula is as follows.

$$V = \frac{\sum s}{n(c-1)} \quad (1)$$

s = r – lo
r = the number given by the rater
lo = lowest validity score
n = number of raters
c = highest validity rating score

Table 1. Practical criteria

Interval	Criteria
1.00-1.80	very less
1.81-2.60	less
2.61-3.40	moderate
3.41-4.20	good

Practical analysis based on small group trials was analyzed descriptively where the items were said to be practical if the average student score was at least good criteria. The following are the practicality test criteria based on the student's readability test.

3. RESULTS

3.1 Product description

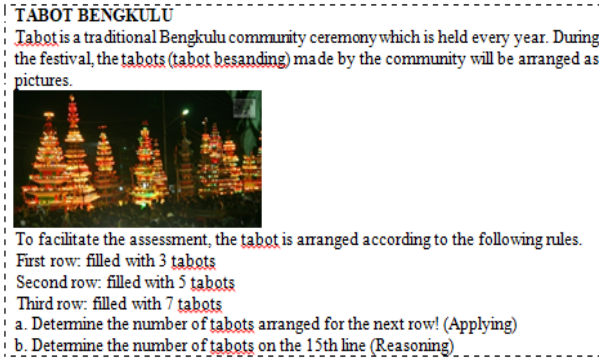
The results of the study obtained three mathematical literacy problems using the Bengkulu context in the form of essay problems. The items problems developed to refer to three levels of thinking, namely knowing, applying, and reasoning. The items problems developed refer to three problems based on the Bengkulu context, namely: (1) Bengkulu custom (Tabot Bengkulu), (2) Bengkulu history (Rumah Bungkarno), and (3) Bengkulu special food tat cake (Kue Tat). The three contexts are contexts that students can generalize because they occur in everyday life. This is following [16] which defines mathematical literacy as the ability to identify and understand the role of mathematics in life. Literacy is also the ability to make decisions and engage in mathematics with the interests of the individual's life as a constructive, caring, and reflective citizen.

3.2 The formative evaluation stage

In this study, the results at the formative evaluation stage were described based on the stages (1) self-evaluation, (2) expert review, (3) small group, and (3) field test. The results of the study are described as follows.

Self-evaluation

Before developing the item's problems, the researcher first analyzed the content to be developed and analyzed with the Bengkulu context that was relevant to the content. This is done so that the problems of the items developed are more contextual for students. The literacy problems developed also refer to the level of thinking, namely knowing, applying, and reasoning. Figure 1 is an example of the results of early product development.


TABOT BENGKULU

Tabot is a traditional Bengkulu community ceremony which is held every year. During the festival, the tabots (tabot besanding) made by the community will be arranged as pictures.

To facilitate the assessment, the tabot is arranged according to the following rules.
First row: filled with 3 tabots
Second row: filled with 5 tabots
Third row: filled with 7 tabots
a. Determine the number of tabots arranged for the next row! (Applying)
b. Determine the number of tabots on the 15th line (Reasoning)

Figure 1 One of the initial product problems before being revised.

Tabot is a Bengkulu custom that is held every year so that students are familiar with the problem of tabot. Mathematizing the tabot problem will be easier for students, for example, students visualize the tabot arrangement in explaining the concept of number patterns. Based on the researcher's assessment, the problem of tabot arrangement in Figure 1 gives more contextual problems to students.

Expert reviews

The results of the development of the early-stage problems were then assessed by two experts, namely lecturers of the postgraduate program for mathematics education, FKIP UNIB. The assessment was conducted to measure the validity of the content consisting of aspects: material, construct, and language. The validity instrument consists of 9 statement items with a score range of 1-5. The results of the validity analysis based on the Aiken equation are as follows.

Table 2. The results of the content validity of the development product

Problem	Content	Construct	Language	Criteria
Problem 1	0.86	0.72	0.75	Valid
Problem 2	0.74	0.68	0.60	Valid
Problem 3	0.72	0.70	0.68	Valid

Problem on the product before and after validation and revised based on the validator's suggestions as shown in Figure 2 and Figure 3.

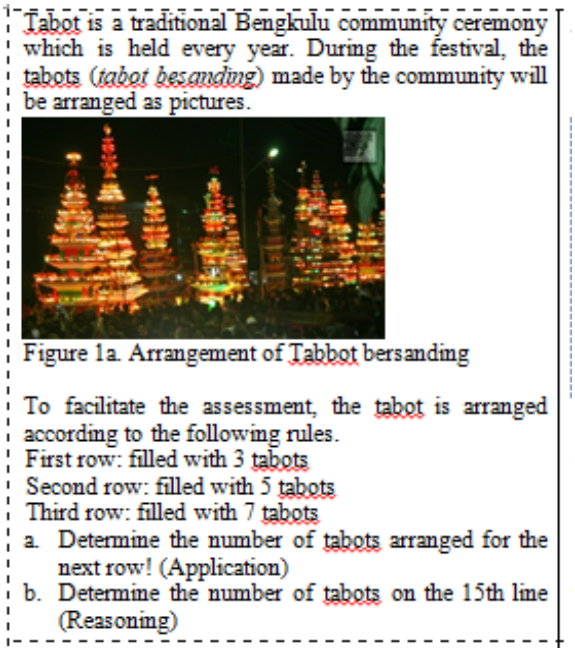

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Figure 1a. Arrangement of Tabbot bersanding

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Figure 2 Problem 1 before revision.

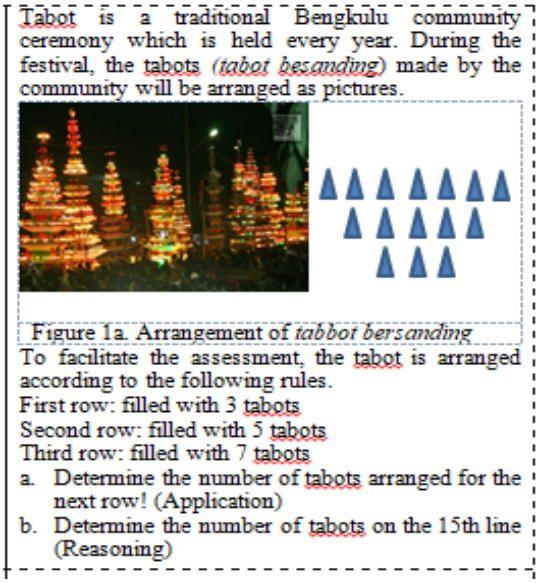
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Figure 3 Problem 1 after revision.

The results of the validity show that there is a change in the image of the tabot. Before being revised the tabot arrangement was not following the pattern in the problem, so a revision was made to describe the number of tabots in each row according to the problem. This is done so that it is easier for students to visualize the problem in mathematical form. In problem number 1 about tabot, the material

that is the focus of the problem is number patterns, namely odd number patterns. After revisions are made based on suggestions from the validator.

Problem number 2 uses the Bengkulu context related to history. The results of the revision are based on expert judgment as shown in Figure 4 and Figure 5.

In Bung Karno's yard, a boundary designed which is arranged sequentially using paving blocks with a surface in the form of a regular pentagon with a side of 10 cm as shown below.

Figure 1 Figure 2 Figure 3

Figure 2a. Bung Karno's house

a. Copy and complete the table for the five pictures! (knowing)
b. What is the perimeter of the boundaries in Figure 1, Figure 2, and Figure 3? (applying)
c. Determine the perimeter of the boundary in the 10th picture! (reasoning)
d. If the perimeter of the perimeter is 470 cm, how many paving blocks are needed? (reasoning)

Figure 4 Problem 2 before revision.

In Bung Karno's yard, a fence (garden fence) will be designed sequentially using paving blocks with a surface in the form of a regular pentagon with a side of 10 cm as shown below.

Figure 2a. Bung Karno's house

a. Copy and complete the table for the five pictures! (knowing)
b. What is the perimeter of the boundaries in Figure 1, Figure 2, and Figure 3? (applying)
c. Determine the perimeter of the boundary in the 10th picture! (reasoning)
d. If the perimeter of the perimeter is 470 cm, how many paving blocks are needed? (reasoning)

Figure 5 Problem 2 after revision.

The focus of improvement on the editorial problems in the previous problem stated that the design of the boundary was improved by explaining that it would be designed and providing a description of "the boundary (fence)". This is to make it easier for students to visualize and avoid confusion about the meaning of the problems. The results of the validator's assessment also revise the boundary image by changing the same color which aims to make students understand that the 1st, 2nd, and third images in the problem are the arrangement of the barrier (garden fence). Furthermore, the comparison of the questions before and after the revision on the third question is as shown in Figure 6 and Figure 7.

A mother buys Tat cake at a Bengkulu specialty food center which will be distributed to her children as illustrated in the picture. The cake is divided according to the age of the child with the distribution rules: 1/2 part for the first child, 2/3 part for the second child, 3/4 part for the third child, 4/5 part for the third child and so on.

Figure 3. Illustration of cutting tat cake

a. How much for the 5th child? (applying)
b. the number of children is written in n, then the rules for writing the distribution of tat cakes in n are ... (Reasoning)

Figure 6 Problem 3 before revision.

A mother buys some Tat cakes at a Bengkulu specialty food center which will be distributed to her children as illustrated in the picture. The cake is divided according to the age of the child with the distribution rules: 1/2 part for the first child from the first cake, 2/3 part for the second child from the second cake, 3/4 part for the third child from the third cake, 4/5 part for the third child from the cake. third cake and so on.

Figure 3. Illustration of cutting tat cake

a. How much for the 5th child? (applying)
b. the number of children is written in n, then the rules for writing the distribution of tat cakes in n are ... (Reasoning)

Figure 7 Problem 3 after revision.

The result of the revision in problem number 3 is a problem about Bengkulu's special food, namely Tat cake. In this problem the mathematical concept applied is about the sequence or pattern of fractions. Some of the revisions were made to the reading of the problems compiled, one of which was in the sentence

reading. The problems are arranged before being revised using a cake so that there will be confusion in interpreting the problems. The problem was revised into several cakes and each part of the cake in the child was corrected based on each cake.

Small group

The problem that is the result of revision based on the validator's suggestions is then carried out in small-scale trials. The trial was carried out in the eighth grade of SMP N 6 Bengkulu City with a total of 6 students. The results of small-scale trials were carried out to assess the practicality of the problems developed through the readability test. The test results are statistically described in Table 3.

Table 3. The results of the assessment sheet based on the small group test

Statement	Score	Criteria
The type of writing and the size of the letters in the problems are easy for me to read	3.60	Good
The pictures used in the problem make it easier for me to understand the problem	3.70	Good
Problems using interesting pictures and illustrations	3.55	Good
Illustrations and problems in the questions I often find or hear in my environment	3.70	Good
The language in the problem is easy for me to understand	3.20	Moderate
The problems are following the material that has been studied	3,30	Moderate
Solving the problem requires the understanding concept	3.40	Moderate
The problems presented are rarely found in problem exercises	3.50	good
Average	3.52	Good

The results of the readability assessment by students in table 3 show that the problems developed are in a good category. In terms of legibility, the developed problems have met the good criteria so that they are practical problems. Based on student assessments in small group trials, it shows that there are three aspects in the moderate category which are generally related to the language of the problems that are still difficult for students to understand. This is because students are not used to solving literacy problems and so far only solve routine problems.

Problems that have been designed and tested by experts and small groups are continued by testing in large groups. The test was carried out in the eighth grade of SMP N 11 Bengkulu City, with a total of 26 students. The test was conducted in two classes and was conducted offline. The description of the results of students' literacy abilities is as follows:

Table 4. Description of students' literacy skills

Statistic	score
mean	37.54
minimum	21.34
maximum	61.25

The test results in Table 4 show that the average literacy ability of students is still low. The average student mastery has not reached 50% where the average score is only 37.54.

4. DISCUSSION

The test results on students show that there are various ways students can solve problems. Several studies related to student responses in solving problems. Figure 8 is an example of a student's answer to problem number 1.

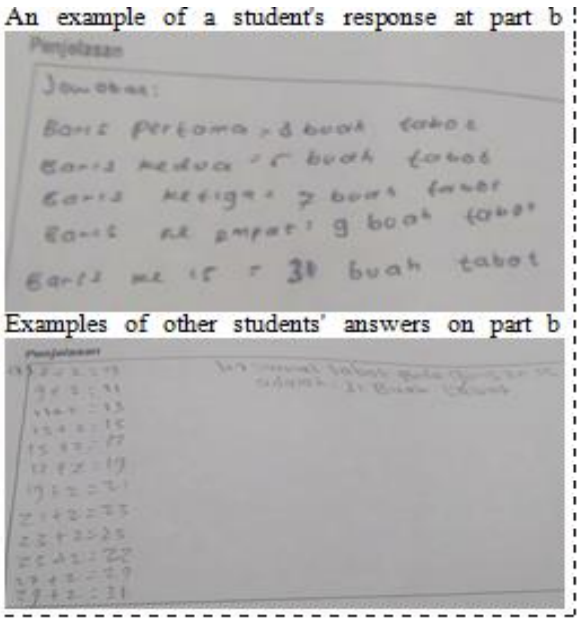

Figure 8 Student's response.

Based on the results of the student's answers, it is known that students solve problems by adding differences in each row. Students know that the difference in the number of tabots in each row is 2 so students continue the fourth row by adding two tabots from the third row, and the next row until the 15th row. Expectations from problem number 1 part b students can answer at the reasoning level where students find the general equation of the tabot pattern. Students have not been able to make a problem

sequence in the form of n so that in the nth row students can determine the number of tabots. The results of the analysis also show that there are no students who have solved the equation or arithmetics sequence where can be calculated using the equation $u_n = a + (n-1)b$.

Furthermore, the results of the analysis of students' answers to problem number two are in Figure 9.

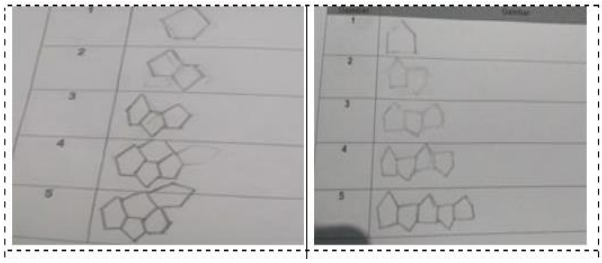

Figure 9 Example of student's response number 2 part a.

Figure 9 shows that students have a wrong response in translating the problems. The student adds on the wrong side so that based on the pattern it does not form a boundary (fence) from the garden. Meanwhile, the example of the matching answer in Figure 5b is correct where students add the sides of the corresponding boundary so that it will form a boundary. Students have correctly added one paving block on each row. Furthermore, in problem number three, some students did not answer the problems and some only wrote what they knew. This is because problem number 3 measures reasoning ability and students have difficulty in understanding the problem.

5. CONCLUSIONS

Based on the results of the study, can be concluded, namely: (1) the mathematical literacy problems using with Bengkulu context that were developed meet the valid and practical criteria. (2) the developed mathematical literacy problems meet the practical criteria based on the students' readability test. (3) In developing literacy problems with regional or cultural contexts, attention should be paid to contextual and relevant issues with the content. The emphasis of the problem or the local context can be clarified by using the relevant image emphasis.

AUTHORS' CONTRIBUTIONS

All authors conceived and designed this study. All authors contributed to the process of revising the manuscript, and in the end, all authors have approved the final version of this manuscript.

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