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The Development of Mathematical Problems in the Context of the Bangka Belitung Traditional House to Train Students' Mathematical Communication Skills

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Abstract- The problem that is currently happening is that students' mathematical communication skills are still low. Based on the review where students were given questions, students were not able to make a mathematical model as a solution to solve the problem. So, this research was conducted to determine the characteristics of valid and practical mathematical questions using the context of the Bangka Belitung traditional house. The research and development model used in this study is the Borg and Gall development model. The subjects in this study were students of class VII at one of the Pangkalpinang Junior High School, with 40 students, consisting of 9 students in class VII B and 31 students in class VII C. Data collection techniques were conducted by interviews and questionnaires. The data analysis techniques used are descriptive quantitative and descriptive qualitative. The questions developed in this study were based on mathematical communication indicators, using the context of the Bangka Belitung traditional house; and planes.

1. Introduction

Students are required to master some mathematical abilities; including mathematical communication skills (Hendriana & Kadarisma, 2019). Mathematics is not only a problem-solving or thinking tool that helps students develop patterns and draw conclusions but also a tool to briefly communicate ideas, thoughts, and concepts clearly, and precisely (Yuniarti, 2014). Students' mathematical communication skills are still low, they cannot write mathematical models to solve problems and communicate their mathematical ideas (Ariawan & Nufus, 2017).

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Mathematical communication skills can be trained by solving problems (Vebrian et al., 2016). Mathematical communication can be trained using context because it can bring up situations that have been felt in real terms. Contextual questions can provide convenience to students in placing mathematics into a context, encourage students to think critically, and attract interest and motivate students (Sharmila et al., 2016). So it helps students use mathematical communication skills when solving problems (Putra & Vebrian, 2019). The context used in learning mathematics can be understood by thinking according to actual situations familiar to students (Susanti, 2016). Therefore, teachers must be able to provide and often give questions to students to attract students' interest and train students' mathematical communication skills (Mardhiyanti et al., 2011).

Etymologically, communication comes from the Latin word '*communications*', which comes from the word *communis* which means "to share" or "to belong together". Mathematical communication ability is a student's ability to convey mathematical ideas both verbally and in writing (Hodiyanto, 2017). The definition of mathematical communication skills is the ability to receive by understanding mathematical ideas or concepts from other people by analyzing, evaluating, and critically looking at them to sharpen their understanding and convey mathematical ideas or concepts verbally or in writing (Ariani, 2017). Thus the indicators of mathematical communication skills used in this study are as follows: (a) reading with an understanding of a written mathematical representation; (b) expressing everyday events in mathematical language or symbols; (c) creating situations or problems using verbally, written, concrete, graphic or algebraic methods; (d) making conjectures (allegations), constructing arguments or making generalizations.

The development of mathematical problems is a process, method, deed of developing and validating questions relating to numbers, and operational procedures used in solving problems regarding numbers (Anisah et al., 2011). Bangka Belitung traditional houses consist of three types: Rumah Panggung, Rumah Limas, and Rumah Rakit (Komandoko, 2010). A plane is part of a flat shape that is bounded by lines or curves and is two-dimensional. At the junior high school level, planes that are studied consist of rectangles and triangles. One of the learning activities in the planes topic is solving problems related to the types, properties, perimeter, and area of quadrilaterals by understanding the properties of quadrilaterals and using the application and solving problems of planes.

Several previous studies have used contexts of the Bangka Belitung traditional houses. Produce TIMSS-type math problems using the context of the Sriwijaya Kingdom with integer and fraction material on mathematical reasoning abilities from research (Vebrian et al., 2016). Produce mathematical problems using the PISA model in the context of the Cual Cloth of Bangka Belitung with flat shape materials on mathematical literacy abilities from research (Putra & Vebrian, 2019). Produce TIMSS-type math questions using the context of the traditional houses of Kalimantan, South Sumatra, and West Sumatra with material numbers, algebra, geometry, and measurements of mathematical reasoning abilities from research (Susanti, 2016). Based on the problems presented previously and the solutions offered. Thus, a study entitled "The Development of Mathematical Problems in the Context of the Bangka Belitung Traditional House to Train Students' Mathematical Communication Skills" was conducted. This research differs from previous research because it uses the context of the Bangka Belitung traditional house with planes to train mathematical communication skills. This study aims to develop mathematical problems that have their charm by using traditional houses' context, to utilize local cultural wisdom presented in mathematical problems. Due to the limitations of articles that discuss the development of mathematical problems to train mathematical communication skills, this article discusses the development of mathematical problems in the context of the Bangka Belitung traditional house to train mathematical communication skills. The formulation of the problem in this study is how the characteristics of math questions using the context of the Bangka Belitung traditional house are valid and practical.

2. Methods

This study uses the Borg and Gall development model. According to Sugiyono, there are ten stages in the Borg and Gall development model, namely: (i) Problem Identification, (ii) Information Collecting, (iii) Product Design, (iv) Design Validation, (v) Design Improvement, (vi) Product Testing, (vii) Product Revisions, (viii) Usage Trials, (ix) Final Stage Product Revisions, and (x) Mass Production (Emzir, 2015). The subjects in this study were students from class VII at one of the Pangkalpinang Junior High Schools in the second semester of the 2022/2023 Academic Year. The design of this product is in the form of

mathematical questions using the context of the Bangka Belitung traditional house which includes: questions, question cards, question grids, instructions for scoring questions, and answer sheets that are used as booklets. Data collection techniques and instruments used are interviews and questionnaires. The data analysis techniques used in this study are descriptive quantitative and qualitative.
The questionnaires used the Likert scale, which is reviewed based on these practical criteria, namely:

Table 1. Product Practicality Criteria

Score in Percent (%)	Criteria	Information
85.01% - 100%	Very Practical	It can be used without revision
70.01% - 85.00%	Practical	Usable but needs minor revision
50.01% - 70.00%	Less Practical	It is recommended not to be used and needs major revision
01.00% - 50.00%	Impractical	It cannot be used

Source: (Aini & Sulistyani, 2020)

The result percentage formula used in this study is as follows:

$$\text{Result: } \frac{total\ score\ obtained}{maximum\ score} \text{ x } 100\%$$

Source: (Ernawati & Sukardiyono, 2017)

As a provision in declaring a decision on the results of the calculation, it is reviewed based on these validity criteria, namely:

Table 2. Product Validity Criteria

Score in Percent (%)	Criteria	Information
85.01% - 100%	Very Valid	It can be used without revision
70.01% - 85.00%	Valid	Usable but needs minor revision
50.01% - 70.00%	Less Valid	It is recommended not to be used and needs major revision
01.00% - 50.00%	Invalid	It cannot be used

Source: (Aini & Sulistyani, 2020)

The result percentage formula used in this study is as follows:

$$\text{Result: } \frac{total\ score\ obtained}{maximum\ score} \text{ x } 100\%$$

Source: (Ernawati & Sukardiyono, 2017)

3. Results and Discussion

(a) Development Phase

The results of each stage of the Borg and Gall development research consists of stages: (i) Problem Identification, (ii) Information Collecting, (iii) Product Design, (iv) Design Validation, (v) Design Improvement, (vi) Product Testing, (vii) Product Revision, (viii) Usage Trials, (ix) Final Stage Product Revision, and (x) Mass Production are described as follows.

(i) Problem Identification

The problem identification stage is the first step in this research because research can depart from the existence of problems. The problems were the lack of creative and interactive activities between students and mathematics in analyzing various strategies that collaborate with mathematical problems in everyday life. Based on the interviews with a mathematics teacher in class VII at one of the Pangkalpinang Junior High Schools, it was concluded that the learning process using mathematical problems in the context of the Bangka Belitung traditional house had never been used. Students tended to get bored and even sleepy during the learning process. This problem is due to the lack of innovation in learning mathematics.

(ii) Information Collecting

Based on the observations and the interviews with the teachers, it is known that students of class VII in one of the Pangkalpinang Junior High Schools can be given questions related to everyday life because students can imagine mathematics that they often encounter in everyday life. It will be easier for students to understand the contents and master mathematical communication skills. This study analyzed the need for mathematical problems by analyzing the 2013 curriculum implemented by one of the Pangkalpinang Junior High Schools. This curriculum uses a student-oriented approach where students must be active during the learning process in the classroom. The mathematics syllabus can adjust the Basic Competencies (KD) and Core Competencies (KI) to be achieved.

(iii) Product Design

The initial questions design has five pages of 15 questions, quadrilateral and triangular contents, and three pictures of Bangka Belitung traditional houses (Rumah Panggung, Rumah Limas, and Rumah Rakit). Furthermore, the product's initial design is submitted to the supervisor by guiding the developed mathematical problems. Revisions were made according to the advice of the validator. Including adding information related to questions, replacing it with the latest images, and fixing the questions according to the traditional houses.

(iv) Development Phase

Validation was carried out to determine the developed questions' validity level. The results of the validation are in the form of suggestions that are used as a basis to improve the questions developed. By the content experts as lecturers in mathematics education at the Muhammadiyah University of Bangka Belitung; the construct expert as a teacher who teaches at SMA Negeri 2 Pangkalpinang; and the linguists as lecturers who teach at the STIE PERTIBA.

Table 3. Percentage of Expert Assessment Results

Expert	Percentage of Assessment Results
Content Expert	90.00%
Construct Expert	79.00%
Linguists	80.56%

(v) Design Improvement

The design improvement stage is a product revision based on experts' suggestions; it is done until the questions developed are declared valid. The revisions made were correcting errors in the wording, adjusting scoring points, and changing punctuation marks according to the use of sentences in the questions.

(vi) Product Testing

At the product testing stage for small-scale subjects, students were given a product in mathematical questions using the context of the Bangka Belitung traditional house to train students' mathematical communication skills. After that, students filled out the given response questionnaire. The following data is the percentage of students' response questionnaire assessment results and the practicality criteria obtained after the calculations.

Table 4. Percentage of Small-Scale Subject Response Questionnaire Results

Student's initials	Score (%)	Criteria
AM	92.86	Very Practical

Student's initials	Score (%)	Criteria
Rh	75.00	Practical
ARV	83.93	Practical
IKL	89.29	Very Practical
FA	83.93	Practical
DM	80.36	Practical
SS	80.36	Practical
Rg	87.50	Very Practical
AS	71.43	Practical
Average Percentage	**82.74**	**Practical**

From the result, it was obtained that 82.74% as the average percentage of the results of the subjects' response questionnaire assessment is practical. Then, interviews were conducted with students to confirm further response questionnaire comments. The results of questionnaires, comments, and interviews with the small-scale subjects recommend making improvements to the colour of the question images, changing the punctuation according to the use of sentences, and adding pictures to the questions so they will be clearer.

(vii) Product Revision

Revisions were made following comments from several small-scale subjects; they are adding pictures to clarify the questions, fixed the colour of the questions, and changed the punctuation which was considered a little difficult to understand.

(viii) Usage Trials

At the trial stage of using this large-scale subject, students were given mathematical questions using the context of the Bangka Belitung traditional house in training students' mathematical communication skills. Subsequently, students filled out the given response questionnaire. The following is the percentage of the large-scale subjects' response questionnaire assessment results and the practicality criteria obtained after the calculations.

Table 5. Percentage of Large-Scale Subject Response Questionnaire Results

Student's initials	Score (%)	Criteria
CRO	87.50	Very Practical
PYE	85.71	Very Practical
INR	87.50	Very Practical
MQA	91.07	Very Practical
HHK	87.50	Very Practical
VR	83.93	Practical
Fj	89.29	Very Practical
Sp	87.50	Very Practical
SN	82.14	Practical
DPR	83.93	Practical
SM	89.29	Very Practical
RP	82.14	Practical
KHA	89.29	Very Practical
ZMP	87.50	Very Practical
CA	87.50	Very Practical
LB	75.00	Practical
Tg	85.71	Very Practical
KJ	71.43	Practical
AH	78.58	Practical
DH	80.36	Practical
EZ	85.71	Very Practical
GJA	85.71	Very Practical
FbA	91.07	Very Practical

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Student's initials	Score (%)	Criteria
DCP	71.43	Practical
SK	89.29	Very Practical
Tb	78.57	Practical
Al	82.14	Practical
CK	82.14	Practical
ZL	92.86	Very Practical
AY	75.00	Practical
Ad	76.79	Practical
Average Percentage	**83.98**	**Practical**

No more problems and comments were found in the small-scale subject trial, based on the results of the analysis of comments in the large-scale subject trial. Furthermore, interviews were conducted with 9 students, including 3 students with high, medium, and low abilities. Interviews with these students were conducted to further confirm the results of the students' response questionnaire. The result shows that 83.98% of the average percentage of students' response questionnaire on a large-scale subject is practical. The result is that the questions are easy to understand, and the difficulty level of the questions depends on students' ability.

(ix) Final Product Revision

Based on the results of the analysis of comments on the large-scale subject trial, no more problems and comments were found in the small-scale subject trial.

(x) Mass Production

The mass production stage is the final stage of this research and is an option that has implications for broader utilization. In this case, it was done in a thesis trial and published in scientific journals, as a mandatory outcome of the thesis. After that, the results will be reported in scientific forums through seminars.

(b) Characteristics of Mathematical Problems in the Context of the Bangka Belitung Traditional House

Based on the results that have been discussed, the development of mathematical problems using the Bangka Belitung traditional house context to train middle high school students' mathematical communication skills has been categorized as valid and practical. Validity can be seen in the results of the validator's assessment; they are the content aspect which obtains a percentage of 90.00% with valid criteria. The construct aspect receives a percentage of 79.00% with valid criteria, and the language aspect receives a percentage of 80.56% with valid criteria. Practically, it can be seen from the results of the students' response questionnaire of a small-scale subject obtained 82.74% with practical criteria, and the large-scale subject obtained a percentage of 83.98% with practical criteria. The questions that have been developed are good and easy to use based on interest, content, and language. This fact was obtained from the results of comments and confirmed from interviews on students' response questionnaires for small-scale and large-scale subject student trials.
The characteristics of mathematical questions using the context of the Bangka Belitung traditional house to train valid and practical mathematical communication skills for junior high school students are:

(i) The developed questions are adjusted to the indicators of mathematical communication. Mathematical communication indicators are fulfilled; this can be seen from the percentages of students who can solve problems in questions based on solving steps by mathematical communication indicators. Mathematical communication indicators used in the questions include: reading with an understanding of a written mathematical representation; expressing everyday events in mathematical language or symbols; creating situations or problems using verbal, written, concrete, graphic, or algebraic methods; and making conjectures (allegations); constructing arguments or making generalizations.

(ii) The developed questions use the context of everyday life events; they are the context of the Bangka Belitung traditional house, making it easier for students to understand mathematical problems. This statement is fulfilled because the content in the mathematical problems uses the context of the Bangka Belitung traditional house: Rumah Panggung and Rumah Limas.

(iii) The developed questions use plane content with the quadrilaterals topic (square, rectangle, rhombus, parallelogram, and trapezoid) and triangles, which explain the properties of planes.

4. Conclusion

Based on the formulation of the problem, results, and discussion, it can be concluded that mathematical questions using the context of the Bangka Belitung traditional house proved valid and practical after going through the validation stages by experts, the testing stages, and revisions. The validity can be seen from the validator's assessment, the content aspect with 90.00% valid criteria, the constructed aspect with 79.00% valid criteria, and the language aspect with 80.56% valid criteria. Practically the questions can be seen from the student response questionnaire for a small-scale subject, who obtained a percentage of 82.74% with practical criteria, and for large-scale subject trials, obtained a percentage of 83.98% with practical criteria. The questions that have been developed are good and easy to use based on interest, content, and language. These results were obtained from questionnaires and interview results of small and large-scale subject trials.

The questions developed are valid and practical and have characteristics such as those following the indicators of mathematical communication; the developed questions use the context of everyday life the context of the Bangka Belitung traditional house; the questions consist of planes containing quadrilaterals (squares, rectangles, rhombuses, parallelograms, and trapezoids) and triangles.

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