Developing of Mathematical Learning Devices Based on the Local Wisdom of The Bolaang Mongondow For Elementary School

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Abstract. This study aims to develop valid, practical and effective mathematics learning tools based on local wisdom of Bolaang Mongondow using PMRI approach. The method used is the development research method which includes the stages of analysis, design and evaluation. Data collection techniques in the form of documentation, walk through, tests, observations, and interviews. Data analysis techniques used qualitative descriptive data analysis. The results obtained are in the form of a valid and practical learning device prototype. Validity is fulfilled qualitatively. Whereas, the practicality shown by experts stated that the developed prototype could be applied to elementary students. Apart from that according to the one to one and small group stages, students can use learning tools well. From observations of student learning activities, the results of student answers, it can be seen that the prototype developed has a potential effect to improve students' mathematical abilities.

Keywords. development, learning tools, mathematics, local wisdom, bolmong

1. Introduction

Learning mathematics in elementary schools has various obstacles, both by teachers and students in general [1]. The difficulties in question are closely related to understanding [1]. Based on interviews with mathematics teachers at SD Negeri 1 Mopait, students often experience confusion when visualizing concepts, principles, procedures, and verbal problem solving in mathematics learning. One type of student difficulty when solving mathematical problems is the difficulty of understanding and using existing principles [2]. Kiswanto [3] in the results of his research revealed that students experience a misconception in defining mathematical objects, so students experience a misconception in determining the relationship of a concept with other concepts, the relationship between the formula and the completion process, and students experience misconceptions in explaining facts related to material mathematics.

Lack of understanding of mathematics makes it difficult for students to understand other concepts [4]. Because if we pay attention to the concepts in mathematics related, this is in line with Gagne's view [4] which says mathematics is a science that if someone already understands a certain basic concept it will be easier for that person to be able to learn and understand the concepts that higher [5]. Gagne [5] also reveals that new concepts are formed because of an understanding of the previous concept, for it is better if the learning sequence starts from simple prerequisites and then increases in complex abilities.
The difficulties faced by these students are influenced by various factors, including the readiness of the learning device by the teacher [7]. The unavailability of a learning environment designed according to the context of students' daily lives can have an effect on students' learning motivation [8]. Though one of the goals of learning is to provide convenience to students to better understand certain concepts, principles, and skills by using approaches, methods, which are most appropriate according to the nature of the teaching material [9]. Munadi [10] stated that one of the benefits of using contextual/realistic learning approaches is increasing learning motivation. By accommodating the needs of students, students will be motivated to continue learning [8]. According to Oemar and Hamalik [11] motivation is very influential in achieving learning outcomes in a student. Therefore, to achieve satisfying learning outcomes, the teacher is required to prepare the learning device to be used. The learning tool in question is the Lesson Plan (RPP), Student Worksheet (LKPD) and learning outcomes test (THB). From the results of observations and interviews in the 1 Kopandakan Elementary School, it was found that indeed the teacher had used the RPP as a reference for teaching but the RPP used was the result of duplication from the previous RPP where the use of learning approaches oriented to the local wisdom context was never developed. Similarly, the LKPD is used, so the difficulties mentioned above continue to occur. In order to overcome this problem, there is a need for innovation in learning devices including using the context of the local wisdom of Bolaang Mongondow community that can motivate students, making learning situations pleasant and interesting, so that student learning outcomes can increase. Based on this, it is necessary to develop mathematical learning tools based on the local wisdom of the Bolaang Mongondow community for valid and practical elementary school students and to see the potential effects of learning devices developed on student learning outcomes.

2. Method
This research uses development research methods with type of formative research. This study consisted of the preliminary stage, namely analysis and design, and the prototyping stage, namely the formative evaluation stage (self-evaluation, expert review, ono-one, small group, field test) [12]. This research was conducted in even semester 2018/2019 academic year with research subjects namely elementary school students 1 Mopait Class V. Data collection techniques in this study include documentation, walk through, tests, observations, and interviews [12]. While data analysis techniques use document analysis, walk through analysis, test analysis, and observation and interview analysis [12].

3. Result and discussion
This research was conducted at SD Negeri 1 Mopait to three students in the one-to-one stage, and six students in the small group stage and 30 students in the field test stage. The students who were the subjects of the study were divided into three categories namely high-ability, moderate-ability, and low-ability.

3.1 Preliminary
At the preliminary stage, researchers prepared and designed RPP and LKPD based on the Local Wisdom of the Bolaang Mongondow Community (Prototype). Here the researcher conducted an analysis of students, curriculum, and material. Student analysis aims to find out the number of students and information about the abilities and activities of class V students who are trial classes. Class V has a total of 30 people. Students who will be the subject of research are students who have different abilities, namely students who have low, medium and high abilities.
Curriculum analysis was carried out to identify material learning mathematics at SD Negeri 1 Mopait. The curriculum used in class V is the 2013 curriculum. The material to be developed by researchers is the sum of fraction numbers.

The summation material for fractions is much related to daily life, making it easier for researchers to use contexts that are appropriate to everyday life. In addition to the sum of fraction numbers corresponds to one of the realistic mathematical characteristics (the use of real-world contexts in everyday life) so that the prototype in the fraction number addition material is very suitable
to be developed with the context of the local wisdom of Bolmong communities involving contextual problems and learning independence.

The process of designing the material related to the making of the initial prototype was planned for 2 meetings then added with an evaluation in the form of Post Test. Each prototype is focused on a number of things, clarity, meaningfulness, conformity of the context that proposes to the indicators and material learned in the RPP and LKPD. In designing prototype I must be related to the principles of the approach of Indonesian Realistic Mathematics Education (PMRI) and PMRI characteristics and characteristics of RPP and LKPD.

3.2 Formative Evaluation
In the stage of self evaluation, researchers conducted their own evaluation of the initial prototype that had been developed by asking for advice from fellow lecturers and other experts. This evaluation is done as a repair of a prototype made at the design stage so that the prototype that has been developed can be tested to the next stage.

The validation results in the expert review stage are used as a basis for revising and refining the prototypes developed. There are three aspects that will be validated by experts / validators, namely content, constructs and languages.

Table 1. Comments/suggestion form experts

| Validator | Comments/Suggestions | Revision |
|-----------|----------------------|----------|
| DK        | Tests given must answer the learning objectives | Tests given have answered the learning objectives |
|           | Add the appropriate test | tests have been added and adjusted |
|           | The test grid is adjusted to the learning objectives | The grid is in accordance with the learning objectives |
|           | Linkages with PMRI must be appropriate | Steps are in accordance with PMRI characteristics |
| JK        | The steps made must be in accordance with the characteristics of PMRI | Material has been adjusted |
|           | Adjust the material and questions developed with the books students use | Image has been fixed |
|           | Fix the image used | Customized images (source included) |
| VS        | Images used must have source / include sources | Images have been adjusted to the context that is close to the student |
|           | the image used matches the context that is close to the student | Already using questions that match the level of ability of students |
|           | LKPD is in accordance with PMRI characteristics | The material developed has been adjusted to the book used by students |
| JHL       | Use questions that match the level of ability of elementary students | the image used has been fixed |
|           | Adjust the material and questions developed with the books students use |
|           | Fix the image used |

Based on the results of the research at the Preliminary stage (preparation and design stages) and formative Evaluation flow. (self evaluation, expert review stage), as well as revisions made by the researcher, the prototype developed (prototype 2) can be categorized as valid. So that it can be tested on class V students at SD Negeri 1 Mopait.

In the one-to-one stage, the improved prototype (revision) was tested on three students who were fifth grade students at SD Negeri 1 Mopait. Here students are asked to observe and work on the questions at the LKPD. After completing work the students fill out the questionnaire sheet. By paying attention to students in working on the LKPD and questionnaire sheets, the researcher will find out
where students feel difficulties in working on the problems and activities in the LKPD, so researchers
can determine whether the prototype needs to be repaired or not.

In the small group stage, the revised prototypes at the stage of expert review and one-to-one will
be tested in small groups consisting of 6 students with different abilities namely two people have low
abilities, two people have the ability while two people have the ability high. The small group stage is
conducted for one day.

Students are asked to observe, work on commands and problems in prototype II. Researchers
interact directly with students to see the difficulties experienced by students during the learning
process and work on LKPD and research instruments (questionnaires). So that it can provide an
indication that the instrument needs to be repaired or not.

After conducting the trial process, students were asked to fill out a questionnaire to find out the
practicality of the developed RPP and LKPD. Based on the results of the practicality of the prototype 2
and the practicality criteria determined by the researcher, the RPP and LKPD developed in the small
group stage are included in the practical category.

In the small group stage, it was shown that students did not experience significant difficulties in
working on the LKPD. The revised results in the small group stage are called prototypes 3, which are
then ready to be tested in the field test stage.

In this field test, it was seen how the overall practicality of the use of RPP and LKPD for the
research subjects. Here prototype III was tested on the fifth grade students of SD Negeri 1 Mopait who
had been selected as the subject of the study. Then the learning results and questionnaires were used to
see the practicality of the prototype 3. The field test data collection process was conducted 2 times. At
the first meeting, the learning process was carried out starting with informing the learning objectives
and approaches used, namely the context of local wisdom of the community, the group division, the
distribution of LKPD to each group. At the first meeting, all students in one group collaborated to
complete activities and questions in the LKPD. Each group was asked to understand each of the
problems found in the LKPD.

Then after working on the LKPD, the researchers asked students to fill out the LKPD
practicality questionnaire on the fraction summation material with the context of the local wisdom of
the Bolmong community. This practicality questionnaire is used by researchers to see the overall
practicality. This questionnaire contains descriptors, choices "yes" or "no" as well as suggestions and
comments. For the choice of "yes" or "no" it is used to classify student answers. Whereas the
comments and suggestions were made by the researchers to see the level of practicality of the LKPD
as a whole.

In the field test stage, students did not experience significant difficulties in working on the
BKPD for the sum of fractions by using the context of the local wisdom of the Bolmong community.
besides that almost all students are interested in learning using the LKPD developed using the context
of the local wisdom of the Bolmong community.

Based on the results of the research obtained in the formative evaluation flow (one-to-one, small
group, field test), the developed prototypes can be categorized as practical, both practical at the stage
of one-to-one and small groups. As a whole (field test)

To get a prototype that has a potential effect on learning outcomes, the researcher uses the
learning outcomes obtained at the evaluation stage (post test)

At this meeting a final test was held to assess the potential effects of the prototype developed
(Prototype 3). For test questions the researcher presents 3 essay test questions. This is intended to be
able to measure the understanding of the concept of adding fractions after working on the LKPD using
the context of the local wisdom of the Bolmong community.

The results of this post-test, there are some students who get satisfactory scores and there are
also some students who get unsatisfactory grades. For the values obtained by students in the post test
stage as a whole can be seen in the appendix, the researcher only displays a portion of the students'
scores in the table 2 below:
Table 2. Students Post test Result

|                  |        |
|------------------|--------|
| Average          | 80.67  |
| The Highest Score| 96     |
| The Lowest Score | 58     |

The table above shows simple posttest results data obtained by students. The lowest value obtained by students at this stage is 58. While the highest value obtained in the post test stage is 96. The average value obtained by fifth grade students of SD Negeri 1 Mopait is 80.67. Based on the results of student responses in the post test stage, the LKPD developed in the context of the local wisdom of the Bolmong community has a potential effect.

4. Conclusion

Based on the results of the study, it can be concluded as follows: (1) This study produced a prototype learning device based on the local wisdom of a balloon community in the form of RPP, LKPD, and THB. The prototype developed has met the valid criteria. This is indicated by the validator's comments and comments. In addition, the prototype developed meets practical criteria, where experts state that the developed prototype can be applied to students, and in accordance with the reality on the ground in the implementation of the one-to-one and small group stages, where students are able to understand the prototype properly. The prototype developed also fulfills the effective criteria seen from the students' answers where each student uses his mathematical abilities to work on prototypes in the small group and field tests. The prototype developed in the small group stage and the field test is said to be interesting and very related to everyday life. (2) The test results in the field test stage show that the mathematical abilities of grade V students at SD Negeri 1 Mopait are still relatively high with an average score of 80.67.

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