Practicality of Learning Tools Based on Contextual Teaching and Learning Approach to Improve Mathematical Communication Skills for High School Students Grade VII

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Abstract. This study aims to develop mathematics learning tools based on contextual teaching and learning approaches in the form of lesson plan and student worksheets for high school students grade VII. This research is a development research. Model used is Plomp model which consists of three stages, namely the initial investigation phase, the prototype development stage, and the assessment stage. This research is limited to the prototype development stage to see the practicality of learning devices that has been designed. Based on the test results of the practicality of learning tools through three assessment data, namely, the observation sheet data of the implementation with an average of 89.38% - the category is very practical, the teacher questionnaire data with an average of 88% - the category is very practical, and the questionnaire data of students' responses with an average of 86.93% - the category is very practical. The results shows that the mathematics learning tool based on contextual teaching and learning approach is valid and practical.

1. Introduction

Mathematics is one of the universal sciences that underlies the development of science and technological progress and is very important in various disciplines in daily life. Because of the importance of the role of mathematics, mathematics becomes a compulsory subject for all levels of primary and secondary education to various study programs in higher institutions. Mathematical communication skill is one of the mathematical abilities that support students' abilities in mastering mathematical concepts in general [1]. In the curriculum that is applied in Indonesia, one of the learning objectives that must be achieved by students is to be able to communicate ideas and ideas in their minds to be further used in solving a mathematical problem that exists in their daily lives. Mathematical communication is a way for students to express mathematical ideas either in verbal, in writing, drawing, diagrams, using objects, presenting them in the form of algebra, or using mathematical symbols [2]. Students need to be taught about how they are able to express their thoughts both in writing and in words, so that later they are able to interact with the community [3].

In 2015, Indonesia was in rank 62 out of 72 countries that participated in the PISA study with a score of 386. TIMSS results in 2015 also showed that Indonesia was still far behind that of other countries participating in the program, which was only ranked 45 out of 50 countries with a score of 397 out of an average score of 500 [4]. The abilities that underlie this mathematical process include communication, mathematics, representation, reasoning, and argumentation, formulating strategies to solve problems, using symbolic, formal, and technical languages and operations in using mathematical
tools [5]. The results of PISA and TIMSS show that the ability of Indonesian students to solve mathematical problems that demand mathematical communication skills are still lacking.

In line with the results of the PISA and TIMSS studies, the reality that occurred in the field also shows the mathematical communication skills of students for junior high school is still relatively low. This is seen when students are given story questions related to the daily lives of students. Some students are confused about how to solve the problem. The confusion arises because students are not able to express the real problem in the form of mathematical models. Students have lack of understanding for any material in learning mathematics and the lack of understanding of the basic concepts of mathematics in students. Students are less able to express mathematical ideas by using symbols, notations or mathematical models. It is seen that students are not accustomed to solving problems that require using their mathematical abilities that is one of mathematical communication skills.

The reasons why students are less able to communicate mathematical knowledge into problems is the lack of teacher creativity in creating more interesting learning, the use of learning methods that are not in line with what is expected, the level of students' ability to communicate mathematics into different problems [6]. Teachers need to work on learning by using approaches that can provide opportunities and encourage students to be able to develop mathematical communication skills.

One alternative that can be conducted to develop students' mathematical communication skills is to create a democratic atmosphere, where individuals are trained to be able to express their opinions to other members through a discussion, then be trained to be able to think independently and be given a safe, comfortable and enjoyable atmosphere so that individuals are not afraid to make mistakes in expressing their opinions [7]. From these statements, in order to make students have good mathematical communication skills, the teacher must compile a learning with an atmosphere that is rich in interactions between both students and students, and students with the teacher through class discussions. One learning approach that can help students construct their own knowledge is by using the CTL approach. Therefore the classroom feels more meaningful and enjoyable in the mathematics learning process.

CTL approach is an approach in learning that links the material being taught with the real daily life of students within the family, school, community and citizens, with the aim of finding the meaning of the material for their lives [8]. CTL approach can stimulate students’ brain to arrange patterns that embody meaning [9]. This means that if students are given a subject matter then they can connect between the knowledge and experience they have so that it is easy to apply to students’ daily lives. This approach will facilitate students to find their true self so that learning will be more interesting and enjoyable [10]. This approach also aims so that in the learning process, students not only memorize the formula but also understand how the process of finding the formula. The CTL approach involves seven main principles for effective learning, namely: constructivism, inquiry, questioning, learning community, modelling, reflection, and authentic assessment [11]. By applying these seven components, students are able to make meaningful connections, conduct self-regulated learning, collaborate, think critically and creatively, assist students to grow and develop [12].

Success in learning, especially to develop students' mathematical communication skills also depends greatly on the preparation made by the teacher before teaching, one of which is the preparation of learning tools that will be used in teaching and learning. Teaching material is a very important part of an overall learning process [13]. Teaching materials are all forms of materials used to assist teachers / instructors in carrying out learning activities in class which are arranged systematically both written and unwritten [14]. So it is necessary to develop a mathematical learning tool that can provide opportunities for students to be able to develop their creativity in solving a problem.

Quality teaching materials are teaching materials that meet valid, practical and effective criteria [15]. To measure the level of practicality, it can be seen from whether the teacher (and other experts) considers that the material to be taught is easy and can be used in teaching and learning [16]. The practicality of the learning device is tested on a limited basis with an observation sheet instrument, teacher questionnaire responses and student responses. The CTL approach can make the mathematics learning process more meaningful because it uses things that are close to students [17]. Students will be given the opportunity to be able to solve a mathematical problem that exists in everyday life through a process
of discussion and argumentation together with their colleagues so that this can make students' mathematical communication skills increase.

2. Experimental method

This research is a development research. The model used is the Plomp model developed by Tjeerd Plomp. When compared with other development models, the Plomp model has several advantages, one of which is to evaluate the practicality of the product through three stages, namely the one to one evaluation stage, small group evaluation, and field tests [18]. The subjects of this study are mathematics teachers and students of grade VII. During the prototype development phase, design, development and formative evaluation activities are carried out. In this phase, self-evaluation and expert review is conducted to check the validity of the designed learning tools. The evaluation itself is carried out to evaluate the prototype that was designed before it is submitted to the experts (expert review). Based on the results of the evaluation, further revisions will be made to the learning tools developed. After the prototype is considered as a good one and in line with expectations, the next step is to evaluate the experts to be validated.

Evaluation of learning tools consists of three stages. The first is individual evaluation involving three students. Second stage is small group evaluation which involves six students. In this small group, test conducted under conditions similar to actual conditions. Final stage is large group evaluation where field test is conducted to see the practicality of the learning device that has been designed. The research instrument was in the form of observation sheets of learning implementation, teacher response questionnaire and student response questionnaire. Data analysis techniques for the practicality questionnaire used a Likert scale arranged in a positive category so that the positive statement obtained a score in accordance with what was stated by Arikunto, namely a score of 4 for strongly agreeing statements (SS), a score of 3 for agreeing statements (S), a score of 2 for statements disagree statement (TS), score 1 for strongly disagree statement (STS) [19]. Learning tools are said to be practical if the achievement value of practicality is equal to or more than 75% [20].

3. Result and discussion

Practicality is related to the ease and progress that students get by using teaching materials, instruments, and other products. A good learning tool should be practical. The practicality aspects that will be seen in this research are usability and implementation. Usability can be seen from the ease of teachers in motivating students and students' interest in using existing devices. The aspect of implementation is seen from the suitability of time allocation, ease of use in the learning process, makes it easy for teachers to present contextual problems and makes it easier for students to understand the material.

Observation sheet of learning outcomes aims to determine the implementation of learning in accordance with the design of learning tools developed. The aspects observed were preliminary activities, core activities and closing activities. The results of the observation sheet of the implementation of learning can be seen in Table 1.

| Meeting | Practicality score | Criteria    |
|---------|--------------------|-------------|
| I       | 82.50 %            | Very practical |
| II      | 83.75 %            | Very practical |
| III     | 85 %               | Very practical |
| IV      | 86.25 %            | Very practical |
| V       | 88.75 %            | Very practical |
| VI      | 88.75 %            | Very practical |
| Average | 85.84 %            | Very practical |

Table 1 shows that, learning tools based on contextual teaching and learning approaches in improving mathematical communication skills of students that has been developed have met the practicality criteria
because they can be used well during the learning process which is shown through the observation sheet of the implementation of learning that has met the very practical criteria with values the average practicality is 85.84%. From each meeting it was seen that there was an increase during the six meetings, this is because in the learning process using the contextual teaching and learning approach will provide students with a deeper understanding of the mathematical material they are learning.

In addition to observing the implementation of the learning sheet, practicality tests are also seen from the questionnaire responses given to the teacher at the end of the learning process. Teacher response questionnaire aims to find out the success of learning and the ease of using learning tools that are developed. The results of the teacher's questionnaire responses after using learning tools based on the contextual teaching and learning approach are shown in Table 2.

Table 2. Teacher Questionnaire

| Aspect   | Practicality score | Criteria       |
|----------|--------------------|----------------|
| Ease of use | 86.12 %           | Very practical |
| Attractiveness | 90.63 %         | Very practical |
| Material   | 88.89 %           | Very practical |
| Time       | 83.33 %           | Very practical |
| Average    | 87.25 %           | Very practical |

Table 2 shows that the results of the teacher's questionnaire responses to learning tools based on contextual teaching and learning approaches in improving mathematical communication skills of students that has been developed have met the criteria of practicality with an average value of 87.25%. So, it can be concluded that the learning tools in the form of an implementation plan and student worksheets have been said to be practical based on the results of the analysis of the teacher's response.

Furthermore, to see the practicality of students' worksheets based on contextual teaching and learning approaches obtained from the analysis of students' responses to the worksheets that have been used during the learning process. Questionnaire responses of students aim to determine the understanding and responses of students to the worksheets used. The aspects asked for in the questionnaire included presentation, ease of use, readability and time. The results of the questionnaire responses of students after using the worksheets of students based on the contextual teaching and learning approach are shown in Table 3.

Table 3. Students Questionnaire

| Aspect      | Practicality score | Criteria    |
|-------------|--------------------|-------------|
| Presentation| 87.11 %            | Very practical |
| Ease of use | 86.98 %            | Very practical |
| Legibility  | 87.11 %            | Very practical |
| Time        | 85.16 %            | Very practical |
| Rata-rata   | 86.93 %            | Very practical |

Based on Table 3, the results of the questionnaire responses of students to learning tools based on contextual teaching and learning approaches in improving mathematical communication skills of students that has been developed have met the criteria of practicality with an average value of 86.93%. So, it can be concluded that the students' worksheets have been said to be practical based on the results of the students' response analysis. As for seeing the results of practicality as a whole can be seen in Table 4.
Table 4. Overall Results of Practicality Lesson Tool

| Aspect                        | Practicality score | Criteria    |
|-------------------------------|--------------------|-------------|
| Observation form              | 85%                | Very practical |
| Study implementation          | 84%                | Very practical |
| Teacher questionnaire         | 88%                | Very practical |
| Students questionnaire        | 86.93%             | Very practical |
| Average                       | 86.93%             | Very practical |

Table 4 shows that the overall results of the practicality of mathematics learning tools based on contextual teaching and learning approaches have very practical criteria with an average practicality value of 86.93%. Based on the results of this study, it can be concluded that, mathematics learning tools based on contextual teaching and learning approaches that have been developed have met the practical criteria in terms of the results of observations of the implementation of learning sheets, teacher response questionnaire and student questionnaire responses after using the developed learning tools.

Mathematics learning tools based on contextual teaching and learning approaches produced have met the practical criteria. This is because the learning process using a contextual teaching and learning approach will give students a deeper understanding of the mathematical material they are learning. This can make students have better understanding in mathematical material because they can make their own discoveries with the knowledge that already exists in students. Through the process of inquiry, students can develop mathematical thinking and communication of students to mathematics will be embedded longer in students’ memories and will be easy to apply the knowledge they have to solve problems related to real world life [21]. The use of mathematics learning tools with a contextual approach can create conducive conditions that allow students to learn actively during the learning process [17].

4. Conclusion

Based on the results of the study, it was concluded that mathematics learning tools based on contextual teaching and learning approaches that were developed were very practical based on teacher response questionnaires, student questionnaires and observation sheets for implementing learning plans.

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