Design Of LKPD Based On STAD Method To Improve Mathematical Communication Skills

Zeni Hernawati, Suparman

Abstract—Mathematical communication is one of the and essential skills in 21st-century learning and the 4.0 Industrial Revolution. Students with low mathematical communication skills will have difficulties in solving HOTS type problems. A teaching material that does not contain mathematical communication skills affects the ineffectiveness of achieving competency standards objectives. The research aims to make the design of the teaching materials appropriate to the model of learning to improve the mathematical communication skills of the students. This research uses a development research using the ADDIE. The subject of research is the students of SMKN 3 Kasihan Bantul. The research object is a mathematical communication, a technique based approach of STAD and learners’ worksheet. Data collection instruments using observation guidelines, interview guidelines, and polls. Data analysis uses Miles-Huberman, which consists of data reduction, data presentation, and withdrawal of conclusions. Research gives some results. Firstly, the mathematical communication skills of the learners are still low. Secondly, the LKPD that complies with the competency standards is needed both by teachers and learners. Thirdly, the STAD method is one of the learning approaches that can be applied to improve the communication skills of Mathematics. Fourth, the absorption of learners on sine rule material, and cosine rules are deficient. This research is to develop the LKPD based on the STAD method as well as to improve the material understanding and mathematical communication skills.

Index Terms—Komunikasi Mathematics, LKPD, Metode STAD

1 INTRODUCTION

Mathematical communication is an ability for students to give something learned through dialogue or reciprocal relationships that occur in a classroom environment. These capabilities form a transfer message that contains students learning mathematics, for example, in the form of concepts, formulas, or problem-solving strategies. Scientific communication is needed by learners to understand mathematical ideas properly. Similarly, learners who already have accurate understanding are also required to be able to communicate their knowledge so that others can realize that understanding. Mathematical communication activities have an impact on learning. The effect of these can increase the average end-class study and increase the number of students who graduate. Communicating mathematical ideas to others can improve accurate sense. The form of mathematical concepts is realized with symbols, tables, diagrams, or other media to clarify the situation or problem. To discuss mathematical ideas with others, it needs mathematical communication skills. Through precise communication and discourse, teachers can foster the involvement and participation of learners. Through accurate efficacy, it also focuses on the deep conceptual understanding of the mathematical standard. One integral part of teaching mathematics is communication in the classroom. While the indicators that demonstrate the ability of accurate contact include; (1) expressing the idea or mathematical situation of a given image is written (2) states the State in the form of pictures or graphics (3) State in the form of mathematical ampersand or mathematical models. (E. Surya, E. Syahputra, N. Jumiati,2018 [7].

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The role of mathematics learning is indispensable in all aspects of life. Nothing passes the mathematical calculations. Communicating ideas using mathematical languages is more practical, systematic, and efficient. Excellent communication must be built in the learning process so that students who are experiencing difficulties and lack of mathematical understanding can be solved.

Some have researched mathematical communication, and obtained results, among others, the results showed that thematically mathematical communication skills have a significant correlation with the type of learning Cooperative. Cooperative learning in the classroom establishes the learners of mutual help, discussion, and debate. The discussion functions to sharpen their knowledge and to overcome gaps in understanding among learners. Various studies have shown communication in mathematics is a necessary competency in mathematics learning.

Of the above, it states that the ability of mathematical communication is indispensable and improved for learners. Mathematical communication skills of students in SMKN 3 Kasihan Bantul need to be improved again. Communication skills of learners in SMKN 3 Kasihan are still low. Learners have not been able to link images to mathematical ideas, and learners have not been able to explain the concept orally or written with illustrations. Learners have not been able to declare daily events in mathematical symbol languages. Learners have not been able to write about mathematics. Learners have not been able to read with the understanding of a written, accurate presentation.

In mathematics learning activities, students need to be assisted in learning the materials that can develop the skills and also in mastering the skills to understand mathematical concepts quick and pleasantly. Examples of these teaching materials are participant worksheets (LKPD). There are
several ways to create a stimulating, interactive, and time-saving learning environment. One such move by setting up learners' worksheets on learning [10]. APOS-based LKPD has a valid and practical aspect of the presentation, ease of use, readability, and time suitability [11]. Expectations of the student worksheets are capable of improving the mathematics reasoning of learners. Student worksheets are indispensable in learning because they are useful in enhancing students' learning activities and outcomes [12]. Students' mathematical communication skills can be improved with learners' worksheets based on realistic mathematical education approaches [13].

This research is the development of ADDIE. The study recommended studies to analyze the needs of student worksheets that correspond to the learning model, the characteristics of learners, and the learning materials. The learning process that happened so far is still a lot less meaningful and always rendered classically [14]. In analyzing the needs of worksheets that support learners' learning is designed based on curriculum analysis, materials, learning methods, teaching materials, student characteristics, and students' needs. Developing LKPD is indispensable for teachers. The student worksheets designed will be used by teachers as a supplement in teaching, student worksheets complement teaching materials in the learning process.

Based on the interview with the teacher, the sheets used have not improved the mathematical communication of the students. Learners who complete the worksheets given by the teacher are only a few. So this research is done to analyze the needs of LKPD according to the characteristics of learners. The hope of LKPD can improve the mathematical communication of learners. Learners' worksheets design analysis is conducted in terms of students' personality, curriculum, and material.

There are several learning models that teachers can use. This study conducted using the method of STAD (Student Teams Achievement Division). STAD is one of the simplest cooperative learning methods. The system in this learning model is by allowing learners to express and communicate with each other. One way is to divide the class into multiple team groups [15]. STAD is a standard method of organizing types of comprehensive plans to teach the subject. The main components of the STAD learning model are five, i.e., class presentations, teams, quizzes, individual improvement scores, and team recognition [16]. STAD is an active learning strategy with a small group inside the class. Students will work in small heterogeneous groups (three to four members). Each team of learners assists each other to understand the material given [17]. The STAD method can increase positive value in learning. Enhanced positive benefits include a sense of responsibility, cooperation, and participation [18].

The learning process with the application uses the techniques Method STAD, generally able to make students more active. In addition to the positive values above, the learning process using the STAD method is also able to improve learners' learning outcomes [19]. Other research results also show that increased mathematical communication skills of students through cooperative learning STAD can enhance the ability of higher than students who directly study conventionally and no Interaction between previous learning models [20]. Collaborative learning of the STAD model with LKPD can develop integrated knowledge Ilmi. [21]. The Cooperative learning strategy of the STAD model strongly supports learners in improving other positive abilities. Among them is the ability of attitude, achievement, and retention of learner's mathematical skills [22]. The STAD method is also able to increase the sense of responsibility, cooperation, and the human thought of learners [23]. The cooperative learning Model of the STAD can improve mathematical communication skills effectively [24].

A learning model that has been done in SMK N 3 Kasihan using conventional learning model. Teachers explain the material, give examples of questions, then students work on the training that the teacher has prepared to find the solution. Students work on their own, so they have difficulties in solving problems or issues given by the teacher. For that, researchers want to implement a learning model in SMK N 3 Kasihan with the model of STAD with This research all of the problems above, namely with the media learning LKPD, using the method of STAD, which can improve the understanding of the material and mathematical communication of students. The learning is done by dividing learners into groups of each group with a maximum of 4 students. Each member group is heterogeneous and works together and is responsible for the understanding of a concept or information. The information provided is simple academic information. The teacher makes the topic selection. Teachers present the materials and students work on their team and to ensure all team members have mastered the lesson. Then, all students take one quiz on the content, where they help each other.

2. RESEARCH METHODS

This type of research is a development research using the ADDIE (analysis, design, development, implementation, evaluation.) model [25]. [26],[27],[28], and [29]. This research aims to analyze the design of LKPD mathematics that can improve the mathematical communication skills of students through the cooperative learning model of STAD. In conventional learning will result in different mathematical communication skills with contextual learning models. On contextual knowledge, mathematical communication skills will be increased [30]. Learning Mathematics with the STAD method can be used as a contextual learning alternative to teachers. Learning Mathematics with the STAD method enhances mathematical communication skills for learners. The results showed that in general contextual learning mathematics can improve mathematical communication skills.

The subject in this insulation is the LKPD-based design of the STAD method. This design is to improve the mathematical communication skills for class X paint SMK N 3 Kasihan. Painting class due to the students of painting class so far have the ability of low communication mathematics. The result of learning mathematics with many little grade data collection instrument in the form of observation, interviews and instrument sheet validation instruments of Media expert
3. RESULTS AND DISCUSSION

In this research, we will have described a poll instrument for the design of the LKPD-based learning model of STAD in grade X L2 SMKN 3 Kasihan on sine rule material and cosine rules. The results of the study are discussing the effects of media expert validation instruments and material experts. Also, it presents the LKPD description based on the learning model of the STAD Lo Student Mathematical communication grade X L2. The material covered is sine rules and cosine rules.

From the observation and interviews conducted by researchers obtained information that the study conducted during this time in SMKN 3 Kasihan that is with the mathematics handbook based on the curriculum-2013 that has been provided by the school. Learners Borrow a textbook. The book contains a collection of materials, definitions, examples of questions, and exercises for the learners are difficult to understand and drab to read. The book has not been able to drive learners to quickly understand the concept of mathematics, one of the sine rules and cosine rules. The learning activity that has been implemented in SMKN 3 Kasihan still carries out conventional differentials. Conventional education is to explain the material and then give examples of problems with completion and end with the practice of training for learners. Students are also only following instructions given by the teacher. Learners have difficulty in completing the same type of problem but different numbers, as well as knowing the same amount, but the kind of problem changed slightly.

Mathematics teachers at SMKN 3 Kasihan already using LKPD. The Learners' Worksheet is used not to use the students' characteristics to develop mathematical communication skills. LPKD needs to be designed and developed as a learning resource in the STAD learning model. Design and development emphasized to develop mathematical communication skills.

In this study, authors devise LKPD design as a learning resource in the STAD learning model. Learners' worksheets emphasized to develop mathematical communication skills. Systematic LKPD contains cover, foreword, table of Contents, competence (KI), basic Competency (KD), Competency achievement indicator, instructions for use, Student activity sheet, worksheets, questions, evaluation, and author profile.

Picture 1. Cover LKPD. The Cover LKPD contains the taught material, the learning model applied, The LKPD Cover contains learning target authors. seen in Picture 1 below

Picture 2. Foreword. The foreword contains gratitude to Allah and the greeting to the parties who have assisted the design efforts of Learners' worksheets. Also, the application of criticism and suggestion as an effort to improve this worksheet. Foreword can be seen in Picture 2 below

Picture 3. The table of contents. The schedule of Contents contains the page information and content of the LKPD listed and details. The table of contents can be seen in Picture 3 below

Picture 4 Core Competency (KI), basic Competency (KD) and Competency Achievement Indicator (GPA). KI KD can be seen in Picture 4 below
Picture 5. Instructions for use LKPD. The contents of the LKPD directive are how to use LKPD based on the syncopation of the STAD learning Model and measurable communication indicators with icons. The LKPD usage instructions can be found in Picture 5 below.

Picture 6. It contains a learner's activity sheet. The learners' activity sheet contains material, examples, and resolutions according to the STAD model and according to mathematical communication indicators. Learners' worksheets can be seen in Picture 6 below.

Picture 7. Worksheets. In the compiled LKPD design consists of 2 worksheets, namely Sinus rules worksheets and cosine rules worksheets. The worksheets can be seen in Picture 7 below.

Picture 8. Evaluation problem. Evaluation problem. The evaluation problem is to know the ability of the students after learning the group through discussion. Benefit the evaluation problem to solve problems on the worksheet. Evaluation problem can be seen in Picture 8 below.

Picture 9. Author profile on the last page. Profile authors Load Biodata authors and education history. Author's profile can be seen in Picture 9 below.
The authors have compiled the design, then validated by media experts and material experts. The validation result of that validator has some comments and suggestions. These comments and suggestions are as follows. Comments and suggestions can be found in the 1.1 table.

Table 1.1

<table>
<thead>
<tr>
<th>No</th>
<th>Comments and Suggestions</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>At the Cofer is written rules of Sinus and cosine rules. Recommended to be changed to sine and cosine rules</td>
<td>Actionable according to suggestions</td>
</tr>
<tr>
<td>2</td>
<td>Pictures of the STAD method steps on the learners' activity sheet need to be trace so that the images and writings can be more apparent. Then the image is centered in the middle</td>
<td>Actionable according to suggestions</td>
</tr>
<tr>
<td>3</td>
<td>On the worksheet is written complete into a work Worksheet 1, because there is a worksheet 2. Work Area is equated and aligns Left right</td>
<td>Actionable according to suggestions</td>
</tr>
<tr>
<td>4</td>
<td>In practice, the icon does not read so that it needs to be brighter or replaced with a more apparent icon</td>
<td>Actionable according to suggestions</td>
</tr>
</tbody>
</table>

LKPD is validated, the author up by fixing design as per suggestion. The next Act 1 can be seen in the Picture 10.

The next act 2 can be seen in the picture 11.

The next 3 can be seen in Picture 12.

The next act 4 can be seen in the picture 13.
The validators in drafting this design consist of two (2) material experts and two (2) Media experts. The result of the Validator is that Expert validation score can be seen in table 1.2.

**Table 1.2**

<table>
<thead>
<tr>
<th>No</th>
<th>Validator</th>
<th>Content Eligibility</th>
<th>Language Eligibility</th>
<th>Presentation Eligibility</th>
<th>Compliance with the STAD model process standards</th>
<th>Quantitative Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Zuhri Ahmad, M.Pd</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2. Irvan Mahesa, M.Pd</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

Total Validator score 1: 20
Total Validator score 2: 20
AVERAGE Validator 1: 4.00
AVERAGE Validator 2: 4.00
Standard Deviation: 0.00

**Table 1.3**

<table>
<thead>
<tr>
<th>No</th>
<th>Validator</th>
<th>Language Eligibility</th>
<th>Presentation Eligibility</th>
<th>Quantitative Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Surya, S. Pd</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>2. Syahputra, N.</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

The following diagram presents the results of processed data from the content expert and Media expert validator. The material expert diagram can be viewed on Diagram 1.1

**Diagram 1.1**

The Media expert validation score viewable in table 1.3

**Diagram 1.2**

4. CONCLUSION

The paper has several findings. The first conclusion is that learners have difficulty studying the material of sine and Cosinus rules. The mathematical communication of learners belongs to the low category. The STAD learning Model can be used to improve the student’s mathematical communication skills. The learning resources that correspond to the STAD learning model are not yet available. Learning resources that embed accurate communication are not, however, possible. The second conclusion is that the ADDIE development model is used to produce the LKPD design that fits the STAD learning model and integrates mathematical communication skills. The third conclusion is that the resulting LKPD design is worthy of the average score of 84 and 85. This design deserves to be used to develop the LKPD following the STAD learning model and can stimulate the students’ mathematical communication skills with revised recommendations.

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