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THE STUDENT WORKSHEET OF MATHEMATICAL COMMUNICATION WITH GUIDED INQUIRY

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ABSTRACT
The ability to communicate is an essential ability of every human being. The importance of communication is also indispensable in the learning process. In mathematical learning, the ability of mathematical communication is very necessary to continue to be developed. The purpose of this research is to produce a valid and practical guided inquiry based mathematical instructional material for the learning of class X SMK students and to know the potential effect of instructional mathematical instructional materials based on guided inquiry for learning of class X vocational students. The research method used in this research is Design Research Type Development Studies. Research is done in two stages of preparation phase (Preliminary) and formative evaluation stage. Formative evaluation stage includes self-evaluation, prototyping (expert review and one-to-one (low resistance to revision), and small group), as well as field test (high resistance to revision). The result of this research is the result of instructional material in the form of Student Worksheet (SW) which valid and practical. Then based on the process of development and analysis of students 'work in SW, the prototype of teaching materials in the form of SW based on guided inquiry model has a potential effect on students' mathematical communication ability.

KEYWORDS: Design Research, Mathematical Communication, Guided Inquiry, Teaching Materials

INTRODUCTION

Communication skills are very important in life [1]. It means that communication skills are important for everyone, including students. Furthermore, NCTM [2] and Chan [3] are adding that communication is strongly emphasized in the learning process of mathematics. In addition, communication is one description of the competencies of core competencies that must be owned by students in Indonesia [4]. Therefore, students' mathematical communication skills are important skills that must be developed.

Characteristics of learning in the curriculum 2013 are to emphasize the process of scientific thinking/ scientific, and to strengthen the scientific approach needs to be applied inquiry-based learning/ inquiry [5]. Approach of learning that adheres to constructivism is an approach that has the

potential as a diversion of learning power to students through the process of knowledge construction, one of which guided inquiry [6]. Guided Inquiry is one of the standard learning processes in 21st Century learning [7]. The learning stages of guided inquiry are the best stages for student learning [8].Thus guided inquiry can be used to assist the development process of students' mathematical communication. Result of analysis of mathematics problem indicator in vocabulary of SMK Muhammadiyah Bangunjiwo show that, the value of mastery of student material with student indicator can make mathematical model of the problem got value of 6.67, student indicator can determine solution of system of linear equation two variable equal to 13.33, and student indicator can solve the problem related to the system of two linear equations of 20.00. Based on the analysis, it can be concluded that the students 'ability in developing mathematical model, determining the value of the variable and the students' skill in solving the problems related to the system of linear equations of two variables still need to be improved. Wardani [9] is adding that in order for students to take an active role in learning mathematics, students need a set of learning process. Therefore, the researcher makes this research with the aim to develop instructional material based on guided inquiry to assist teachers in developing students' mathematical communication ability. This research involves teachers' subjects of mathematics class X and 25 students class XB SMK Muhammadiyah Bangunjiwo.

METHOD

This research uses research design type research development method. Research design is a development model for designing and developing an intervention in learning such as; teaching programs, strategies and learning materials [10].This research is conducted in two stages: preparatory stage and formative evaluation stage [11-15] covering self-evaluation, prototyping (expert review and one-to-one (low resistance to revision), and small group), and field test (high resistance to revision). The research scheme can be seen more clearly in Figure 1.

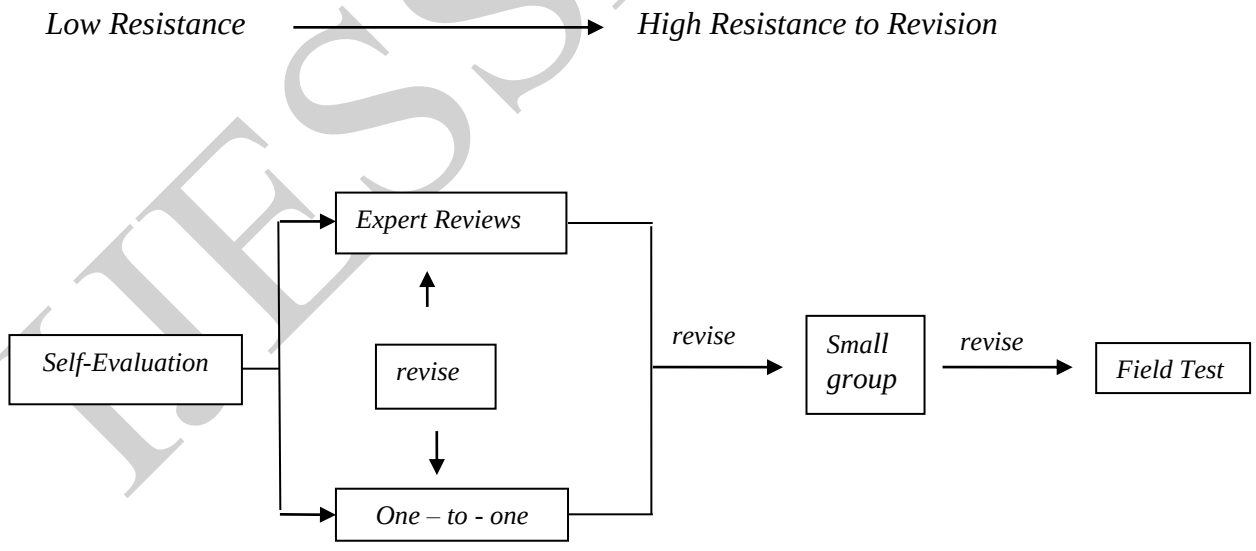


Figure 1: The design flow of formative evaluation [11-14]

In this preliminary stage the researcher determines the place, the subject of research, and performs other preparations such as arranging the research schedule and procedures of cooperation with the classroom teacher to be the place of research. Then in the second stage of formative evaluation, starting from self-evaluation, at this stage the researchers do two things first student analysis,

curriculum analysis, and analysis of material which then proceed with the process of completion of teaching materials hereinafter called prototype 1. Prototype 1 in parallel is validated to expert reviews and one to one, the result of the revision at this stage is called prototype 2. Prototype 2 is tested in a small group called prototype 3. Prototype 3 is tested on field test in the class that becomes research subject. Focus prototype 3 to see the potential effects of teaching materials that are developed against students' mathematical communication skills.

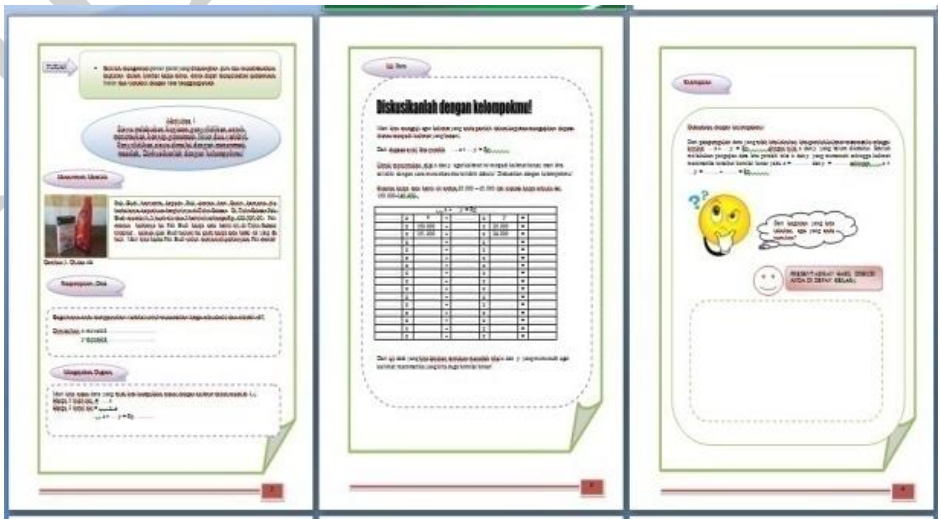
The instruments used in this research are validation sheet, student comment sheet; walk through, interview guides, observation sheets, video, photos, field notes, and scoring guidelines. All instruments used to collect the data in these results. Finally, all data analyse by using descriptive analysis and triangulation data.

RESULT AND DISCUSSION

This development resulted in a set of teaching materials in the form of a collection of LKS contained in the Student Workbook, Teacher Handbook, and Lesson Plans (RPP) that are valid, practical, and have a potential effect on students' mathematical communication skills. The results are obtained based on the following steps;

1. Stage Preliminary, at this stage the researcher designs instructional materials based on guided inquiry, hereinafter called prototype 1.
2. Prototyping include; self-evaluation, expert reviews, one-to-one, small group, and field tests.

Self-Evaluation, at this stage the researchers do an evaluation of prototype 1, then prototype 1 is given to 5 people expert reviews that is Dr.Suprapto, Dr.Sugiman, Drs.Sudarman, M.Pd, Drs. Suismanto, M.Pd, and WaraSuli Mahadi, S.Pd. simultaneously prototype 1 is given to students in the one to one stage (consisting of 3 students, 1 low ability students, 1 medium ability students, and 1 high ability students). Expert reviews to see the validity of teaching materials, while one-to-one to see the quality of instructional materials. Results from expert reviews and one-to-one are called prototype 2. Prototype 2 is tested on a small group of 6 students (2 low ability, 2 medium ability and 2 high ability). Results on small group trials are called prototype 3. At this stage it is seen that all students can use the developed teaching materials. Prototype 3 was tested in field test stage involving 25 students of class XB SMK Muhammadiyah Bangunjiwo. The prototype developed can be seen in figure 2.



The Field test was conducted in three meetings on April 19, April 21 and April 25, 2018. The results

can be seen in Figure 3 that contains the pre-test and post-test results.

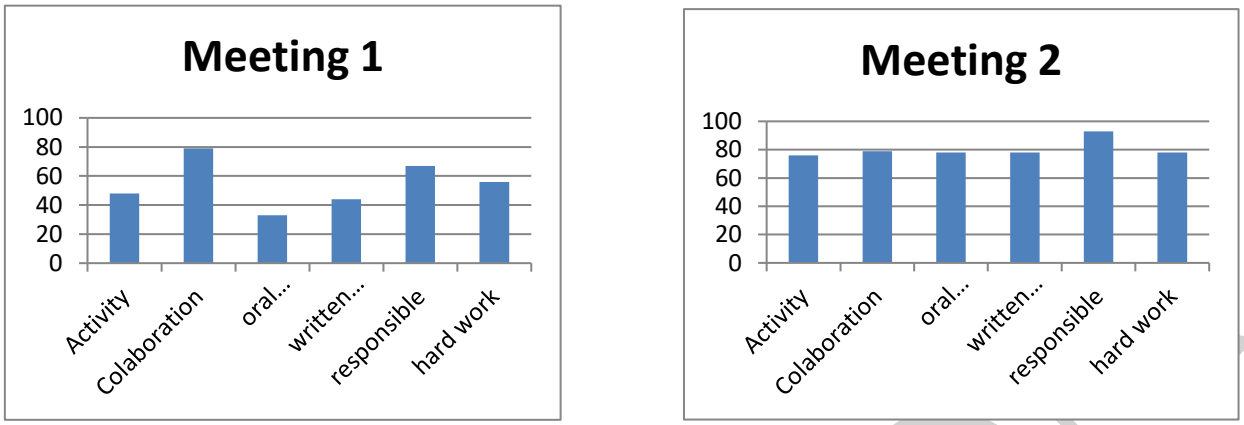


Figure 3: Results of the first and second meeting test field

The comparison of the score of the test score of the students before and after using the teaching aid can be seen in Table 1.

Table 1: The results of the test scores of mathematical communication

Mathematical Communication Capability Indicators	Pre-test Score	Post-Test Score
Ability to use terms, notations, mathematical symbols and structures to present ideas, situations, and mathematical relationships with real-life objects or diagrams / charts.	23	43
Explain ideas, situations, and mathematical relationships with real objects, images, or diagrams.	16	41
Drawing conclusions, compiling evidence, giving reasons or evidence.	26	43

This research produces a set of guided inquiry-based teaching materials to develop students' mathematical communication skills. The process of developing the device is done in two stages: preliminary stage and prototyping stage. At the stage of development of the device, obtained the design of teaching materials as prototype 1, then the first prototype parallel given to the experts and students so that the result of prototype 2 has categorized valid. Next prototype 2 is tested on small group; the result is prototype 3, which has categorized valid and practical. Prototype 3 is tested on the subject of the test field to see the potential effect of using the prototype. In field test, it is involving 25 students of class XB SMK Muhammadiyah Bangunjiwo. Field tests were held for three meetings. Meeting 1 on April 19, 2018, the activity of students still tend to passive, this is because both teachers and students are still adapting to the learning model used. The use of teaching materials is still with a lot of guidance. As shown in Figure 2. However, at the 2nd meeting, on 21

April 2018, it appears that the development is quite good, it means better student learning activities, communication skills both oral and written also better, as shown in Figure 3. Further the results of the 3, on April 25, 2018 showed the development of students' mathematical communication skills, from categorized good enough to be categorized well. Furthermore, based on the analysis of students' answers at the test post, observations during the learning process with developed learning materials, and the results of interviews with some students, the results obtained that the use of teaching materials developed positive impact on the development of mathematical communication students in class.

CONCLUSION

Based on the results of research that has been done, then concluded that 1) prototype developed has categorized valid and practical. Valid can be seen in the comments of experts who stated that the prototype developed good categorized and feasible to use. Practically, it seen from the ease of students in utilizing the prototype developed, helping students in the learning process. 2) Prototypes that have a potential effect on students' mathematical communication abilities. This is seen in the field test stage where all students can train and develop the ability of mathematical communication skills both oral and written in the process of teaching-assisted learning materials developed.

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