

Development of Worksheets Based on Contextual Approach to Increase Student's Mathematical Problem Solving Ability

Yerizon, Edwin Musdi, Jasmine Ardeliza

Mathematics Department Universitas Negeri Padang, Indonesia



Abstract - The aims of this research is to develop students worksheet (LKPD) based on Contextual Teaching and Learning which is valid, practical, and effective. LKPD contains of 7 components, namely constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment. The effectively of LKPD can be seen from the result of problem solving ability. The type of this research is development research where the subject of this research is students of junior high school class VIII. The instruments used were tests, questionnaires, and observation sheets. The results showed that: a) LKPD is valid with score 0,384, b) LKPD is very practical from student and teacher response, c) LKPD is effective to improve student problem solving ability with level of mastery 75,11%.

Keywords - Problem Solving Ability; Contextual Teaching And Learning; Valid, Practical; Effective.

I. INTRODUCTION

The purpose of mathematical learning in Indonesia is stated in the curriculum of 2013 (MoNE: 2013) namely; (1) understanding of concepts; (2) reasoning; (3) communication; (4) problem solving; (5) and attitude of appreciating the usefulness of mathematics in life. Mathematics is a tool of thinking, communicating, solving of practical problems, whose elements are logic and intuition, analysis and construction, generality and individuality (Uno, 2008).

Recognizing the importance of the role of mathematics, the improvement of the quality of mathematics learning at every level of education needs to get serious attention. Various efforts have been made by the government to improve the quality of mathematics learning such as: improving the curriculum, teaching training for the teachers, educational seminars, and improvement of facilities and infrastructure. But the effort has not shown the maximum result, the quality of learning is still far from expectation.

Problem solving ability is one of the mathematical ability that plays an important role in the success of learners.

Conney (Hudoyo, 1988) states that teaching problem solving of learners allow them to be more analytical in their life. The learners who have trained to solve the problems, then they will be able to make decisions. Because they have got skill about how to gather relevant information, analyze information and realize how important to re-examine the results.

Based on the results of observation found that the success rate of learners in solving the problem is still low. This is because the teachers generally provide practice questions that similar to the examples of problems, which are the questions that can be solved with one step only and routine problems. As a result, the learners feel difficult to solve the problems which are different with the examples although the concept is still the same. This is similar to Trianto (2009: 89) which stated that many learners can memorize the concept and less able to use the concept if they encounter real life problems related to the concept. This condition is supported with the fact that most of learners can not solve the problems when they faced the mathematical problem solving.

Soedjadi in Sufri (2010) denote that the characteristics of mathematics are: (a) having the object of abstract study, (b) based on agreement, (c) deductive mindset, (d) having empty symbols of meaning, (e) conversations, and (f) be consistent in the system. Learning will be more meaningful if the student feel what he or she is learning, not just knowing it. According to Nurhadi in Rusman (2010), Contextual Teaching and Learning (CTL) is a learning concept that help teachers to relate the material taught to real situations of learners and encourage their knowledge with application in their life as family members and society.

Based on the above problems, one of the innovations that can be applied is by using CTL based on learning. Since the CTL approach can encourage the learners to learn the materials in accordance with the topics and can help educators to relate subject matter to the real situations. In the learning process which is involving the learners in groups and motivate learners to make connections between knowledge and its application in daily life.

CTL is a learning system that involves the learners fully in the learning process. CTL includes 7 learning components (Johnson, 2010, Suyadi, 2014), namely constructivism, inquiry, questioning, learning community, modelling, reflection, and authentic assessment. In CTL, the learners learn the mathematical concepts associated with daily life. This will give a very strong influence on the character, attitude, and mindset as well as the ability of learners in responding and solving the problems in life. Through this research, the learning tools will be developed based on contextual approach.

In CTL there are 5 important characteristics in the learning process (Sanjaya, 2008), namely: a) activity knowledge, b) acquiring and adding new knowledge, c) understanding knowledge, d) applying knowledge, and e) reflecting knowledge. Furthermore, Priyatni in Hosnan (2014), states CTL has the following characteristics:

- a. Learning is carried out in an authentic context, meaning that learning is directed to learners having skills in solving problems in real or learning contexts attempted to be implemented in learning in real life settings.
- b. Learning provides opportunities for learners to do meaningful learning tasks.
- c. Learning is done by learning by doing.
- d. Learning is done through learning in a group.
- e. Creating learning to know each other deeply
- f. Learning to ask, to inquiry, to work together.
- g. Learning as an enjoy activity.

From the above opinion, it can be concluded that the contextual learning of mathematics is to get the ability to think, reason, communicate, investigate and solve the problems, learn to discipline, self-study, be positive towards mathematics, and know how to learn and can find and use the facts, skills, concepts and rules. Therefore, CTL-based worksheets will be developed. Worksheet is a guide for learners to conduct the investigation or problem solving activities. This activity sheet can be a guide for cognitive aspect development exercises as well as guidelines for the development of all aspects of learning (Trianto, 2010). There are four steps in developing LKPD, namely: a) Determination of indicators, b) Collection of materials, c) Compilation of components, and d) Checks and improvements (Setiawan, 2007).

II. RESEARCH METHODS

The type of research is Design Research. Plomp and Nieveen (2013) stated that the design research is the of kind of research with aims to design and develop an intervention (such as programs, strategies and learning materials, products and systems) in order to solve complex educational problems and to develop knowledge (theory) about a characteristics of the intervention and the process of design and development. The development model used in this research is the adaptation of the Plomp model developed by Tjeerd Plomp. According to Plomp and Nieveen (2013: 19), this development model consists of three stages:

- a. Preliminary research, is a preparatory phase consisting of needs analysis, curriculum analysis and concept analysis.
- b. Prototyping phase or development stage is the process of designing and developing learning devices gradually by using formative evaluation to evaluate and improve the prototype developed.
- c. Assessment phases or evaluation stage in the form of semi summative evaluation to conclude whether the final prototype or product is in accordance with the desired criteria of practicality and effectiveness.

Based on the results of the analysis at the preliminary research stage, the design of the development of tools based on Contextual approach was developed. Then the design of learning tools based on a contextual approach is evaluated and refined gradually based on the formative evaluation stage. The stages of formative evaluation consist of self evaluation, expert review, one-to-one evaluation, small group evaluation, and field tests.

III. RESULT AND DISCUSSION

A. LKPD Design Phase

This LKPD contains of the introductory, table of contents and the material discussed for the circle matter in junior high school class VIII. There are three aspects to be considered in designing LKPD, namely: didactic and material aspects, linguistic aspects and aspects of graphs.

In didactic aspects and material presentation of the material on LKPD begins by providing illustrations that contain problems in everyday life. The presentation of this material is a form of activity of constructivism which is one component of the contextual approach. This problem is related to the material being studied in order to arouse the learners to be more enthusiastic in following the learning process. Examples of problems related to the area of the circle are used in the context of determining the cheaper price of pancake whether large diameter or small diameter. The problem is presented with the aim of directing learners to study the material about the area of the circle. After understanding the problem, learners are asked to estimate or present their opinion on how to compare the cheaper price of martabak. Temporary answers from learners can be delivered verbally to the teacher. To test learners' tentative answers on how to determine cheaper martabak prices, teachers direct learners to determine the extent of martabak by first finding the broadest formula of the circle.

After performing the activities in the LKPD, learners are asked to present their ideas about what they have learned. After the students finish the students are asked to present the findings in front of the class. This presentation activity is the modeling stage of the contextual approach. This modeling aims to determine the work of learners and facilitate in equating the ideas of learners. The next activity is to provide practice questions that aim to see the level of students' understanding of the material they have learned. Meaningful learning is expected to be achieved by learners by doing the exercises and sharing experiences with peers. Various exercises will lead students to construct their own knowledge to understand the material by using ideas in many situations.

The final activity in this LKPD is to conduct actual assessment activities. Every activity undertaken learners on the learning process would be very meaningful and given an assessment that will increase the spirit of learners to be able to learn better. A clear assessment of this LKPD is to provide an assessment for each student activity at the end of the meeting.

In the language aspect, the language used in accordance with the enhanced spelling (EYD). LKPD uses simple and communicative language such as the use of the word "Ananda" and in accordance with the level of understanding of junior high school students and avoid the use of terms that are difficult to understand by learners. In addition, commands and questions on LKPD are prepared with clear sentences so as to direct learners to perform activities or answer questions as expected.

In the aspect of the graph, cover or cover page contains the identity or title of LKPD based on contextual approach, title of subject studied is the material of circle, identity column of learners as owner of LKPD, and accompanied by Picture of objects in everyday life in the form of circle that is Gambarroda, and earth. Presentation The image is intended to make students feel close to the circle material because it is very much its application in everyday life.

The selection of red color is based on the demand of most of the learners who completed the questionnaire in the preliminary study. The background color used in LKPD based on contextual approach is red brick and combined with color-color. The selection of LKPD measures is also based on the demand of most learners on preliminary research.

B. Self Evaluation Stage

Before consulting and discussing to the experts, a prior evaluation of the learning device has been designed. In LKPD evaluated are typing errors, precise use of punctuation, the accuracy of the size of the writing, the suitability of the problem with the image presented, the availability of the empty space. In general, many errors occur in typing words and punctuation.

C. Expert Review Stage

The validation of LKPD was performed by 5 validators ie 3 mathematics education experts to validate the didactic aspect and content aspect, 1 Indonesian language expert to validate the language aspect and 1 educational technologist to validate the display aspect. Prior to being validated some parts of LKPD have improved or revised based on suggestions from validators. Suggestions from validators for LKPD improvement can be seen in Table 1.

Table 1. Validated Suggestions for LKPD

No	Suggestions
1	Should the elements of the circle are explained by stories relating to the activities of learners in everyday life
2	Improve sentence writing and Drawings in some sections
3	Selection The image on the cover page matches the exact object of the circle (eg wheel, rotary object)
4	The drawings in the LKPD heading for each meeting are one course and note the numbering system

LKPD validation result based on contextual approach in all aspects can be seen in table 2.

Table 2. LKPD Validation Results Based on Contextual Approach

No.	Aspect of Validation	Validity Index	Category
1.	Didactic and Materials	0,812	Valid
2.	Language	0,889	Valid
3.	Graduation	0,800	Valid
Average Validity Index		0,834	Valid

Based on Table 2, it can be seen that in general the validity of didactic aspects, linguistic aspects and aspects of graduation have met the valid criteria with the average index of validity are 0.812, respectively; 0.889 and 0.800. Overall validity of LKPD based on contextual approach has fulfilled the valid criteria with the average of the overall index of 0.834. Furthermore, to LKPD based on improved contextual approach, practicality test is done. Practicality test aims to find out how far the benefits, ease of use and efficiency of time use LKPD based on contextual approach by teachers and learners. The result of LKPD practice is described as follows.

D. One-to-one Evaluation Stage

LKPD-based contextual approach is tested to 3 learners with 2 medium-skilled learners and 1 low-ability learners. Selection of students to do LKPD based on contextual approach done by the teacher. The learner is asked to try LKPD based on contextual approach according to their respective understanding to the Drawings, problems, illustrations, orders, and questions in LKPD. Information

gathering is done by observation during learners doing LKPD.

The following description of the results of the individual evaluation stages in each LKPD based on a contextual approach. Based on these observations, it can be concluded that the obstacles encountered in LKPD 1, among others, learning guidance still doubt the students "answer all questions in LKPD 1 properly and correctly" so that the word "all" is omitted. In LKPD 1 learners do not understand the sentence that explains about the meaning of the circle is "the circle is the set of all points on the same spaced plane to a certain point called the center point" so that the sentence is changed to "circle is the set of all the dots on a flat plane spaced equally to a particular point called a center, points spaced equal to the center are called radii.

In LKPD 2 students do not experience so many obstacles in understanding the statements and sentences that exist in LKPD 2, while for instructions in LKPD 2 can be understood learners well. For practice questions learners need guidance and direction from researchers. In general, learners can understand the purpose of the command and statement that exist in LKPD well.

E. Small Group Evaluation Stage

After conducting individual evaluations, revisions are made in accordance with errors found by learners during the individual evaluation process. Then the evaluation proceeds with a small group evaluation by practicing learning tools that have been designed on a group of learners. Evaluation was conducted on 8 students of class VIII with heterogeneous ability. At this stage learners are divided into 2 groups. Evaluation of small groups conducted as many as 5 meetings.

In LKPD 1 students are also still hesitant to compose sentences to be written on the places that have been provided. In the core activities of the students are asked to understand the problems that exist in LKPD. When understanding the early part of LKPD about the center, the fingers and diameters of learners have little difficulty in answering questions and drawing conclusions about the definition of the center, the radius and the diameter of the circle. Likewise with the definition of partition and apothem of the circle so that learners need an explanation from the researchers. Researchers provide guiding questions to make it easier for learners to understand the intent of questions and commands. In the next section learners have started to familiarize themselves to identify the elements of the circle before making the definition.

At the end the researcher asks one of the groups to deliver their work forward. Since only one group that appears to present the material about the elements of the circle causes the other group to be inactive in the learning so that the teacher in the school suggests on the presentation test field about the elements of the circle presented by several groups. At the end the learners are guided to do the exercises but not all the exercises are completed because the time has been more than planned.

F. LKPD Practical Assessment Stage

After a revision based on individual evaluation and small group evaluation, the learning tools are then tested in a limited way to class VIII SMP 5 meetings. During the trial, the learning activities were observed by two observers i.e researchers and one mathematics teacher. Observer in charge of observing the implementation of learning using learning tools based on contextual approach based on the observation sheet that has been provided. Practicality data of instructional tools based on contextual approach obtained from student's response questionnaire, teacher response questionnaire and observation of learning implementation. The test result data obtained can be described as follows.

Questionnaire given to learners after following all learning using LKPD based on contextual approach can be seen in Table 3. In Table 3 shows that the average level of LKPD practicality based on contextual approach according to the response of learners is 85.29%. Thus, it can be concluded that LKPD-based contextual approach is very practical according to the learners' responses.

Table 3. Results of Participant Questionnaire on LKPD based on contextual approach

No	Aspect Assessed	Average	Percent age	Category
1.	Ease of Use	3.41	85.21	Very Practical
2.	Timing Efficiency	3.29	82.29	Very Practical
3.	Benefits	3.44	86.04	Very Practical
Average Overall		3.411	85.29	Very Practical

Questioning questionnaires according to the teacher aims to obtain information about the practicality of learning devices based on teacher predictions and considerations.

Questionnaire Questionnaires were given to teachers after all LKPDs were completed in the learning process. The teacher questionnaire response results will be presented in Table 4.

Table 4. Results of Teacher Response Questionnaire on CTL-Based Mathematics LKPD

No	Aspect Assessed	Average	Percent age	Category
1.	Ease of Use	3.4	85	Very Practical
2.	Timing Efficiency	4	100	Very Practical
3.	Benefits	3	75	Very Practical
Average Overall		3.5	86	Very Practical

In Table 4, the result of questionnaire of teacher response to practicality gives 86% practicality value. Based on predetermined criteria, then the practicality of instructional device based on contextual approach is stated very practical.

Observation of the learning implementation is focused to see whether the learning has been in accordance with the learning steps that have been designed in the lesson plan, and to identify the constraints experienced during the learning process. The result of the analysis on the observation sheet is taken as one of the considerations in determining the value of the practicality of learning tools. Observations were conducted by 2 observers, ie researchers and one mathematics teacher. Observation was done 5 times.

The first meeting all learners look happy and enthusiastic about doing LKPD. When learners discuss the illustrations of the contextual issues presented in LKPD already seen the creation of learning societies because learners debate in understanding the problems given. At the second meeting can be said there are no obstacles in the learning process because almost all learners already understand what they do and the time required according to the planned time.

In general, the activity process has been running smoothly but there are only a few obstacles when doing the exercises in LKPD that learners do not understand how to do the problems that exist in LKPD.

Stage Effectiveness of CTL Based Learning Device The effectiveness of mathematics learning device is seen from

the result of math problem solving test of the learner after learning by using mathematics learning tool based on contextual approach. Contextual approach-based learning tools can be said to be effective if able to increase the problem solving ability of math learners.

After the test conducted the researchers obtained the test data that can be seen in Table 5.

Table 5. Results of Data Analysis of Test Results Problem Solving Problems Learners

	Completion		Total
	Completed	Not Completed	Percentage
Number	17	5	22
Percentage	77.27	22.73	100
Grade Point Average			75.11

Based on Table 2 above, it can be seen that from 22 students who attended the test, 17 students or 77.27% complete means that the value of the students above the determined KKM score and 5 students or 22.73% is not complete meaning that the value of the learners is still below the KKM. Furthermore from the average class that is in the learning process using learning tools based on the contextual approach that is 75,11 means that the classical has shown mastery. The effectiveness of learning tools based on this contextual approach is also seen from the comparison of the percentage score of the ideal scores of initial skills test and final test. Percentage score achievement is ideal for each problem solving indicator. In the indicators understand the problem 68.18% learners managed to get the ideal score, meaning that most learners are able to understand the problem by constructing their own knowledge. Some learners do not achieve the ideal score because they can not understand the problem well. This is because the students' answers are not complete or some answers are still wrong.

The effectiveness of instructional devices is concerned with the effects or effects of instructional devices designed against learners. According to Nieveen in Plomp (2013) effectiveness is divided into two parts, namely the effectiveness of expectations and actual effectiveness, the effectiveness of hope that the use of interventions (learning devices) is expected to have an impact in accordance with expected results. While the actual effectiveness is the use of interventions (learning devices) that impact on expected results. The effectiveness of this research was conducted to see how far the usefulness, impact and benefit of learning

tool based on the contextual approach to the problem solving ability of learners. Learning tools can be said to be effective if the device has a good impact on the problem solving skills of learners.

The effectiveness value indicates how far the usefulness and benefits of the learning tools are based on the contextual approach in improving the problem solving skills of the learners. Based on the data analysis there is an increasing percentage of the number of learners who obtained the ideal score for all indicators of problem-solving abilities in the final test when compared with the ideal score scores on initial ability tests. Through the results of mathematical problem solving test analysis of learners obtained can be concluded that the learning tool based on contextual approach has been declared effective.

LKPD is also equipped with training questions in the form of problem-solving questions. While working on problem solving problems in LKPD, learners can understand the problem and plan the settlement by constructing their own knowledge. Solve problems by constructing their own knowledge as well as by finding and lasting learners can recapture by performing a contextual component of reflection. By working on these exercises, the problem solving ability of learners can be improved.

IV. CONCLUSIONS AND SUGGESTIONS

A. Conclusion

Based on the process and the results of research that has been implemented, then obtained the following conclusions.

a. The developed CTL-based LKPD is valid both in content and construct.

b. LKPD-based CTL developed already meet the practical criteria both in terms of implementation, ease and time required. It can be seen from empirical data, that is questionnaires data of practicality according to learners, teacher response questionnaire and observation data of learning implementation.

B. Suggestions

The CTL-based LKPD developed has been effective, judging by empirical data. Percentage mastery of learners using contextual approach based learning tools reached 77.27%.

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