

# The Development of Mathematic Instructional Administration to Improve Problem Solving Ability

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**Abstract.** This study aimed to (1) produce a learning tools of Mathematics developed in the application of Contextual Teaching and Learning (CTL), (2) determine the effectiveness of learning tools of Mathematics developed in the application of Contextual Teaching and Learning (CTL), (3) determine the improvement of students' problem-solving skills with Mathematics learning tools developed in the application of Contextual Teaching and Learning (CTL). The subjects of this study were students of grade VII-1 of Junior High School (SMP N 2) of Gebang totaling 26 people. This research was an R & D study with a Dick & Carey development model. The results of this study indicated that (1) Mathematics learning tools developed in the application of Contextual Teaching and Learning (CTL) were effectively used, (2) the improvement of students' problem-solving skills with the learning tools developed.

**Keywords:** Learning tools, Contextual Teaching and Learning (CTL), problem solving skills

## 1 Introduction

The problem that often arises in the world of education was the weak ability of students to use their thinking skills to solve problems. Students tended to be presented with various information that demand memorization only. There was a lot of knowledge and information that students have but it was difficult to connect with the situation they face. Instead of being able to solve a problem, their knowledge was not relevant to what they are facing.

Based on the PISA (Program for International Student Assessment) study, in 2000, Indonesia was only able to occupy position 39 of 41 countries in the Mathematics field with a score of 367. In 2003, Indonesia was ranked 38 out of 40 countries with a score of 361. In PISA 2006, Indonesia ranks at 50th out of 57 countries with a score of 391. In the implementation of PISA 2009, Indonesia won 61st position out of 65 countries with a score of 371. While in PISA 2012, Indonesia was only able to reach 64th position out of 65 countries with a score of 375 [1]. Based on the data above, it can be concluded that the quality of education in Indonesia was still very low.

Mathematics learning should begin with the introduction of problems that were appropriate to the situation. In fact, the management of Mathematics learning in schools has not yet referred to the objectives of the Mathematics subject set in the Content Standard. This situation that might cause achievement or achievement in learning Mathematics for Indonesian students does not improve. This condition was increasingly apparent when looking at international assessments of Indonesian students' mathematics learning achievements.

Learning was no longer a "transfer of knowledge", but develops students' potential consciously through more dynamic and applicable abilities.

Education as a tool to make people useful for themselves and the social environment required a meaningful learning process. Meaningful learning required the activities of students to be active during the learning process. Student activities that were active in the learning process can be influenced by several factors. One of the factors that can influence it is the learning tool prepared by the teacher as a tool to support the achievement of meaningful learning.

Learning devices were certainly very needed in supporting the occurrence of the learning process. Learning devices were a set of tools that can help the learning process take place. Learning tools needed in managing the teaching and learning process can be: syllabus, Learning Implementation Plan (RPP), Student Activity Sheet (LKS) and modules.

In the process of preparing learning devices, a learning model was needed. Not all suitable learning models were applied in accordance with the environmental needs of students. For that, as a teacher must be able to understand the closest environmental conditions of students so that they can produce good learning devices. This can be done by applying the Contextual Teaching and Learning (CTL) learning model.

Contextual Teaching and Learning (CTL) was one of learning models that links the closest environmental conditions of students to the learning process. CTL made students able to relate the contents of academic subjects to the context of their daily lives to find meaning [2]. CTL was the connection of every material or topic of learning with real life [3]. CTL learning can be dealt with through the development of learning tools by applying the CTL model in it, both through learning resources, learning media and so on.

The CTL approach in learning Mathematics was chosen with the intention of efforts to improve the quality of learning. The CTL approach not only creates a comfortable and pleasant learning atmosphere but also meaningfulness. One of the media or learning resources that can be chosen in the CTL approach to learning Mathematics was the Student Worksheet (LKS). Trianto (2010) [4] suggested that LKS contained sheets containing a number of information or guidelines aimed at directing students to behave as expected by the teacher. Basically, LKS was very appropriate to be used to make students work independently. LKS was used as a step for students to carry out investigation or problem-solving activities. Information in LKS can be used as an exercise for students to develop aspects that must be possessed in the learning process.

Based on observations in grade VII -3 of Junior High School (SMP N 2) of Gebang Even Semester 2017-2018 Academic Year showed that out of 30 students only 13.3% of students actively listened to the teachers' explanation and did questions and answers in class, while 86.6% of students were seen just sit quietly without a learning response. The rest of the activities carried out by students were only playing in class, telling stories with friends, and scribbling books. Of the five items of Mathematical story form in the form of a test essay in solving problems about integers given, only 10% of the number of students were able to answer the question with the correct answers and completion steps while the other 90% answered the question with the wrong answers and resolution steps. Observation of students' responses to Mathematics learning showed that of the 30 students only 20% of students like Mathematics learning the rest 80% of students do not like Mathematics learning.

Mathematics learning in schools should emphasize the involvement of students who were active, and develop the view that Mathematics as a science was not just a calculation involving symbols and numbers. Rather, it was more about the application of mathematical concepts that exist in real life that are encountered everyday. So that abstract mathematical

concepts can be understood by students and applied in solving problems in their daily lives. Mathematics learning that wanted to be linked in the daily lives of students, should be adapted to the environmental conditions of students. This was to suit the needs of students. One of them was through the development of learning tools tailored to the conditions of the environment and the needs of students. Based on the description above, it was needed to conduct research on the development of CTL-based mathematical learning tools to improve students' problem-solving abilities.

### **1.1. Mathematics Learning Tool**

Learning tools were a set of learning resources used by teachers and students to support the learning process. Learning devices were all learning resources, media and facilities used in the learning process [5]. In the learning process, the learning device consisted of various components used by the teacher. In this study, the learning tools in question were Student Worksheets (LKS), and Problem-Solving Ability Tests.

Student worksheets (LKS) were usually in the form of instructions and steps to complete a task in each subject matter [6]. Whereas [7] explained that the sheets were used to direct in the form of teaching with certain subjects in helping students improve reasoning process skills. LKS must be made by the teacher concerned so that the learning activities are adapted to the situation and conditions of learning, so that the existence of LKS allows students to maximize understanding in an effort to form basic abilities according to the indicators of achievement achieved.

### **1.2. Learning Contextual Teaching and Learning (CTL)**

According to Sanjaya (2011) [8], CTL was a learning model that emphasizes student activity in full, both physically and mentally. Contextual learning was a concept of learning that helped the teacher connect between the subject matter he teaches and the real-world situation of students and encourages students to make connections between the knowledge they have and their application in daily life. The advantages of CTL learning were (1) learning becomes more meaningful and real, (2) learning was more productive and able to foster the strengthening of concepts to students, while the weakness of the CTL learning approach was that teachers were more intensive in guiding.

### **1.3. Mathematical Problem-Solving Ability**

Problem solving ability was an ability that must be possessed by students in learning Mathematics. The problem-solving ability was considered to be the goal in the Mathematics learning process that students must have in learning Mathematics, because basically the problem solving ability was able to develop children's thinking skills in dealing with the problems they encounter in their daily lives.

Problem solving was a unity in Mathematics learning that cannot be separated from the Mathematics programs. In learning Mathematics required students to have problem solving skills. Not only must, but problem solving skills were indeed needed in the Mathematics learning process [9]. Learning Mathematics was a subject that teaches to think about getting things done. Problem solving skills required someone to find out the problem to be solved. According to [10] problem solving was "the process of accepting problems as a challenge to solve the problem while according to [11] Dahar (2011) problem solving was a human activity that combined concepts and rules that have been obtained previously, and not as a generic skill. Dewey describes the process that can be carried out as steps in solving problems,

namely: (1) understanding the problem, (2) planning the solution, (3) implementing the plan, (4) examining the process and results [12].

## 2 Methodology

This type of research was R & D development research. This research produced a product that was used in the school. This research was conducted at Junior High School (SMP N 2) of Gebang. The study was conducted in the odd semester of the 2017/2018 academic year on comparison material. The subjects of this study were grade VII students of SMP N 2 Gebang while the objects in this study were Mathematics learning tools in the application of the developed CTL. The development model used in this study was a model of Dick & Carey. The steps to develop the modification of the Dick and Carey model were; (1) identification of learning objectives, (2) learning analysis, (3) analysis of learning and context, (4) determining learning objectives, (5) developing and selecting learning materials, (6) developing learning strategies, (7) developing and choosing learning materials, (8) designing and conducting formative evaluations, (9) making revisions, (10) summative evaluation.

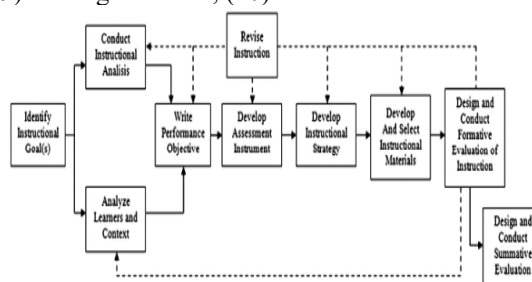


Fig. 1. Modification model of Dick and Carey.

The purpose of this study was to find out; (1) the effectiveness of Mathematics learning tools developed in the application of Contextual Teaching and Learning (CTL), (2) enhancing students' problem-solving skills with the learning tools developed. The instrument of this research was; (1) learning tool validation sheet consisting of LKS validation sheet, (2) problem solving ability test (3) student response sheet. The analysis of this research data on the expert validation questionnaire sheet uses descriptive quantitative, namely calculating the average percentage of indicators while the assessment data analysis tests the problem-solving ability using classical learning completeness and response sheet data analysis students use the Likert scale which was converted to an average percentage.

## 3 Result and Discussion

The development of Mathematics learning tools developed in the application of Contextual Teaching and Learning (CTL) referred to the 10-stage Dick and Carey development model. LKS that has been developed has been validated by the Mathematics material validators, linguist validators, and learning design expert validators. The results of expert validation showed that the Mathematics learning tools in the implementation of

Contextual Teaching and Learning (CTL) got a percentage score of Mathematics learning material by 86%, language at 85%, and learning design by 96% with very valid and feasible criteria.

The results of the problem-solving ability test showed that the pretest data obtained an average value of 57.32 with the percentage of classical learning completeness only reached 11% while the posttest data obtained an average value of 80 with the percentage of learning completeness in the classical reaching 88%. Based on the data above showed that overall students have achieved specified competencies and there was an increase in problem solving abilities after learning was done by using these learning tools. The results of student responses indicate that the responses of students obtain an average percentage in the first trial of 85% while in the second trial it was 89.1%. Based on data from trial results I and II  $\geq 80\%$  it was concluded that the learning device developed was effective.

#### 4 Conclusion

Based on the results of the study showed that the Mathematics learning tools developed in the application of Contextual Teaching and Learning (CTL) was effectively used and there was an increase in students' problem-solving skills with the learning tools developed.

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