Prima: Jurnal Pendidikan Matematika
Vol. 8, No. 3, September 2024, pp 627 - 634
P-ISSN: 2579-9827, E-ISSN: 2580-2216
Web: http://jurnal.umt.ac.id/index.php/prima

THE DEVELOPMENT OF LEARNING TOOLS USING CONTEXTUAL TEACHING LEARNING MODEL FOR IMPROVES SOLVING CAPABILITY STUDENT PROBLEMS ON APPLICATION MATERIALS DIFFERENTIAL AND INTEGRAL

Rustani Silitonga[1], Pargaulan Siagian[2], Pardomuan Sitompul[3]
[1,2,3]Universitas Negeri Medan, Jl. William Iskandar Ps. V Sumatera Utara, Indonesia
e-mail: rustanysil02@gmail.com

Abstract

This research aims to provide a teaching tool that incorporates the Contextual Teaching and Learning paradigm into materials for varied and integrative applications. The following is what this research intends to explain: 1) the validity, practicality, and effectiveness of instructional tools utilizing the contextual teaching and learning model to enhance students' problem-solving skills in the context of differential and integral application materials; and 2) How well do students' problem solving abilities improve using learning tools with contextual teaching learning models on the differential and integral application material developed. Analysis, definition, development, implementation, and evaluation are the five stages of the ADDIE paradigm that are used in this research. Here are the results of the study: 1) Based on the results of trials I and II, experts have determined that the learning device meets both the valid, practical and effective criteria; it uses the contextual teaching learning model to enhance students' problem-solving abilities in the created differential and integral application material: 2) Improving one's ability to solve problems by means of learning resources that use a contextual instructional learning paradigm on topics pertaining to differential and integral applications. The N-gain value was 0.41 in the first trial and 0.47 in the second, both of which are considered to be of "medium" quality.

Keywords: Learning Tools, ADDIE Model, Contextual Teaching Learning, Problem Solving, Differential and Integral Applications

Abstrak

Penelitian ini bertujuan untuk menyediakan perangkat pembelajaran yang menggabungkan paradigma Pengajaran dan Pembelajaran Kontekstual ke dalam materi untuk aplikasi yang bervariasi dan integratif. Berikut ini adalah apa yang ingin dijelaskan oleh penelitian ini: 1) seberapa baik perangkat pembelajaran berdasarkan model pembelajaran pengajaran kontekstual bekerja untuk membantu siswa meningkatkan kemampuan pemecahan masalah mereka dalam materi aplikasi diferensial dan integral; dan 2) seberapa baik peningkatan kemampuan pemecahan masalah siswa menggunakan perangkat pembelajaran dengan model *contextual teaching learning* pada materi aplikasi diferensial dan integral yang dikembangkan. Analisis, definisi, pengembangan, implementasi, dan evaluasi adalah lima tahap paradigma ADDIE yang digunakan dalam penelitian ini. Berikut adalah hasil penelitian: 1) Berdasarkan hasil uji coba I dan II, para ahli telah menentukan bahwa perangkat pembelajaran memenuhi kriteria valid, praktis dan efektif; menggunakan model pembelajaran pengajaran kontekstual untuk meningkatkan kemampuan pemecahan masalah siswa dalam materi aplikasi diferensial dan integral yang dibuat: 2) Meningkatkan kemampuan seseorang untuk memecahkan masalah melalui sumber belajar yang menggunakan paradigma pembelajaran instruksional kontekstual pada topik yang berkaitan dengan aplikasi diferensial dan integral. Nilai N-gain sebesar 0,41 pada percobaan pertama dan 0,47 pada percobaan kedua, keduanya dianggap memiliki kualitas "sedang".

Kata kunci: Perangkat Pembelajaran, Model ADDIE, *Contextual Teaching Learning*, Kemampuan Pemecahan Masalah, Aplikasi Diferensial dan Integral

INTRODUCTION

Math is a scientific topic that is taught and used in lessons at every educational level, from elementary school all the way through college. Most everything that people do include

Received: July 3, 2024; Revised: September 15, 2024; Accepted: September 29, 2024

some kind of mathematical calculation. In everyday life, there is always a mathematical answer to every problem. Mathematics is a crucial subject because of the many practical applications it has, argues Milaturrahmah (2017).

The ability to solve problems is fundamental to the study of mathematics. The importance of problem-solving skills in mathematics education has been recognized for some time. One of the main objectives of the curriculum is to teach students how to solve problems effectively. The ranking of the development of problem-solving skills as a top aim in the curriculum designs of many countries demonstrates the value of these talents.

"Problem solving skills have an important place among the main objectives of the curriculum," were the words of Ozturk and Guven (2016). Minarni (2017) argues that problem solving is a very important ability for humans to acquire since, from the moment of their birth, they have faced complex problems that required them to find solutions. In addition, as stated by Liljedahl et al. (2016), there is a long-standing belief that solving mathematical puzzles is an essential component of both learning and teaching mathematics. Mathematical competence must to be shown via problem-solving tasks, not by depending on previous knowledge of how to solve problems, according to Szabo and Andrews (2017: 1455).

As they go through problems, students have the opportunity to apply what they've learned conceptually, think critically, and employ strategies. When it comes to problem solving, there are four distinct indicators that Polya (1973) found: 1. Identifying the issue; 2. Formulating a strategy to solve it; 3. Implementing the plan to resolve the problem; and 4. Assessing the results and process of the solution. Many students experience difficulty in solving mathematical problems. The difficulty lies in students representing the sentences in the problem into mathematical sentences. Sometimes students can answer math questions without paying attention to the process of getting the answer. This causes students to experience difficulties learning mathematics which results in students' low problem solving abilities. Students more often and like to take notes or memorize mathematical concepts, even though they do not understand what they are memorizing and noting. The most common difficulties or errors experienced are in the strategy of carrying out calculations, checking the process and results of calculations (Wahyudi, 2014). Things like this cause when at any time students are given a mathematical problem and asked to solve it using a

structured process, they do not understand the problem and are unable to use the strategies that will be used to solve the problem that has been given.

Problem solving activities will be more meaningful if the learning is linked to problems found in everyday life. One of the mathematical materials related to real life is the application of differential and integral which is taught further at the high school level so students need to understand it well. The results of previous research also found that students' difficulties in learning differential and integral material lie in its application in daily life and the integration techniques used by students when solving problems are still considered inadequate. Most likely this will result in students' understanding being limited only to procedural knowledge, not to contextual applications of material (Ahmad, 2019).

Real world problems are non-routine problems, through the use of non-routine problems, students not only focus on how to solve problems with various existing strategies, but also realize the power and use of mathematics in the world around them and practice investigating and applying various concepts and materials mathematics that has been studied in class.

For this reason, the learning process in the classroom needs to be changed. Shoimin (2014) stated, "To make learning enjoyable, there needs to be a change in the way of teaching from traditional models to innovative learning", so that students are actively involved and learning is linked to everyday life. One effort to achieve this is by implementing learning that emphasizes the meaningfulness of knowledge. By using these learning models and tools, it is hoped that a pleasant learning process can occur and trigger an effective learning process. The learning model that can be used to make the learning process enjoyable is the Contextual Teaching and Learning learning model.

Contextual teaching and learning (CTL) is based on the premise that both students and teachers may benefit from establishing linkages between theoretical concepts and practical exercises. Trianto (2009) said that learning mathematics with contextual learning requires learning to be meaningful and useful for students in learning using various contexts so as to present situations that students have actually experienced.

Contextual teaching and learning is a learning system that is suited to the brain's performance in constructing patterns that create meaning, by connecting academic content with the context of students' daily lives (Jatmiko, 2010). This works well with materials with

differential and integral applications, which are vital to people's everyday lives. Building on the background information supplied, the researcher is interested in exploring the construction of learning aids that boost students' problem-solving abilities on differential and integral application material via the usage of the contextual teaching learning model.

METHODS

This study is all about research and development. Developing and perfecting a brand-new product is what R&D is all about. The ADDIE model of development was the basis for this investigation. A, design, development, implementation, and evaluation make up the five main steps of this paradigm, as the name suggests. Researchers will improve students' problem-solving skills in differential and integral application content via contextual teaching and learning using a learning tool they develop using this technique. The final product is evaluated based on the specified product quality criteria. Educational materials such as student books and worksheets are made. Class XI students from SMA Dharma Pancasila Medan were the ones that participated in the study. By creating a learning tool that employs a contextual teaching learning paradigm, this project also aims to improve students' problem-solving abilities in integral and differential application content.

RESULTS AND DISCUSSION

This research initiative produced a variety of instructional materials, including student booklets and worksheets. No instructional resource is ever complete without first establishing the Contextual Teaching Learning (CTL) methodology. The validation team that helped develop this educational resource consists of five experts in the field. According to the results of the five validators, the average total validity of the Student Books was 3.43 and the average total validity of the LKPD was 3.46. With results showing tcount > ttable, the mathematical problem-solving skills test instrument likewise came into the valid category, proving that the test instruments and questionnaires could be used and were valid. Reliability for mathematical problem-solving skills was 0.843 (very high category) before the exam and 0.840 (very high category) after. The validation score for the Learning Implementation (RPP) was 3.53. Next, this value is referred to the validity criteria that have been determined. So referring to these criteria, it can be concluded that the lesson plan developed meets the validity criteria in the valid category. The five validators also assessed

the content validity of the mathematical problem solving ability test with a valid assessment, the pre-test validation result was 3.51 and the post-test was 3.56, the language and writing of the questions were very understandable. Furthermore, the recommendations are without revision. These results show that all questions and statements designed meet the valid criteria by the validator. Learning aids developed utilizing the CTL learning model have met the validity standards established by expert and practitioner assessments, according to the results of the aforementioned investigation. Results from the expert review of the student workbooks and textbooks are shown in Tables 1 and 2 below:

Table 1. Student Book Validation Results

Category	Average	Aspect
Format	3,46	Valid
Language	3,51	Valid
Contents	3,31	Valid
Total average	**3,43**	**Valid**

Table 2. Student Worksheets Validation Results

Category	Average	Aspect
Format	3,46	Valid
Language	3,54	Valid
Contents	3,4	Valid
Total average	**3,46**	**Valid**

Based on the learning materials offered to an observer at both trial meetings I and II, which were based on the CTL learning model, the practicality requirements were not met by the learning implementation observation score in trial I. In the first meeting, the average of the observations was 2.73, in the second, 2.87, and in the third, 3.27. The average of the three meetings was 2.97, which falls into the "poorly implemented" category. Second trial participants, on the other hand, had an average of 3.47 meetings each week across all three trials. The average observation result for learning implementation in experiment II was 3.62, which is considered to be a "well implemented" outcome. So, it's safe to say that the CTL learning model-based learning tools have met all the practical needs for learning tools.

In order to meet the efficacy criteria, the contextual teaching learning model-based learning tool that was built: (1) classical completeness reaches 83.33%, that is, it meets the completeness criteria, namely ≥ 80% of students reach the KKM, (2) achievement of learning objectives, namely at the 1st meeting, is obtained at 81 .75% in learning objective 1,

achievement of learning objectives at meeting 2 was obtained by 78% in learning objective 2, achievement of learning objectives in meeting 3 was obtained by 76.90% in learning objectives 3 and 4. In accordance with the criteria for achieving learning objectives, it is said to be objective learning was achieved with criteria ≥ 75%, (3) the student response questionnaire score in trial I was 84.17% and in trial II was 87.50%. In accordance with the learning aspect criteria, it received a positive response ≥ 80%, The fact that the students were able to grasp the material shows that the teaching was interesting and not boring.

Students' ability to solve problems has clearly improved across the board. Results from trials I and II showed that students' ability to solve mathematical problems improved, according to the normalized gain index. As a result of scoring 0.41 (0.30 < n-gain ≤ 0.70), the students' talents were deemed "medium" in trial I. In addition, the second trial met the "moderate" criteria with an increase of 0.47 (0.30 < n-gain ≤ 0.70). Therefore, it is reasonable to assume that students' ability to solve mathematical problems may be improved by using learning materials developed around the contextual teaching and learning paradigm. The average students' mathematical problem solving abilities for the pre-test and post-test can be seen in the following table:

Table 3. Average Problem Solving Ability

Information	Average		
	Pretest	***Posttest***	***N-Gain***
Trial I	**55,79**	**74,18**	**0,41**
Trial II	**56,12**	**76,95**	**0,47**

CONCLUSION

Educational materials developed using a contextual teaching and learning approach are valid. One reliable and valid research instrument is the Mathematical Problem Solving Ability Test. The learning device has met the criteria for practicality with a score of 3.62 in the "well implemented category" for analysis of Trial II learning outcomes, based on the suggested contextual teaching learning model. The learning aids developed using the contextual teaching learning paradigm fulfill the effectiveness criteria based on (1) classical completeness, (2) attainment of learning objectives, and (3) ratings from student response questionnaires. Results for solving mathematical problems improved in trials I and II, according to the normalized gain index. Therefore, it is reasonable to assume that students'

ability to solve mathematical problems may be improved by using learning materials developed around the contextual teaching and learning paradigm.

ACKNOWLEDGMENTS

The author would like to express his deepest gratitude to all parties who have participated and supported this research. Thank you to supervisors, institutions, respondents, colleagues and beloved families for the guidance, facilities, participation, support and prayers that have been given.

REFERENCES

Ahmad, A. M. (2019). Analisis Kesulitan Belajar Matematika Pada Materi Integral Luas Daerah di Bawah Kurva dan Volume Benda Putar. *An-Nahdhah*, 12(23).

Milaturrahmah, N., Mardiyana, M., & Pramudya, I. (2017). Mathematics Learning Process with Science, Technology, Engineering, Mathematics (STEM) Approach in Indonesia. *Journal of Physics: Conference Series*, *895*(1).

Jatmiko, H. W. 2010. Pembelajaran Sistem Persamaan Linier Dua Variabel dengan CTL. Program Studi Tadris Matematika IAIN Tulungagung.

Minarni, A. (2017). On Eight Grade Students Understanding in Solving Mathematical Problems. *Asian Social Science*, *13*(12), 86–96.

Ozturk, T., & Guven, B. (2016). Evaluating students' beliefs in problem solving process: A case study. *Eurasia Journal of Mathematics*, *Science and Technology sariEducation*, *12*(3), 411–429.

Liljedahl, P., Trigo, M. S., Malaspina, U., & Bruder, R. (2016). Problem Solving in Mathematics Education. In *Encyclopedia of Mathematics Education*. Germany: Spring OPen.

Szabo, A., & Andrews, P. (2017). Examining the interaction of mathematical abilities and mathematical memory: A study of problem-solving activity of high-achieving Swedish upper secondary students. *Mathematics Enthusiast*, *14*(1–3), 141–160

Polya, G. (1973). *How To Solve It: A New Aspect of Mathematical Method (Second ed)* (Second). New Jersey: Princeton University Press.

Wahyudi, I. (2014). *Panduan Lengkap Administrasi Mengajar Guru*. Jakarta: Prestasi Pustaka.

Shoimin, Aris. 2014. *68 Model Pembelajaran Inovatif dalam Kurikulum 2013*. Jakarta: Ar:Ruzz Media.

Trianto. (2009). *Mendesain Model Pembelajaran Inovatif-Progresif*. Jakarta: Kencana Prenada Media Grup.