

Flipbook Digital Instructional Materials Developed Using Contextual Teaching and Learning Methods to Improve Students' Mathematical Problem-Solving Skills Students at Bina Insan Batang Quiz

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Abstract. The purpose of this study is to evaluate the efficacy, validity, and practicality of instructional materials designed with the Contextual Teaching and Learning (CTL) approach to improve students' ability to solve mathematical problems. The results of a study done at SMP IT Bina Insan Batang Kuis with eighth-grade students in the 2023–2024 school year show that: 1) The materials are valid; the average validation scores for lesson plans, teaching materials, and student worksheets are 4.59, 4.71, and 4.74. 2) In trial II, practicality scores increased to 4.24 (high) from 3.03 (medium) in trial I. 3) 88.5% of students finished assignments, while success rates for learning objectives ranged from 76.22% to 92.15%, demonstrating effectiveness. Student opinion was positive, averaging 90.2%. 4) There was a noticeable improvement in reasoning abilities; trial II showed an average normalized gain of 0.471, suggesting medium progress.

Keywords: contextual and teaching learning, learning models, students' mathematical problem-solving ability, teaching resources.

1 Introduction

Education Law 20 of 2003 provides that "Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble morals, and the skills needed by themselves and society, nation and state" [1]. A student is said to have attained optimal growth of understanding of competence if the student can get education that meets his or her talents, abilities, and interests. The current fact is that pupils' mathematical problem solving abilities remain low at both the basic and secondary education levels. The low ability of students to answer mathematical issues is related to the teacher's mathematics learning approach, which focuses too much on problem solving. Defines mathematical

problem-solving as a human activity that mixes previously acquired concepts and norms, rather than a general talent [2].

Based on initial observations, researchers discovered issues with the mathematical problem-solving abilities of students in Junior High School (SMP) IT Bina Insan class VIII; nonetheless, the mathematical problem-solving abilities gained remained relatively poor. Observations from two classes revealed that 32 pupils, or 58.2%, had mathematics scores below the Minimum Completeness Criteria (KKM). This demonstrates that learning outcomes are still rather low. Even though the pupils' average scores are considered good, they need to be improved more to achieve the best possible results. believes that students' learning outcomes may be used to determine whether or not learning is successful [3]. Students with poor learning outcomes may struggle to continue their education at a higher level, such as college or university, which can limit their prospects of gaining a better job in the future.

The underlying cause of mathematical problem solving ability differs, and teachers employ typical ways in learning exercises. Conventional teaching methods are also ineffective in involving student participation. Mathematical problem-solving talents in learning necessitate a step-by-step approach for problem resolution. Polya (1973) identified many processes that must be examined in the issue-solving process, namely: (1) how students grasp the problem; (2) how students construct a resolution plan; (3) how students carry out their completion plans; and (4) how to evaluate the results and solutions made [4]

Mathematical problem solving ability is defined as the ability to identify known and asked about elements, as well as the adequacy of the required elements, to create or compile mathematical models, to select and develop a solution strategy, and to explain and check the correctness of the answers obtained [5].

Interviews were also conducted with mathematics subject teachers and students at SMP IT Bina Insan Batang Kuis class VIII to supplement the findings of observations, which suggested that one of the factors influencing the low mathematical problem solving abilities of class VIII students at SMP IT Bina Insan Batang Kuis was the use of less interesting teaching materials. Students continue to use textbooks and non-interactive teaching materials that are typically used during classroom learning, with no utilization of creative teaching materials. Feels that teaching materials are too difficult for students to understand, which might lead to misconceptions since students struggle to comprehend the book's contents [6]. Teachers and students demand their learning materials to be more engaging and relevant to real-world situations, so that they can comprehend how the principles they study can be used in everyday life.

Learning with Contextual Teaching and Learning (CTL)-based teaching materials can be the right solution for teachers in maximizing the learning process according to the current needs of students because the teaching materials are designed in an attractive and innovative manner, accompanied by pictures, animations, learning audio, and practice questions that directly receive instant feedback from students [7].

Implementing learning through teaching materials can encourage students to actively explore their knowledge and learn independently [8]. The usage of teaching materials can help motivate students to learn since they have a full look and include diverse teaching resources such as text, audio, video, animation, and images with appealing color proportions [9].

Contextual Teaching and Learning (CTL) is a learning system founded on the notion that if a learner understands the lesson's purpose, they will be ready and able to absorb it [10].

Education, like other aspects of society, undergoes changes as technology advances. The advancement of science and technology in the twenty-first century promotes interactive learning. To confront the challenges of 21st-century learning, everyone must have critical thinking skills, as well as knowledge and abilities in digital literacy, information literacy, instructional material literacy, and information and communication technology mastery [11].

Digital teaching materials refer to a person's capacity to effectively use, understand, and engage in the digital environment. This requires knowledge of information technology and online communication, as well as vital abilities in obtaining, assessing, and using information effectively in the digital world. Digital literacy, also known as digital information literacy, as a person's ability to absorb and use information from multiple sources via a computer connected to the internet. The availability of learning teaching materials and their use is also a problem encountered in classroom learning [12]. There is a need for complementary teaching materials that can help students carry out learning and repetition independently [13]. Learning teaching materials must be more interesting and fun so that students are more enthusiastic in learning. Learning should have meaning as an activity carried out to create an atmosphere or provide services so that students want to learn [14]. One of the digital learning teaching materials that can be used to support the current learning process is e-modules.

Contextual models improve students' mathematical problem-solving abilities more than traditional learning techniques [15]. The CTL Learning Approach is a link between instructional material or subjects and real-life situations [16]. The characteristics of contextual teaching and learning are as follows: cooperation between students and teachers (cooperative); mutual assistance between students and teachers (assist); fun, not boring; learn with passion (enjoyfull learning); contextually integrated learning; using multimedia and learning resources; how active students learn (student active learning); sharing with friends (take and give); critical students and creative teaching. Student reports include not just report cards, but also student work results, practicum outcome reports, student essays, and so on [17].

The significance of generating educational materials is as follows: a) effective teaching materials are very helpful in the learning process so that learning objectives are more easily achieved, b) teaching materials can provide useful information for students in the learning process, c) variations in teaching materials can give students enthusiasm for learning, avoid boredom, and have implications for students' interest and motivation in participating in the learning process, d) developing a variety of models is very important because defines the learning approach as our starting position or point of view on the learning process, which refers to the perception of the occurrence of a process that is still extremely broad in nature. [19] Meanwhile, defines teaching materials as any type of material utilized by teachers to conduct teaching and learning activities. [20].

2 Methods

This is an example of educational development research, also known as Research and Development (R&D). Research and development (R&D) procedures are those that are used to

create new items and then "test their effectiveness" [21]. This study used a more general learning design paradigm, specifically the ADDIE model. Development research in learning is a process that involves developing and validating products utilized in the learning process [22]. This study was conducted at SMP IT Bina Insan Batang Kuis, which is located in JL. Nusa Indah Gg. Melati No.47, Tanjung Sari, Kec. Batang Kuis, Kab. Deli Serdang, North Sumatra. This research was conducted during the even semester of the 2023/2024 academic year. Class VIII students at SMP IT Bina Insan Batang Kuis, specifically VIII-ASMA with 26 students and VIII-RUFAIDAH with 29 kids.

The researchers utilized the ADDIE research approach, which stands for Analysis, Design, Development, Implementation, and Evaluation. This study approach was chosen because it is more systematic and comprehensive, as each stage includes an evaluation stage.

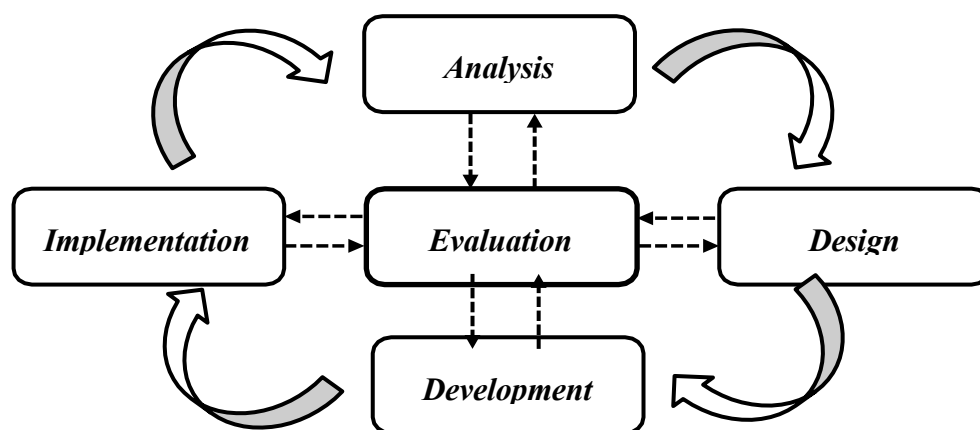


Fig. 1. ADDIE Model Development Design

(Branch 2009 : 2)[23]

The steps or methods in this research comprise the Analysis, Design, Development, Implementation, and Evaluation stages.

2.1 Analysis

The analysis stage is where the researcher assesses the need for constructing a learning model, as well as the feasibility and development requirements. The initial analysis conducted by researchers in this development research was to make observations at SMP IT Bina Insan Batang Kuis on the mathematics subject of Statistics material, resulting in the following information:

Table 1 . Observations at SMP IT Bina Insan Batang Kuis on the mathematics

Class	Student Street	KKM	Not pass	Percentage	Passed	Percentage
VIII- ASTHMA	26		16	61.5%	10	38.5%

VIII- RUFAIDAH	29	75	16	55.1%	13	44.9%
Amount	55		32	58.2%	23	41.8%

Overall, 23 (41.8%) pupils passed the KKM, while 32 (58.2%) did not. In general, the cognitive development of IT Bina Insan Batang Kuis Middle School students moves into the formal operational stage. This is demonstrated by the age range of children between 13 and 16 years old, when cognitive growth is characterized by logical, abstract, and idealistic thinking. As a result, it would be highly appropriate if mathematics learning in schools adopted a CTL strategy that was able to assist students actualize an abstract theory into concrete issues, so that students could more readily understand the topic.

2.2 Design

Designing student flipbook media to produce a prototype (first design of flipbook media) for Statistics material. Activities at this stage include the following:

1. Creating Storyboards
2. Arrangement of Learning Materials
3. Media Selection.
4. Create a Learning Implementation Plan (RPP)
5. Create Student Worksheets (LKPD)
6. Create a flipbook blog

2.3 Development

The next stage of the ADDIE paradigm is development. This stage is the next step in the design process for a product. Products must be verified to ensure that they are safe for usage. Material experts, media experts, and design experts all perform validation.

2.4 Implementation and evaluation

The learning tools are tested at the research location, which is class VIII of SMP IT Bina Insan Batang Kuis, which contains trials I and II. The learning implementation stage is represented by draft II. The findings of teacher interviews are used to evaluate teachers. Upon completion of the evaluation stage, the products undergo final revisions based on input from subject matter experts and instructional materials specialists. Additionally, the product is assessed using data from the student response attractiveness questionnaire and test results to ascertain its viability and efficacy.

3. Results and Discussion

3.1 Description of the Validity of Teaching Materials and CTL Learning Model Tools

The assessment involves several components, notably material aspects, presentation aspects, and language aspects, as shown in the table below:

Table 2 . Recapitulation of Validation Results of Developed Teaching Materials

No	Object The Assessed	Total Average	Description
1.	Implementation Plan (RPP)	4.59	Very Valid
2.	Sheet Activity Participant Educate (LKPD)	4.74	Very Valid
3	Teaching materials	4.71	Very Valid

Expert validation results usually indicate that the CTL model teaching materials generated can meet the demands of statistical learning needs. As a result, we can infer that the CTL model teaching materials generated in this study met the validity criteria.

3.2 Description of the Practicality of Teaching Materials and CTL Learning Model Tools

The practicality of learning media is vital to understand because one of the objectives for learning media is ease of use [24]. The observation score for learning implementation did not fulfill the practicality criteria in trial I, with a score of 3.07 at meeting I and a score of 3.00 at meeting II, resulting in an average of 3.03 (category "Medium"). Regarding trial II, the results were 4.47 at the first meeting, 4.20 at the second meeting, and 4.07 at the third meeting. In trial II, the average score for witnessing the application of learning was 4.24, falling into the "High" category. This is corroborated by [25] point of view, which holds that learning media meet practical requirements if their observations during class yield results that fall into the good or very good category.

3.3 Description of the Effectiveness of Teaching Materials and CTL Learning Model Tools

The following table displays the answers to the response questionnaire that 26 students completed following their use of the CTL learning model:

Table 3 . Results of Assessment of Learning Effectiveness Criteria in Trials I and II.

Type of Assessment	Overall Average			
	Trial I	Category	Trial II	Category
Problem solving skill	73.81	Enough	82.46%	Good
Achievement of Learning Goals	73.80	Enough	83.09%	Good
Student Response	80.2	Good	90.2%	Very good

Ability to solve problems in a trial There were 14 pupils (53.8%) in the poor group, 9 students (34.6%) in the sufficient category, and 3 kids (11.6%) in the good category that I received. The trial resulted in an overall average that fell into the good category. However, out of the four learning objectives, only two—finding the average value of a data set (68.92%) and figuring out the mode and median values of a collection of data (52.31%)—were completed. Trial I's overall student responses likewise yielded a respectable average. Only 67% of respondents indicated that they were interested in the statement item about students' interest in the presentation of teaching materials and LKPD.

The findings of this study lead to the conclusion that the generated textbook is legitimate, practical, and beneficial for usage in the learning process. Students will be more active in managing their learning tasks if they implement the learning model developed by teachers in the early stages of learning and complete their assignments, resulting in more effective learning and having an impact on student learning outcome criteria. Based on the findings of this study and previous research, it is possible to conclude that the CTL model teaching materials developed met the indicators of effectiveness in terms of the completeness of student learning as evidenced by students' achievement of mathematical problem solving ability tests.

3.4 Increasing Students' Mathematical Problem Solving Abilities

There has been an increase in students' mathematical problem solving abilities, according to the study of the students' mathematical problem solving ability exams from trials I and II. The number of students who received $g < 0.3$, or the "low" group with a value of 0.295, indicated that there was an increase in the students' mathematical problem solving ability in trial I, according to the average normalized n-gain. In the second experiment, the average gain was 0.471, falling into the "Medium" category ($0.30 \leq g < 0.70$).

$t_{count} = 2.890$, $t_{table} = 2.00$ at the 5% significance level, and $t_{table} = 2.65$ at the 1% significance level are the results of the comparison. This indicates that at both the 1% and 5% significance levels (2,002.65), t_{count} is bigger than t_{table} . to improve one's capacity for solving mathematical puzzles. Therefore, it can be inferred from the findings of current research as well as earlier research that the CTL model teaching materials can enhance students' aptitude for solving mathematical problems.

4. Conclusion

According to expert validation scores of 4.59 for learning implementation plans, 4.71 for teaching materials, and 4.74 for student worksheets, the research on digital learning media created utilizing the CTL technique shows that the educational resources are valid. This indicates overall strong validity. An 88.5% student completion rate and first-period medium practicality scores that improved to high were noted in the observational data. Ninety-two percent of students expressed satisfaction, indicating that the learning objectives were largely satisfied. Success rates ranged from 76.22% to 92.15%. Furthermore, there was a noticeable improvement in the students' ability to solve mathematical puzzles, as seen by the average normalized N-gain scores moving from a low to a medium category between trials.

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