Prototype Applied Differential And Integral Learning With Contextual Teaching Learning

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Abstract. Differential and Integral Applied Prototype with Contextual Teaching Learning SMA Kota Medan. Research produces: Teaching materials, Learning Program Plans, Student worksheets on Contextual Teaching Learning in High School (SMA) Medan City. The implementation process according to 4-D define, design, develop, and disseminate includes the process of implementing differential and integral applied learning in grade XI Senior High School. The implementation was carried out on x differential and integral applied learning on Newton's law of cooling with cookie dough put in the oven at a certain temperature, Toricelli flow problems with a tank filled with water then water removed with a cross section p cm, population growth and weathering by measuring the age of fossils, the spread of epidemics in a limited area and the dissemination of information through contextual teaching learning models

Keywords: validity, practicality, effectiveness, development, prototype.

1. Introduction

The breakthrough of Medan City government policy in order to build good urban planning and which is based on the intention for a civilizational progress. This strategic plan produces the City's core programs, namely: Medan blessing, Medan advanced, Medan clean, Medan building, Medan conducive, Medan innovative, and Medan identity (RPJMD 2021-2026).[1]

Thus the program "Medan Maju". In short, Medan Maju has the goal of "Improving the quality of the people of Medan City" or "Improving the quality of educators and education personnel".[2]

This program is consistently carried out in order to create educators as pioneers of changes in children's civilization in the school world. The meaning of this program is a basic need and is an annual program of the Medan City Government, because the young generation of Medan City in this case students are in the hands of professional educators and one of the main responsibilities of the city government in advancing the civilization of the people of Medan City

In order to support the progress of City civilization through education, it is necessary to maximize the Medan City Government, such as:

1) Encouraging the improvement of education quality by improving effective and modern digital media-based education services.
2) Encouraging the improvement of the quality of education through appreciating principals, teachers and outstanding students.
3) Encouraging the improvement of education quality through increasing the competence of certified teachers in using digital technology for learning.
4) Encouraging the improvement of education quality through increasing competence, curriculum and national assessment for educators and education personnel starting at the elementary school level in Medan City.
5) Encouraging the improvement of the quality of education through improving the managerial competence of school principals.
6) Encouraging the improvement of education quality through increasing the competence of educators and improving the welfare of poor students at elementary, junior high and high school levels in Medan City.

In accordance with Unimed's Strategic Plan: Increasing resources by taking into account the development needs of existing study programs, and national needs for education and research services[3]. Educational research policies are based on the real needs of schools to enrich educational teaching materials in the form of learning innovations. The development of effective and efficient learning resources and education systems is sought to involve the academic community in collaboration with related agencies. Improving the quality of learning with the improvement of the quality of human resources and the welfare of the community[4]. Educational research policies based on real needs in schools are carried out to enrich educational teaching materials in the form of learning innovations. The development of effective and efficient learning resources and education systems is pursued by involving the academic community in collaboration with related agencies.[5]Improving the quality of learning boils down to improving the quality of human resources and the welfare of people's lives[6].

As the only State LPTK in North Sumatra, Unimed is a consulting center to solve educational problems. Learning devices used in the learning process in the classroom[7]. The learning tools developed are[8]: Learning Program Plan (RPP), Syllabus, Student Worksheets (LKPD), books and evaluation tools. Preparation of early stage tools in learning. Therefore, the quality of the devices used determines the quality of learning[9]. To produce good quality devices, learning tools are carefully arranged[10]

In the teaching materials in the Odd-Even semester of high school, differential and integral learning[11] in the curriculum is related to the application of Newton's law of cooling, Toricelli's law, flow problems, laws of growth and weathering, pandemic laws and information dissemination through contextual teaching learning models.

As is known, the implementation of the curriculum and implementation tools is not as expected, where the government is perceived to lack socialization of its implementation. The government announced that the curriculum was implemented by strengthening socialization for some time. So that with the completion[12] of a few years of full socialization in school; can help the successful implementation of the curriculum. In socializing implementation, strengthening the development of high school mathematics learning tools, increasing the validity, practicality, and effectiveness of learning implementation.[13]

Problem Statement
1) What is the validity of the learning prototype of differential and integral high school teaching materials related to the application of Newton's law of cooling, Toricelli's law, flow problems, law of growth and weathering, pandemic law and dissemination of information through contextual teaching learning models?
2) How is the practicality of the learning prototype of differential and integral high school teaching materials related to the application of Newton's law of cooling, Toricelli's law, flow problems, laws of growth and weathering, pandemic laws and information dissemination through contextual teaching learning models?
3) How is the effectiveness of the learning prototype of differential and integral high school teaching materials related to the application of Newton's law of cooling, Toricelli's law, flow problems, law of growth, weathering, pandemic law, dissemination of information through contextual teaching learning models?

2. Method
This research is a development research using Thiagrajan's 4D model development[14]. According used to produce certain products, and test the effectiveness of these products. The research location used in this study was SMA Gajah Medan Kota Medan as many as 17 people. The research will be conducted in January-November 2023.

The implementation activities follow[15] the Four D's: Define, Design, Develop, and Disseminate development of learning prototypes for differential and integral high school teaching materials related to the application[16] of Newton's law of cooling, Toricelli's law, flow problems, law of growth, weathering, pandemic law and dissemination of information with contextual teaching learning.

In this study held are: validation sheet; expert and practitioner assessment sheets to measure the validity, practicality and effectiveness of teaching materials; observation sheet; questionnaires of student and teacher responses; and learning outcomes tests.

3. Results and Discussion
The results of the research prototype learning prototype applied integral differential in Class XI SMA Kota Medan teaching materials, RPP oriented contextual teaching learning at SMA in Medan City**.**

The realization of the validity, practicality, and effectiveness of the devices used, through data analysis, shows that:

3.1. Average RPP Validation Results 1-RPP 06

The state of the process of implementing RPP 1 - RPP 6 differential and integral applied learning related to the application of Newton's law of cooling, Toricelli's law, flow problems, laws of growth and weathering, pandemic law and information dissemination through contextual teaching learning learning models, which are designed to be improved or revised according to validator suggestions and research team input, in trials. In the application of teaching materials that are contextual, differential, and integral, Newton's law of cooling is applied in cooking cookie dough into an oven whose temperature is kept constant; Toricelli's law applied to a tank of a certain height a meter with a cross section of d cm and the velocity of water coming out of the tank cross-section is: $v = 0{,}2600 \sqrt{2gh}$; the law of growth by differentiation and geometry and the time required for C14 levels in weathering according to Willard Lubby's law; and the law of spreading plague or analogous to the spread of information which states that the rate of change of plague in a community is directly proportional to the number who experience plague with a healthy number. This application is an application with problems that are the context of actual problems faced in the midst of contemporary community life.

The results of the assessment of expert validators RPP 1 - RPP 06 applied integral differential learning developed, are briefly summarized in Table 1.

Table 1. Summary of RPP 1 - RPP 06 Component Validation Results

Number.	Assessed aspects	Average Score	Information
1	Core Competencies	4,06	Valid
2	Basic competencies and indicators of competency achievement	4,06	Valid
3	Learning Objectives	4,07	Valid
4	Learning Materials	4,09	Valid
5	Learning Methods	4,15	Valid
6	Media and teaching materials	4,13	Valid
7	Learning resources	4,13	Valid
8	Learning steps	4,09	Valid
9	Valuation	4,13	Valid
	Total Average	4,10	Valid

Based on Table 1. above, it can be explained that the validation results from expert validators against RPP 1 - RPP 6 components: Core competencies 4.06 are valid; Basic competencies and competency achievement indicators 4.06 are valid; Learning objectives 4.07 valid, learning materials 4.09 valid, learning methods 4.15 valid, media and teaching materials 4.13, learning resources 4.13; learning steps 4.09; The rating is 4.13, and the average total score is 4.10. Thus, from the results of the assessment expert validators conclude that the differential and integral applied prototypes developed are valid.
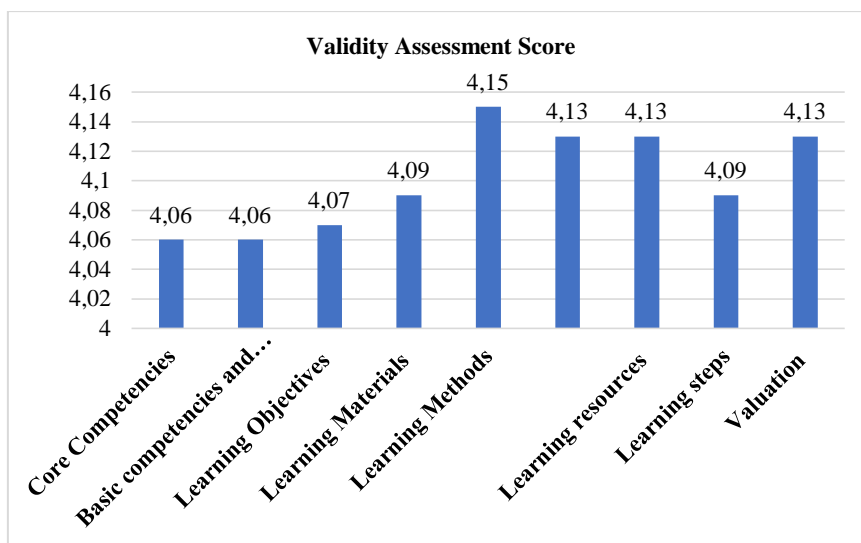
Figure 1. Average Histogram of Component Validity Score RPP 1 – RPP 6

3.2. Average Results of Practicality of RPP 1- RPP 6

The results of the implementation of integral and integral differential applied prototype learning in class XI SMA Kota Medan based on the contextual teaching learning model meet the criteria on aspects of teacher activities and student activities in the trial, briefly presented in Table 2.

Table 2. Average Results of Observations of the Implementation of Integral Differential Applied Learning Trials RPP 1 – RPP 6

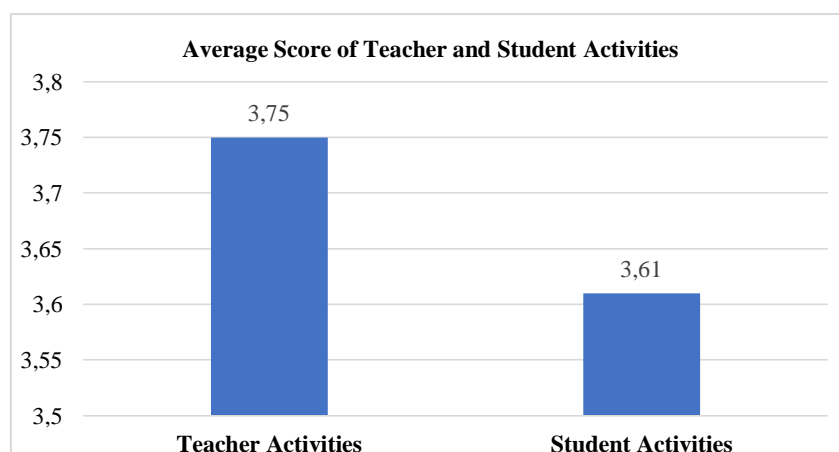| Average Score of Teacher and Student Activities	RPP 1-RPP 6
Teacher Activity	3,75
Student Activities	3,61

Figure 2. Average Learning Prototype Implementation Score RPP 1 – RPP 6

Thus, from the results of the RPP 1-RPP 6 lecture trial, it shows that the practicality of learning based on teacher and student activities is classified as practical criteria. This also concludes that the implementation of integral differential applied prototype learning For the application of contextual, differential, and integral teaching materials with Newton's cooling penalty will be applied in cooking cookie dough into an oven whose temperature is kept constant; into Toricelli's law on a tank of a certain height a meter with a cross section d cm and the velocity of water escaping from the cross-section of the tank: : $v = 0{,}2600\sqrt{2gh}\frac{m}{s}$; flow problems will apply the initial water content in the tank with the water content that comes out along with the speed of water in and out; the law of growth by differentiation and geometry and the time required for C14 levels in weathering according to Lubby's law; and the law of the spread of plague or analogous to the spread of information which states that the rate of change of plague in a community is directly proportional to the number who experience plague with a healthy number. This application is the application of problems that are contextual to actual problems that exist in the midst of people's lives that are currently being tested RPP 1 – RPP 6 by using an integral differential applied prototype in class XI SMA Kota Medan, based on the contextual teaching learning model, it meets practical criteria.

3.3. The results of the completeness of RPP 1- RPP 6

The implementation of an integral differential applied prototype in class XI of SMA Kota Medan based on the contextual teaching learning model meets the completeness criteria presented in Table 3 below:

Table 3. Summary of Student Learning Completeness of RPP 1 - RPP 6 Implementation

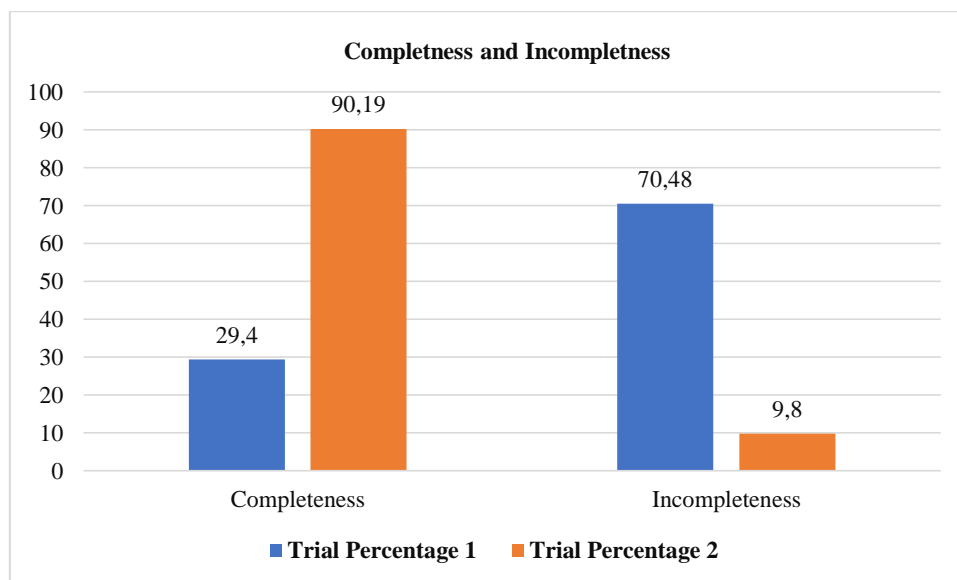|	**Trial Percentage 1**	**Trial Percentage 2**
Completeness	29,4	90,19
Incompleteness	70,48	9,8

Figure 3. Completion Percentage of Trial 1 and Trial 2 RPP 1 – RPP 6

Overall, based on the results of trial 2, it shows that the implementation of RPP 1 - RPP 6 integral differential applied prototype in class XI SMA Kota Medan 80.52 contextual teaching learning models meet the criteria of meeting the effectiveness criteria.

In line with Harahap's research[17]. (2022)., which was carried out in MTsN by developing interactive student worksheets on mathematics learning to improve students' problem-solving skills and learning independence, obtaining validity, practicality, and effectiveness of the developed LKPD tools; The implementation pattern with the Four D's in the number row pattern material experienced a significant increase of 80.52% in the category of both positive attitudes and negative attitudes with a percentage of 81.15% in the good category[18]. While the research conducted by Pulungan Khairun Nisa[19]. (2022). The development of smartphone application-based learning tools to improve learning outcomes and student learning independence at SMAS Nurul Amaliyah which resulted in trial I and trial II there was an increase in learning outcomes from an average score of 60 to an average score of 78.7. Increased learning independence from trial I 3.36 to trial II from 3.90 . Then the results of Ginting Attania's research. (2022)[20]. Development of learning tools based on contextual teaching learning models with the Karo cultural context to improve the problem-solving ability and self-efficacy of junior high school students, which results in an increase in students' mathematical problem-solving abilities using CTL-KBK-based learning tools seen from the N-gain value in the distribution results of 0.49 which is in the medium category; is increasing the achievement of student self-efficacy by using CTL-KBK-based learning tools seen from the N-gain value in the spread results of 0.47 which is in the medium category. Sirait Febry is researching. (2022)[21]. Development of autograph-assisted problem-based learning models to improve students' mathematical problem-solving abilities, which resulted in the implementation of learning devices in trial I of 3.93 and trial II of 3.80 which showed practically developed devices; While the effectiveness aspects of learning tools developed are seen from the learning objectives of classical completeness, the achievement of learning objectives, student responses and learning time at least the same as ordinary learning. The classical completeness of mathematical problem solving ability in trial I was 66.67% and trial II was 86.67%. The achievement of learning objectives in trial I has been achieved for questions 1-4, while for questions 5 has not been achieved. While in trial II the achievement of the learning objectives has been achieved, which is ≥ 75% per question item. The average student response in trial I was 91.60% and trial II was 97.71%. Through the gain index, it was obtained that in trial II there was an increase with a score value of 3.83. Thus, this research pattern of improving learning outcomes of applied prototypes, differential and integral to contextual teaching learning at SMA Kota Medan tends to increase in trial II, very relevant to previous research.

4. Conclusion

The implementation of integral differential applied prototype learning in class XI SMA Kota Medan based on the contextual teaching learning model produced in accordance with the achievement target with criteria of validity, practicality, and effectiveness. So the use of differential and integral applied prototypes with contextual teaching learning SMA Kota

Medan, differential and integral applied prototype learning with contextual teaching learning SMA Kota Medan can be used on a larger scale.

The development of integral differential applied prototype learning in class XI of SMA Kota Medan based on the contextual teaching learning model is an enrichment material for students at SMA Kota Medan which greatly opens students' thinking insights into differential and integral applications

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