The Development of Student Digital Worksheets Based on Logan Avenue Problem Solving (LAPS)-Heuristic to Improve Critical Thinking Skills

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The Development of Student Digital Worksheets Based on Logan Avenue Problem Solving (LAPS)-Heuristic to Improve Critical Thinking Skills

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Abstract *This research aims to develop a student digital worksheet product with a valid, practical, and effective model of Logan Avenue Problem Solving (LAPS)-Heuristic . Using the ADDIE model, results show the worksheet enhances critical thinking skills. The validity obtained from the material expert is 92% and based on the media expert is 85.4%. Also, the percentage of practicality is 92.9% and is included in the practical category. Implementation of learning with the application of student digital worksheets Effectiveness was demonstrated with 86.67% of students meeting learning completeness, and a medium improvement in critical thinking skills (gain score: 0.639). From the collected data, it is concluded that the Logan Avenue Problem Solving (LAPS)-Heuristic learning model developed meets the qualifications of valid, practical, and effective.*

Keywords*: **Student Digital Worksheet, Logan Avenue Problem Solving (LAPS)-Heuristics, Critical Thinking.***

Abstrak . Tujuan dari penelitian ini untuk menghasilkan produk lembar kerja digital siswa dengan model pembelajaran Logan Avenue Problem Solving (LAPS)-Heuristik yang valid, praktis, dan efektif. Dengan menggunakan model ADDIE, hasil penelitian memperoleh lembar kerja digital dapat meningkatkan kemampuan berpikir kritis. Validitas yang diperoleh dari ahli materi sebesar 92% dan berdasarkan ahli media sebesar 85,4%. Selain itu, persentase kepraktisan sebesar 92,9% termasuk kategori praktis. Keterlaksanaan pembelajaran dengan penerapan lembar kerja digital siswa efektif ditunjukkan dengan 86,67% siswa memenuhi ketuntasan belajar, dan peningkatan kemampuan berpikir kritis yang sedang (Skor N-Gain: 0,639). Melalui data tersebut diperoleh model pembelajaran Logan Avenue Problem Solving (LAPS)-Heuristik yang dikembangkan memenuhi kualifikasi valid, praktis, dan efektif.

Kata kunci : Lembar Kerja Digital Siswa, Pemecahan Masalah Logan Avenue (LAPS)-Heuristik, Berpikir Kritis.

1. Background of The Problem

21st century learning that emphasizes learning skills that must be instilled in students including critical thinking, creative thinking, communication, and collaboration. Critical thinking skills are abilities that must be mastered enabling students to think, describe, solve problems and express opinions based on the information they have learned (Aliftika 2019). Looking at the situation in the field, namely based on the findings of interviews with one of the mathematics teachers at SMAN 8 Medan, it is obtained that some students get daily test scores below the KKM 70. This is because students have difficulty working on non-routine problems where the problems given during the test are

different from the examples discussed during the lesson. Finally, students fixate on the solution given by the teacher and do not try to find other solutions. This also causes students' thinking skills in exploring information to be low, which also has an impact on conceptual understanding so that students cannot solve problems.

One of the reasons for the low critical thinking skills of students is that teachers still apply teacher centered learning. Teacher Centered Learning is learning in the form of lectures when following the learning process or listening to lectures, students are only limited to understanding while taking notes. In addition to the learning model which is a pedagogical anticipation, the design of the teaching materials used must also be clearly and systematically described in the presentation of material, sample questions are questions made based on indicators of critical thinking skills. Teachers have not implemented student worksheets that support students to develop critical thinking skills. Student worksheets often use student worksheets from publishers, whereas student worksheets can be made by educators themselves based on the needs of students so that they can build their concepts in solving problems According to Siregar,et al., (2022: 62) an important role in media selection because it can present, edit and distribute information and the need to consider curriculum factors that can support the student learning process to achieve appropriate competencies

Researchers analyzed several learning models that focus on students implemented into student worksheet, one of these models is Logan Avenue Problem Solving (LAPS)-Heuristic. This model can facilitate students to think critically as outlined in the student worksheets. In the process of making student digital worksheets with the help of the Articulate Storyline 3 application, According to Yasin & Ducha (2017), one of the interactive media that can be used is Articulate Storyline, because this software is very interesting if used as an interactive learning media. And this software can involve students in learning this helps students stay engaged and makes learning easier for them to comprehend. (Siregar,et al.,2022) By providing student digital worksheets based on Logan Avenue Problem Solving **(**LAPS)-Heuristics not only provides quality teaching materials but also provides answers to produce learning that is easy to understand. In

addition, this student digital worksheet can facilitate the improvement of students' critical thinking skills by using a learning approach that is self-adjusting in the learning process.

2. REVIEW OF RELATED LITERATURE

1. Critical Thinking Skills

Azizah, et al (2018:62) state that mathematical critical thinking skills are the cognitive process of students in distinguishing problems and analyzing, identifying, and examining the information needed to provide a plan to solve existing problems.

Facione (in Lestari, 2018) suggests four indicators of mathematical critical thinking skills are: (1) Interpreting, where students begin by understanding the problem through noting what is known and what is being asked; (2) Analyzing, where students identify relationships among statements, questions, and concepts presented in the problem; (3) Evaluating, demonstrated by applying the appropriate strategy to solve the problem; and (4) Concluding, where students draw accurate conclusions based on their solutions.

2. Logan Avenue Problem Solving Model

According Shoimin (in Ningsih,et al., 2020) "The Logan Avenue Problem Solving (LAPS) - Heuristic model is a series of questions that are demanded in problem-solving, Logan Avenue Problem Solving (LAPS) - Heuristic usually uses the question words what is the problem, is there an alternative, is it useful, what is the solution, and how should you do it".

Arini et al (2021) also suggest that there are four phases in the LAPS-Heuristic, namely:

1. Understanding the problem At this stage, the teacher will help Student recognize the problem so that they can understand the various parts of the problem.
2. Devising a plan At this stage, Students will be directed to examine known and unknown data/variables, filter out various information obtained, and finally define the problem, after which they will be directed to develop a problem-solving plan to find alternative solutions to the problem from various points of view.
3. Carrying out the plan (solving the problem) At this stage, Students carry out problem-solving steps based on alternative solutions chosen in the previous stage.
4. Looking back (re-examining the results obtained) This stage is intended to help Students by reviewing the problem-solving steps that have been carried out.

3. Student Digital Worksheets

Student Digital Worksheet is part of E-Learning in the form of electronic or internet-based student worksheets and learning media to support student learning activities (Farkhati & Sumarti, 2019).

Puspitasari, A.D (2019: 18) states that an "Interactive Student Digital Worksheet is a form of presentation of teaching materials that contains animated content, images and videos that are structured into learning units in a digital format so that users are more interactive with the product results.

4. Articulate Storyline 3

Articulate Storyline is a software that acts as a learning support media. Its function is to present learning materials in the form of e-learning by using a storyline project. This software allows users to combine various media elements such as visuals, sound, and multimedia content in learning presentations with the help of Articulate Storyline, learning materials can be presented interestingly and interactively (Siregar, et al.,2023).

3 . Methodology

The research took place during in the even semester of the 2023/2024 academic year at SMA NEGERI 8 Medan. From all students of class XI of SMAN 8 Medan, 1 class XI will be selected at the school. Also, the object of this research is a learning media in the form of Student Digital Worksheets assisted by articulate storyline 3 developed based on Logan Avenue Problem Solving (LAPS)-Heuristic model. The purpose of this research is to develop Student Digital Worksheets wit the Application of Derivative material in class eleven grade 3 SMAN 8 Medan and the feasibility of using the media. The methodological approach used in this research is Research and Development (R&D). The research model used is the ADDIE instructional model.

4 . Results and Discussion

This research and development produces interactive student worksheets to improve the critical thinking skills of eleven-grade students. The worksheet contains the Application of Derivatives material and tests in two classes of eleven-grade students of SMA Negeri 8 Medan. At the Implementation stage, the learning media in the form of the developed mathematics student worksheet was tested with class teachers and 30 students of SMA Negeri 8 Medan.

1. Validity

The validation results consist of validation of lesson plans, Student Digital Worksheets, pretest and posttest tests. The validation results can be observed in the table below:

Table 4. *1* Validity of Learning Devices

No	Learning Tools	Percentage of Validity	Category
1	RPP	92%	Very Valid
2	Student Digital Worksheets (Material Expert)	92%	Very Valid
3	Student Digital Worksheets (Design Expert)	85,4%	Very Valid
4	Pretest	90,2%	Very Valid
5	Posttest	88,89%	Very Valid

In table 4.1 above, it can be seen that the lesson plans, student digital worksheets, critical thinking ability tests obtained a percentage of validity in the very valid category. It said that the learning tools that have been prepared meet the criteria for use.

2. Practicality

In this study, student digital worksheets can be said to be practical if the teacher and student response questionnaires get results that can meet the predetermined practical criteria. Based on the results of the practicality data analysis results, the percentage of practicality for the teacher response questionnaire is 90.27% where the percentage falls into the very practical category.

Furthermore, based on the student response questionnaire, the percentage obtained by practicality is 92.9% which is included in the very practical category that has been determined. Therefore, based on these two results, both from teacher and student response questionnaires, it can be concluded that student digital worksheets based on Logan Avenue Problem Solving are very practical to use in learning.

3. Effectiveness

In the trial of student worksheets that have been developed based on Logan Avenue Problem Solving, the results of the final ability test (posttest) are obtained with classical student learning completeness of 86.67% or equivalent to individual student learning completeness of 26 students out of 30 total students

Description	Pretest	Posttest
Average test result	45,5	80,16
Number of students who completed the test	2	26
Percentage of students who completed the test	6,7%	86,67%
Number of students who did not complete the learning	28	4
Percentage of students who did not complete the learning	93,3%	13,33%
Classical learning completeness	Not Completed	Completed

The next criterion for determining the effectiveness of student digital worksheets is the achievement of learning indicators/objectives from the pretest and posttest results. The provisions for achieving indicators/learning objectives are at least 75% for each indicator obtained by at least 65% of students. The percentage from indicator achievement during the field trial is shown in Table 4.3.

Table 4. 3 Percentage of Achievement of Field Trial Indicators

No	Indicator	Pretest		Posttest	
		Percentage	Description	Percentage	Description
1	Interpretation	63%	Not Completed	91%	Completed
2	Analysis	46%	Not Completed	85%	Completed
3	Evaluation	39%	Not Completed	84%	Completed
4	Inference	34%	Not Completed	79%	Completed

The percentage of indicator achievement in the field trial is presented in the following figure:

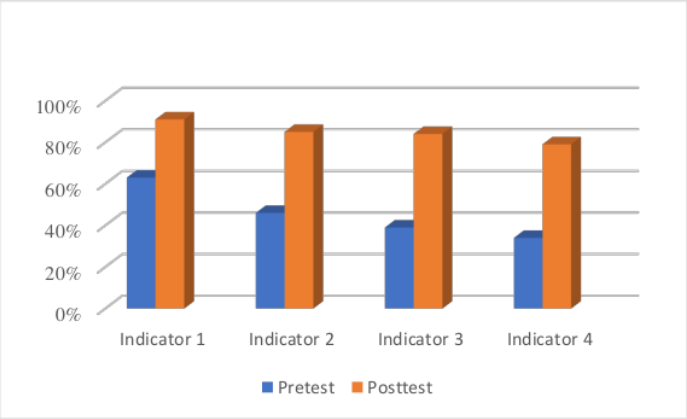

Figure 4.1 Diagram of Percentage Achievement of Field Trial Indicators

Furthermore, the improvement of critical thinking skills can also be analysed based on the n-gain value. Table 4.4 below illustrates the improvement in students' mathematical critical thinking skills, presented as a N-Gain score.

Table 4.4 Improvement of Critical Thinking Skills in the Form of Gain Score

Interval Gain	Category	Students	Percentage	Average of Gain
$0{,}7 \leq g \leq 1$	High	7	23%	0,639
$0{,}3 \leq g < 0{,}7$	Medium	23	77%	
$9 < 0{,}3$	Low	0	0%	
Amount		30	100%	

Based on the description above, it is concluded that learning by applying student digital worksheets with the LAPS-Heuristic model is effective to improve students' critical thinking skills.

5 . Conclusion and Suggestion

1. Based on the results of the validity data analysis, the percentage of validity obtained on the material expert is 92% and based on the media expert is 85.4%, it said that the student digital worksheet is declared very valid.

2. Based on the results of the practicality data analysis, the percentage of practicality for the teacher response questionnaire was 90.27% (Practical). Then based on the student response questionnaire, the percentage of practicality is 92.9%(practical).
3. Based on the results of the effectiveness data analysis, the percentage of effectiveness of the assessment of classical student learning completeness obtained from the results of the posttest or final test with classical student learning completeness of 86.67%, assessment of the completeness of learning objectives that have been achieved on items 1,2 and 3

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