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Development of Problem Based Learning Model Learning Tools Based on HOTS Questions to Improve Critical Thinking Skills and Self Efficacy of Students

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Abstrak

Penelitian ini mengkaji tentang keabsahan, kepraktisan, dan kemanjuran model pembelajaran berbasis masalah (PBL) berbasis HOTS untuk meningkatkan keterampilan berpikir kritis dan efikasi diri dengan menggunakan perangkat pembelajaran yang dikembangkan, jawaban siswa atas soal berpikir kritis, dan lembar angket efikasi diri. Penelitian ini menggunakan model pengembangan 4-D yaitu *Define, Design, Develop,* dan *Desseminate*. Peserta didik kelas VIII menjadi partisipan dalam penelitian ini. Hasil penelitian menunjukkan bahwa perangkat pembelajaran valid dengan (a) rata-rata hasil validasi RPP sebesar 3,4, lembar kerja siswa sebesar 3,6, tes kemampuan berpikir kritis sebesar 3,8, dan lembar angket efikasi diri sebesar 3,8. Pendekatan pembelajaran berbasis masalah (PBL) yang memuat soal-soal HOTS seperti RPP, LKPD, TKBK, dan Angket Efikasi Diri dinyatakan valid; Kegunaan Perangkat pembelajaran yang dikembangkan memenuhi kriteria ahli dan praktisi serta dapat digunakan; Keefektifan perangkat pembelajaran dengan menggunakan model pembelajaran berbasis masalah menunjukkan pada uji coba sebesar 20% siswa tuntas dalam melakukan pretest dan 87% siswa tuntas dalam melakukan posttest; Peningkatan keterampilan berpikir kritis dengan menggunakan model yang dikembangkan mencapai 0,6 dengan kategori sedang; Efikasi diri siswa sebesar 80,1.

Kata Kunci: *Keterampilan Berpikir Kritis, Pengembangan perangkat pembelajaran, Pembelajaran Berbasis Masalah, Efikasi.*

Abstract

This study examines the validity, practicality, and efficacy of HOTS-based problem-based learning (PBL) models to improve critical thinking skills and self-efficacy by using developed learning devices, students on critical thinking questions, and self-efficacy questionnaire sheets. This study uses a 4-D development model, namely Define, Design, Develop, and Desseminate. Grade VIII students became participants in this study. The results of the study showed that the learning devices were valid with an average validation result of the RPP of 3.4, student worksheets of 3.6, critical thinking ability tests of 3.8, and self-efficacy questionnaire sheets of 3.8. The problem-based learning approach containing HOTS questions such as RPP, LKPD, TKBK, and self-efficacy questionnaires was declared valid; usefulness the developed learning devices meet the criteria of experts and practitioners and can be used; the effectiveness of learning devices using problem-based learning models showed in the trial that 20% of students completed the pretest and 87% of students completed the posttest; The increase in critical

thinking skills using the developed model reached 0.6 with a moderate category; Student self-efficacy was 80.1.

***Keywords**: Critical Thinking Skills, Learning tool development, Problem Based Learning (PBL), Efficacy.*

A. Introduction

Critical thinking helps children find the proper answer by synthesizing information in their cognitive system (Cahyono, 2017). Ennis in critical thinking has several indicators that must be grouped into five aspects: (1) providing a simple explanation and analyzing questions and asking and answering questions that require an explanation, (2) building basic skills and observing and considering observation reports, and (3) making conclusions and inducing, deducting, and deciding (Hidayat, A dan Viora, 2018). Critical thinking is part of high-order thinking abilities, according to (Suharto., 2017). According to (Fachrurozi, 2021), critical thinking in mathematics tests, questions, connects, and assesses all parts of a situation or topic.

Unfortunately, arithmetic learning has not been applied well. Due of disinterest in arithmetic, students lack critical thinking. Guided and regular practice improves critical thinking (Rosnawati, 2013, Maulidah, et all 2020). The government's 2013 Curriculum promotes critical thinking since graduation criteria need critical, creative, and effective thinking based on Susilawati's strengths and interests (2020). Math is still hard to grasp, making it hard for children to concentrate. Students' lack of self-confidence makes them feel incapable to solve difficulties, even when they haven't tried (Susilawati, W, et all 2019).

Students' self-efficacy is their confidence in solving problems. As per (Alifia, N. N., Rakhmawati, 2018). Self-efficacy is the conviction that a person can identify, organize, and complete a task to attain his objectives. Self-efficacy helps pupils handle difficulties and increase learning. (Kamil., 2021) states that self-efficacy may affect pupils' problem-solving. Math classes provide various sorts of difficulties. Low to high difficulty, students must be confident in their ability to solve challenges, students with strong self-efficacy concentrate more on problem-solving than their flaws. A person with high mathematical self-efficacy may easily motivate themselves to study, trust in their ability, persevere in solving problems, and control and improve their efforts. Thus, a learning tool innovation is required to enhance.

Learning instruments are crucial to learning. studying gadgets may boost students' enthusiasm in studying, creating a good learning environment. The instructor must construct a learning gadget that engages kids to learn. (Das, K. P., & Wilkinson, 2017) defines learning devices as instruments or equipment that help instructors and students learn. Learning gadgets are crucial for teachers because (1) they provide classroom rules. (2) Professional teachers must examine their learning gadgets. (3) Learning gadgets promote professionalism, but teachers must be competent to build and utilize them to provide a good learning experience. The Regulation of the Minister of National Education Number 41 of 2007 on process standards

emphasizes the importance of learning devices. It regulates the planning of the learning process and requires educators in educational units to prepare devices completely and systematically to achieve educational goals. The right learning model and learning devices are needed to help students master attitude/affective, skills/psychomotor, and knowledge/cognitive competencies (Sabaruddin, 2019) . (Alfina., 2017) also emphasizes the relevance of learning gadgets in the classroom. Teachers may employ learning gadgets to drive classroom learning toward competencies. Designing and using appropriate learning gadgets may promote student learning completeness and independence.

Student Worksheets (LKPD) are printed instructional resources that comprise materials, summaries, and directions for executing learning activities based on competencies. (Prastowo, 2018). In classrooms visited by researchers, instructors utilize existing books as exercise for pupils instead of worksheets (LKPD). In 2013, LKPD was included to the curriculum. The 2013 curriculum requires student worksheets instead of LKS. LKPD has shorter content with more interactive and contextual questions than LKS, separate from students and learners. 2015:73 Sasmito Thus, instructors' learning tool development shows their expertise. Learning tools developed in this approach will make it simpler for instructors to educate and won't force them to rethink how they teach. The link between each learning device used by each instructor is crucial to learning, yet SMP Negeri 3 Medan does not employ student worksheets, thus its learning gadgets are not connected. Common school learning gadgets include

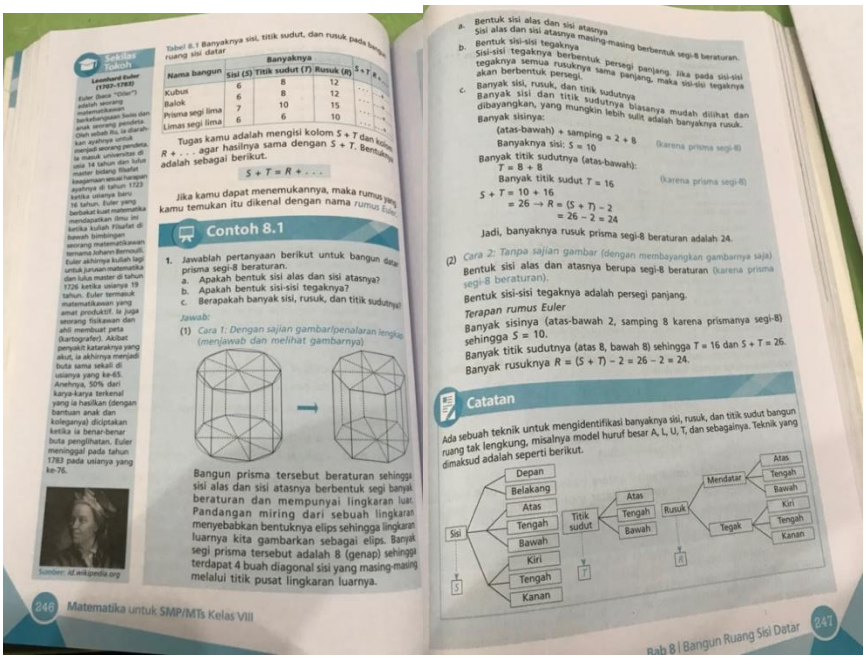

Figure 1. Learning Tools Used by Teachers in Schools

See Figure 1. The school employed the current RPP k13, but later researchers will construct curriculum-aligned RPPs related to books and LKPD. The examples in the book are not High Order Thinking Skills (HOTS) problems, thus students are not used to solving them. The learning process helps produce top graduates, according to (Maulia, 2017). To achieve this, the 2013 curriculum mandated high-order thinking skills (HOTS) and 21st-century competencies. Students acquire these two conclusions via learning activities and practice questions in student books as measures of education quality development. According to Brookhart (Riswanda, 2018), learning assessment exams that evaluate high-level thinking abilities are essential to improve students' reasoning skills. HOTS is a criteria for instructors or creators of student book questions, so they must improve students' attitudes to reach learning objectives.

(Dawa, 2021) found that after three stages of development, a junior high school mathematics learning device for algebra material was created with a guided discovery approach using 4 RPP, 4 LKS, and a learning outcome test device on algebra competencies. The validation findings indicated that the learning gadget matched the requirements. The outcomes of teacher, student, and learner implementation observations were also useful. The experiment revealed that the learning gadget improved students' critical thinking and mathematics communication abilities.

Accordingly, (Sholikhah, M., & Hartono, 2015) found that the device met the valid criteria before being used in the field, teachers and students said it was practical to use, and trial II showed that 88.24% of students had critical thinking skills with a minimum score of 67, an increase from the previous study. According to observations and interviews at SMP Negeri 3 Medan with mathematics subject teachers, learning devices in schools are not yet fully available, have not been implemented, and have not focused on critical thinking skills and student self-efficacy, so students are not used to trying different ways to solve problems. Here are one student's responses to researcher questions about linear equations.

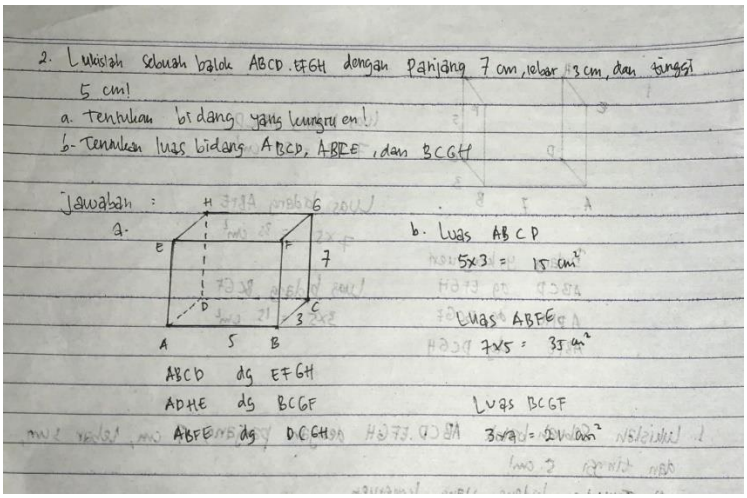

Figure 2. Results of Answers Worked by Students

While students struggle with finding the area of a cuboid, they may overcome the issue by sketching congruent cuboid areas. Students were unable to properly address the researcher's challenge. The lack of student grasp of the topic also lowers student involvement in mathematics study. Students are more interested in remembering than comprehending, hence the RPP and student books include unrelated exercises.

Teachers also indicated they solely utilized practice questions from the teacher's and student's books, not LKPD. Additionally, some students are still insecure and afraid to ask questions about unfamiliar subject. Students fear being incorrect and being chastised by the instructor if they inquire, which implies they don't comprehend. Students are less confidence in voicing their thoughts throughout learning, which affects their performance. Based on the backdrop, the researcher wants to create a Problem Based Learning model learning tool employing HOTS questions to increase critical thinking and self-efficacy in SMP Negeri 3 Medan students.

B. Research Method

In this particular study, the research methodology that was used was development research, often known as research and development. The model that was used in this investigation was the 4-D development model development model, namely Define, Design, Develop, and Desseminate. The processes of the research were carried out in accordance with the steps that were suggested by Thiagarjan (Sugiyono, 2018). These steps are comprised of four phases of development, which are referred to as Define, Design, Develop, and Desseminate. The lesson implementation plan (RPP), student worksheets (LKPD), critical thinking skills assessments, and self-efficacy surveys are the learning materials that will be produced as part of this research project. SMP Negeri 3 Medan, which can be found at Jl. Pelajar No. 69, Teladan Timur, Kec. Medan Kota, Medan City, North Sumatra Province, was the location where this study was carried out during the academic year 2022/2023. The participants in this research were students who were enrolled in the eighth grade at SMP Negeri 3 Medan during the academic year 2022/2023. In spite of the fact that the motorcycle taxi studied in this investigation is a problem-solving learning tool that makes use of HOTS questions on the Flat-Sided Space Building material. Plans to improve students' critical thinking skills and self-efficacy in the material pertaining to the Cartesian Coordinate System are the only learning tools that have been developed as a result of this research. These plans have been developed into learning implementation plans (RPP), student worksheets (LKPD), critical thinking skills tests, and self-efficacy questionnaires.

C. Result and Discussion

The product of this research is a learning device based on the Problem Based Learning (PBL) model on the material of cubes and blocks for junior high school students in grade VIII. The design of this research was carried out including four stages, namely defining, designing, developing and distributing

Define

In light of the findings of the observations and analysis of learning devices carried out at SMP Negeri 3 Medan, it has been determined that instructors do not currently own learning gadgets that are capable of enhancing the mathematical learning skills of their pupils. A description of the learning process that is now being implemented is not included in the Learning Implementation Plan (RPP) that is currently in place. In addition, the school does not use LKPD in its student learning process. Moreover, throughout the process of learning, pupils are not actively engaged in the process of solving a problem; rather, the instructor provides them with the solution via direct instruction. As can be observed from the explanation that was just presented, there is an issue with the way that mathematics is being taught at SMP Negeri 3 Medan. Therefore, in order to find a solution to this issue, it is essential to create educational tools that are based on the Problem-Based Learning (PBL) paradigm. Students get training to be active and autonomous in the process of problem-solving with critical thinking via the development of learning devices that are based on the Problem-Based Learning (PBL) model. This training is accomplished through the learning experiences that students go through in their daily lives.

Design

This stage aims to design learning devices. This stage consists of four stages, namely test preparation, media selection, format selection and initial design of learning devices. The results of each stage are described as follows. Critical thinking ability test, the preparation of the critical thinking ability test is based on its indicators. This test consists of 4 questions with the time provided to complete the questions being 60 minutes. self-efficacy questionnaire, the preparation of the statement items in the questionnaire is based on the Self-Efficacy indicator. Each statement consists of four answer choices, namely strongly agree, agree, disagree and strongly disagree. The preparation of this questionnaire includes the grid of the Self-Efficacy questionnaire statement items. Media selection results, the learning media used in this study were in the form of pictures to make it easier for students to connect spatial geometry material with everyday life.

Develop

The draft produced in the initial design was validated by experts. The revised learning device based on input from the validators is a learning device that has met the valid criteria. The results

of the learning device validation criteria are described as follows. The results of each stage are described as follows. You can find the validation results in table 1 below.

Table 1. Validation Resuts

No	Aspect	Average	Category
1	Learning Tool Plan	3,4	Valid
2	Student Worksheets	3,6	Valid
3	Critical Thinking Ability Test	3,8	Valid
4	Self-Efficacy	3,8	Valid

Based on Table 1, the average total validity of the learning device is in the interval: $3 \leq Va < 4$. Based on the validity criteria, it can be said that the learning device developed is "Valid".

Critical Thinking Ability Test Achievement Analysis Results

The students' critical thinking ability test was conducted once at the beginning before the learning activity began, called the Pre-Test, and once at the end of the learning after carrying out two meetings of teaching and learning activities, called the Post-Test. The purpose of the Pre-Test and Post-Test was to determine the increase in students' critical thinking abilities obtained after being given learning treatment on the material of two-variable linear equation systems. The data from the field trial results can be seen in Table 2 below.

Table 2. Level of Completion of Pre-Test and Post-Test Critical Thinking Skills in Trial

Category	*Pre-Test*	Classical Completion Percentage	*Post-Test*	Classical Completion Percentage
	The number of students		The number of students	
Completed	6	20 %	26	87%
Not Completed	24	80 %	4	13%
Total	30	100 %	30	100 %
Average Score of Students	44,8		80,6	

From the table above, it can be seen that the average class of student learning completion in the pre-test trial was 6 people who got a passing grade of 44.8, while in the post-test trial there were 26 people who got a passing grade.

Data Analysis on Improving Students' Critical Thinking Skills

The increase in critical thinking skills in the trial will be seen through the N-Gain from the pre-test and post-test results in the trial. The results of the N-Gain calculation are presented in Table 3 below.

Table 3 Summary of N-Gain Results of Students' Critical Thinking Skills

N-Gain	Interpretation	The number of students

g > 0,7	High	13
0,3 < g ≤ 0,7	Medium	12
g ≤ 0,3	Low	5

According to categorization, the trial's N-Gain rating of 0.62 indicates a 62% gain in students' critical thinking abilities, which is "Medium". According to the table above, 13 pupils have an N-Gain score of > 0.7 or a "High" critical thinking score. Critical thinking abilities grow for 12 pupils in the "Medium" group (N-Gain score < 0.3 < g ≤ 0.7) and 5 in the "Low" category (N-Gain score < 0.3).

Description of the Results of the Student Self-Efficacy

Questionnaire In this study, the distribution of the student Self-Efficacy questionnaire was carried out after learning. The questionnaire given consisted of 39 statements consisting of 19 positive statements and 20 negative statements from 3 indicators of student Self-Efficacy. The description of the results of student learning interest in my trial is shown in the following table.

Table 4. Description of the Results of the Student Self-Efficacy Questionnaire in Trial I

Description	Hasil *Self-Efficacy*	Rata-rata
Highest Value	71	80,08
Lowest Value	60	

Table 4. above shows that the average student interest in learning is 80.08 with the highest value of 71 and the lowest value of 60.

Results of the Dissemination Stage

After the valid and effective criteria were met in the trial, the final device (Final Draft) was obtained. The next step was to carry out limited dissemination in the form of distributing the final device to the MGMP forum at SMP Negeri 3 Medan which was marked by the submission of the learning device to the MGMP forum with the hope that the mathematics teachers who were members of the forum could apply the learning device in subsequent learning. The main step after the submission of the final device was to submit the results of the development to the entire population in this study.

Diseminate

After the valid and effective criteria are met in the trial, the final device (Final Draft) is obtained. The next step is to carry out limited distribution in the form of distributing the final device to the MGMP forum at SMP Negeri 3 Medan which is marked by the submission of the learning device to the MGMP forum with the hope that mathematics teachers who are members of the forum can apply the learning device in subsequent learning. The main step after the submission of the final device is to submit the results of the development to the entire population in this study.

Discussion

Based on the results of the test analysis in the trial, it was obtained that students' critical thinking skills had met the classical completion criteria. This is because the material and problems in the mathematics learning device developed are in accordance with the conditions of the students' learning environment. By using this learning device, students will find it easier to understand the material on the two-variable linear equation system. The achievement of the final test of students' critical thinking skills in the trial was 87% with 26 students declared complete and 4 students declared incomplete with an average N-gain score of 0.62. So it can be concluded that in the trial of the application of the learning device based on the problem based learning (PBL) learning model that was developed, it has met the classical completion criteria (> 85%) (Siregar, M. N. N. dan Aghni, 2021). So it can be said that the learning device based on the problem based learning (PBL) learning model that was developed has met the effectiveness criteria in terms of achieving students' critical thinking skills. Student learning completion is due to an important idea taken from Vygotsky's theory, namely scaffolding, which is in line with one of the characteristics of realistic learning approaches that emphasize the need for continuous interaction between students and other students, also between students and mentors (teachers), and students with learning tools so that each student gets positive benefits from the interaction. In addition, in a realistic approach, the assistance provided by the teacher is limited to the students' questions at the beginning given by the mentor (teacher) by providing instructions or suggestions until the students understand the purpose of the questions.

With the provision of assistance (scaffolding) by the teacher at the initial stage of learning and while they complete their assignments, students will be more active in handling their learning tasks, resulting in more effective learning and having an impact on student learning completion classically. This is in line with the opinion of (Nieveen, 2013) who stated that effectiveness refers to the way students experience the curriculum and the results of student achievement in accordance with the objectives set by the developer. Based on the research results, the supporting learning theory, the completion of student learning individually and classically, it can be concluded that the learning device has met the criteria for effectiveness, so that this learning device is effective for use in learning.

D. Conclusion

This research draws numerous findings from its analysis and discussion: Based on validator analysis, the Problem Based Learning (PBL) model-based learning device's validation findings are "Valid" with an average value of 3.6. Based on learning implementation insights, the Problem Based Learning (PBL) model-based learning device created meets practicality requirements. The average learning implementation value is 3.86, indicating "well implemented". Problem Based Learning (PBL) model-based learning technology meets

efficacy requirements. 20% or 6 students completed the traditional pre-test of critical thinking abilities. Students' critical thinking post-test classical completion was 87%, or 26 students. The N-Gain indicator shows how the learning model improves students' critical thinking. The N-Gain index score for improving critical thinking was 0.6, indicating "Medium". Student self-efficacy was 80.1. Where student questionnaire responses were shown.

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