Development of Learning Devices Based on Problem Based Learning Models with the Assistance of Book Creators to Improve Mathematical Problem Solving Ability and Student Learning Independence

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Abstract. The purpose of this study is: 1) to describe the effectiveness, practicality and effectiveness of learning tools based on the problem learning model in improving students' mathematical problem-solving abilities and independent learning with the help of the book creator; 2) to improve the ability to solve mathematical problems and Student independence in learning. The subjects of this study were the students of Class X at SMKS YWKA in Medan for the academic year 2022/2023. The results of the study show that: 1) Problem-based learning tools developed using the author's books to improve problem-solving skills and independence meet the criteria of effectiveness, practicality and validity; 2) Problem-based learning can be used using the developed book creator Tools to improve problem-solving skills and learning independence.

Keywords: Learning Devices, Problem Based Learning Model, Book Creator, Problem Solving Ability, Learning Independence.

1 Introduction

The rapid development of globalization in the 21st century has made all aspects of life also experience development, including in the world of education. Mathematics taught at school has a function as a child's development in the ability to count, measure, derive, and use mathematical formulas used in everyday life (Masfufah R. & Ekasatya A., 2021: 292). The application of arithmetic as a tool to address a variety of problems found in daily life.

AISTEEL 2023, September 19, Medan, Indonesia

DOI 10.4108/eai.19-9-2023.2340431

Problem-solving skills are very important when learning mathematics (Albay, 2019). When learning mathematics, it is necessary to prioritize problem-solving skills because engaging with problems encourages students to think deeply and creatively when solving problems they face (Ellita et al., 2019: 448). The following international test measures students' problem-solving abilities, known as PISA.

Table 1. Indonesian Mathematics PISA results from 2000 to 2018.

Year of Study	Indonesia's Average Score	International Average Score	Indonesia's Ranking	Number of Study Participating countries
2000	367	500	39	41
2003	360	500	38	40
2006	396	500	50	56
2009	371	500	61	65
2012	375	500	64	65

(Hadi & Novaliyosi, 2019)

A survey by the Program for International Student Assessment (PISA) showed that Indonesian students have poor problem-solving skills. This shows that Indonesia's mathematics achievement is still below average and students' ability to solve mathematical problems is still low (Putri, Suryani, & Jufri, 2019: 332). The result is often incorrect answers from students. It can be seen from the data that students only focus on the final answer and therefore do not take into account the process of understanding planning and problem solving, resulting in students' answers often being wrong.

Facts in the field show that the knowledge that students have in studying mathematics is only through explanations from the teacher, so that in solving the questions it is only limited to following the examples of the questions given. Interviews were also conducted with class X mathematics teachers at the SMKS YWKA Medan. The teacher said that "students are generally used to working on routine questions and are used to using formulas that are commonly used. This way when students have questions related to the problem, they will ask the teacher which formula they should use. This is due to students' lack of understanding of the material taught by the teacher, which results in students having difficulty solving problems. Difficulties in understanding this may impact student learning outcomes.

In addition to cognitive aspects, affective aspects are also important in mathematics. One of the attitudes that students must possess is autonomous learning as it is closely related to problem solving. Learning independence is a learning ability in which the individual learning process is promoted, controlled and evaluated by the individual himself [1].

Learning independence is very important and needs to be developed in students as students [2]. Independent learning is the skill of a student who does learning independently. Independent

[1] Jumaisyaroh, T.: The Effect of Applying a Problem-Based Learning Model on Mathematical Problem Solving Ability. Vol. 2, pp. 157-169. Kreano: Innovative creative mathematics journal (2014).

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learning is an effort made in independent learning activities based on one's own motivation to master certain material so that it can be used in solving the problems faced [3].

To see the learning independence of class X students at SMKS YWKA Medan, an interview was conducted with the mathematics teacher regarding the independence of students learning independence. The math teacher said that there were still many students who could not become independent learners. It can be seen when students do not make preparations before facing learning at school, and study the material only when a test is to be carried out, students tend to say it is difficult when working on questions that are different in form from the example questions given by the teacher, and when asked to work on questions students are just waiting for friends to come forward to work in front of the class. It can be seen that students' learning independence is still low.

In view of the low ability of students to solve mathematical problems and the low independence of students' learning, it is necessary to work hard to improve it. One of the important factors that can improve students' mathematical problem-solving skills and learning independence is improving the quality of learning through the development of the right learning tools. Using learning equipment can bring good learning benefits. Learning tools are developed for the purpose of improving and producing new products. Furthermore, it aims to develop learning tools that can solve classroom learning problems, since there are basically no learning resources that can meet the needs of various learning processes (Hasibuan, A.M., et al., 2020). In this case, it is necessary to select learning tools and connect them with the learning goals to be achieved, especially in terms of solving given mathematical problems and students' autonomous learning.

According to the analysis of the learning tools used by teachers, it can be seen that the lesson plans used by school mathematics teachers do not guide students to build knowledge to improve their skills in solving mathematical problems. The learning steps performed in RPP are routine activity steps that do not guide students in applying mathematical skills to solve problems.

The next weakness is that the learning resources used by teachers and students during the learning process do not use student worksheets (LKPD) but only the same books used by teachers. Therefore, students only receive materials and questions from the teacher.

The learning process occurs effectively when students are actively engaged in meaningful tasks and engage deeply with the learning material. Involving students in learning increases the likelihood of independent learning, thereby improving students' problem-solving abilities. Problem-based learning model is one of the learning models that requires students to actively participate in problem solving.

The problem-based learning model trains and develops students' problem-solving abilities based on real, realistic problems and stimulates high-level thinking skills[4]. This learning process begins with the teacher's explanation of a problem. Furthermore, students solve their

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own problems independently or in small groups, integrate their knowledge to solve problems, and finally report the results of their work in the form of written reports or presentations. The PBL model presents practical problems in real life situations, making students integrate previous knowledge while researching new information to find solutions to these problems. According to Gabriella and Mitarlis' recent research (2021), problem-solving activities implemented within the PBL educational model facilitate the growth and maturation of students' cognitive abilities by providing them with ample opportunities to develop their critical thinking skills.

In the era of digitalization, education must make more use of technology in the learning process. The development of electronic learning tools such as student books and student worksheets is in accordance with the current conditions that require online learning. The use of e-books and e-LKPD in learning as an alternative learning resource that allows students to study independently by accessing teaching materials anytime and anywhere with their gadgets. Electronic books and electronic student worksheets through multimedia devices can make the learning process more interesting and interactive because they can convey messages in the form of pictures and videos.

The observation results were also found in the learning process that did not utilize the use of technology in developing learning resources, one of which was teaching materials. The teaching materials used are only student books and Student Worksheets (LKPD) which are viewed from the internet so that student response is low in learning. The learning resources used were also only the same books used by teachers and students, this was also expressed by one of the students through filling out interview sheets by students during observation, namely the books used were the same as those used by the teacher and the LKPD was not used during learning. Furthermore, schools already have projectors but have not utilized them optimally. Projectors are used only occasionally in showing videos taken from YouTube.

After evaluating the contextual information presented above, the issues pertaining to this study can be outlined as follows:

- The teacher's ability to create lesson plans is subpar, and they also lack an understanding of suitable models or approaches to enhance student engagement and motivation in learning mathematics. This is due to a lack of alignment with the students' individual characteristics and needs.
- Based on the lesson plans employed by teachers during instruction, it appears that students are not utilizing LKPD as a tool for educational reinforcement.
- The capacity to solve mathematical problems is still lacking.
- According to one of the mathematics teachers who was interviewed, the level of self-reliance in student learning appears to be lacking.
- Students have not been able to develop an independent learning attitude and only receive information from the teacher.
- Learning devices used in the learning process have not utilized electronic media.

Regarding the formulation of the problem in this study, the following points are being considered:

- Current questions concern the credibility, feasibility and effectiveness of educational resources using problem-based learning with the help of book authors, particularly in the context of improving students' mathematical problem-solving abilities and independent learning.
- How can problem-based learning tools be developed with the help of book authors to improve students' mathematical problem-solving skills and learning independence?

2 Method

2.1 Research Type

The ADDIE learning tool development model is implemented for the purpose of development research. This research model follows a five-stage process, which includes Analysis, Design, Development, Implementation, and Evaluation. In this type of research, the focus is on creating learning tools that are designed to be effective in classroom settings. The development of these tools is carried out using the Problem Based Learning model, and they are subsequently tested in class X at the SMK level, with the help of a book creator. Throughout the development process, each stage involves a set of activities that are geared towards producing quality products. The final product is evaluated based on a range of quality aspects. The learning tools produced through this process take the form of e-books and e-LKPD mathematics at the SMK level, as well as Learning Implementation Plans (RPP). Additionally, tests are conducted to assess problem-solving abilities and student learning independence.

A. Analysis

The analysis phase includes the implementation of the analysis, that is:

a. Student Needs Analysis

b. Analysis of Student Characteristics

c. Curriculum Analysis

d. Analysis of Learning Objectives

B. Design Stage

a. Preparation of tests and non-tests

b. Media Selection

c. Format Selection

C. Development Stage

a. Development of Learning Devices

b. Expert Validation (Material and Media)

c. Design Revision (Revision I)

D. Implementation Stage

a. One-to-One-Trial

b. Revision II

c. Small Group Trial

d. Revision III

e. Field Trials

f. Final Product Revision

E. Evaluation Stage

At this stage, data is obtained regarding the evaluation of the use of learning tools.

3 Research Subjects and Objects

The study subjects were 22 students of SMKS YWKA, Medan. Testing the effectiveness of learning devices implemented at SMKS YWKA Medan for Class X. The subject of this study is the development of learning tools in the form of e-books and e-LKPD. The variables involved in this study are as follows:

a. The assessment of the effectiveness of the developed learning materials comprises of two crucial aspects: content validation and construct validation. These validations are conducted by a team of five experts, including one design expert, one linguist, one content expert who is well-versed with the 2013 curriculum, and two experienced teachers. The data is collected via a questionnaire that consists of several indicators related to the quality of teaching materials.

b. Teachers' ability to manage learning is an assessment of teachers' ability to conduct teaching and learning processes, including preparation, introduction, core activities, conclusions, time effectiveness and the ability to regulate lessons.

c. The use of e-books and e-LKPD learning devices in studying provides students with a plethora of activities. These activities correspond to the material being studied, and involve the use of student worksheets. Student activities include focused listening and paying attention to the teacher's explanations, whether it be through direct instruction or via e-books and e-LKPD. Students are also expected to follow group procedures, work collaboratively to solve problems, ask questions, express opinions, engage in group discussions, and ultimately draw conclusions.

d. Student learning outcomes are the results obtained by students through learning outcome tests and learning process outcome tests (emotions), measured using learning outcome testing instruments.

e. Student responses are student responses or ratings to instructional materials assessed using the Student Impressions Tool.

f. Research procedures

g. The research process adapts to the ADDIE R&D model. The ADDIE model stands for Analysis, Design, Development or Production, Implementation or Delivery and Evaluation.

Content validation is based on the opinions of five experts in the field of mathematics education. Based on the opinions of these experts, the average value for each aspect was calculated to determine the overall average.

Table 2. Criteria Level of Validity.

No	*Va or Total Average Value*	Validity Criteria
1	$1 \leq Va < 2$	Invalid
2	$2 \leq Va < 3$	Less valid
3	$3 \leq Va < 4$	Valid
4	$Va = 4$	Very Valid
No	*Va or Total Average Value*	Validity Criteria

(Yolanda, 2021)

with:

Va is the value that determines the level of validity of teaching materials.

The standard states that a model-based learning tool designed for problem-based learning has a good level of validity if the minimum level of validity achieved is valid ($3 \leq Va < 4$). If a level lower than this is achieved, revision based on expert contributions and subsequent implementation of validation measures will be required.

After the data collection is completed, the overall average score is determined based on the results of the learning implementation observation (O_k), and the categories are shown in Table 3.

Table 3. Criteria for the Level of Implementation of Learning.

No.	Learning Implementation Level	Implementation Criteria
1.	$1 \leq O_k < 2$	Not implemented
2.	$2 \leq O_k < 3$	Poorly executed
3.	$3 \leq O_k < 4$	Well done
	$O_k = 4$	Very well done

The developed learning device is said to be practical if the average learning implementation is at least in the category of 'well implemented' ($3 \leq \mathbf{O_k} < 4$).

To calculate the improvement in problem-solving skills after developing a learning tool using a problem-based learning model, it is determined by a winning formula.

The normalized gain categories are presented in Table 4.

Table 4. Normalized gain categories.

N-Gain Score	N-Gain Criterion
$0{,}00 < N - Gain \leq 0{,}30$	Low
$0{,}30 < N - Gain \leq 0{,}70$	Currently
$N - Gain > 0{,}70$	Tall

The statements used in the Student Learning Independence Questionnaire instrument are arranged on a Likert scale.

The assessment intervals to determine a student's degree of independence in learning are shown in the table below.

Table 5. Student Learning Independence Level.

Interval Score	Category
$M_i + Sd_i < x \leq M_i + 3Sd_i$	Tall
$M_i - Sd_i < x \leq M_i + Sd_i$	Currently
$M_i - 3Sd_i < x \leq M_i - Sd_i$	Low

(Zainwal dan Aulia, 2019)

Description:

- M_i is the ideal mean
- $M_i = \frac{1}{2}(S_{max} - S_{min})$
- Sd_i is the ideal standard deviation
- $Sd_i = \frac{1}{6}(S_{max} - S_{min})$

X is the score

4 Result and Discussion

4.1 Result

4.1.1 Analysis

The first stage of the ADDIE development model is the analysis stage. PBL e-books and e-LKPD were developed due to problems in the learning process that had been implemented. First, this needs analysis is carried out by analyzing the learning situation, giving a test of students' initial communication skills and the actual condition or picture in the field. Secondly, analyze the characteristics of students to understand their attitudes in the process of learning mathematics. The aim is to develop according to the student's personality, especially in terms of the intensity of using e-books and e-LKPD teaching materials as a source of mathematics learning and the student's learning speed. Mathematics and students' activities change during the learning process. Third, curriculum analysis is carried out by taking into account the characteristics of the curriculum used in the school concerned. This is done so that the development of learning media meets the requirements of the course. Learning objectives are formulated by describing the indicators for achieving learning outcomes into more specific indicators, adjusted based on the results of the material and analysis of previously performed tasks. Learning indicators and objectives will be aligned with the core and essential competencies in the 2013 curriculum.

4.2.1 Design

Design is the preparation process before a product is created. Three steps are required at this time, namely (1) exam preparation, (2) media preparation according to material characteristics and learning objectives, (3) format selection, that is, H. Review the format of existing teaching materials, determine the format of teaching materials, and develop teaching materials. Preparation for tests and non-tests is based on the establishment of learning objectives and indicators of skills to be measured. Tests are developed to suit students' cognitive ability levels. A scoring guide containing answer keys and scoring guidelines for each test item is used to score test results. Media were chosen to optimize the use of teaching materials in the development of classroom learning tools. The media chosen were student books and LKPD using book creators. The selection of formats in the development of learning tools can be done by examining existing learning device formats (in the form of lesson plans, student books, and LKPD) and in accordance with the requirements for preparing these tools.

4.1.3 Development

The development stage is the process of turning a design into a finished product. To meet the learning objectives, the development step requires designing and modifying e-books and e-LKPD. The development stage aims to produce a mathematics learning tool that has been revised based on the advice of experts (validators) and data obtained from trials. At this development stage there are two steps of activity, namely the assessment of experts and trials. The activity carried out at this stage is the validation of problem-based learning tools.

4.1.4 Implementation

The next step is implementation or application. This phase will take place in a small area of the school designated as a research site. The instrument used in this study was tested before implementing the developed device, i.e. H. Test students' ability to learn to solve questionnaire questions independently. The research instrument was tested in courses outside the sample. Next, validity and reliability tests were conducted. The purpose of this phase is to develop a good research tool that is efficient and suitable for field experiments.

The research design of pretest and posttest group design adopts the following model:

O_1	**X**	**O_2**

with:

O_1 = Initial test (pre-test) is carried out to determine learning outcomes before treatment

X = Treatment through problem-based learning using the developed Book Creator.

O_2 = A final test (post-test) is conducted to understand student learning outcomes on product, process, and performance tests following treatment. After conducting the post-test, a questionnaire was administered on students' learning responses.

4.1.5 Evaluation

The purpose of this stage is to evaluate the effectiveness and practicality of the e-book and e-LKPD products. Feedback obtained from questionnaires and observations will be utilized to revise and improve the product. The ultimate goal is to ensure that the device meets the intended objectives and can be distributed widely (Mulyatiningsih E, 2012).

4.2 Discussion

4.2.1 The Validity of Learning Devices Developed

Based on the results of research on material validation, it shows results with an average percentage of. The validation results of the five validators stated that they were valid with a total average RPP of 3.75; Student Book 3.8; LKPD 3.74. The solving ability test is mathematics and the student learning independence questionnaire is valid. The learning device is said to be valid due to several factors, including: first, the learning device developed has fulfilled content validity. This means developing learning tools according to the demands of the existing curriculum. A measuring tool is said to have content validity if the content or material of the measuring instrument is truly representative material for the learning material provided. That is, the content of the measuring instrument is estimated according to what has been taught based on the curriculum. The construct validity of learning tools has been fulfilled, as evident from the fact that the creation of this particular tool aligns with the fundamental concepts and benchmarks that define mathematical problem-solving proficiency.

4.2.2 Practicality of Learning Devices Developed

The learning aids that were created during the first testing phase were deemed impractical based on the criteria established prior. As a result, the next step is to conduct a re-test, specifically trial II, with a focus on addressing the practical aspects that were not met. Trial II was conducted in the X-BM class of SMKS YWKA Medan, utilizing a larger sample size of 22 students as test subjects. The process of acquiring knowledge in this particular class occurs over the course of three meetings, as per the pre-established lesson plan. After conducting a thorough examination of the second trial's learning implementation, it was determined that the average score for the "well-implemented" criteria stood at 3.21.

According to Yolanda's (2021) research, a learning tool is considered practical if it receives an average score within the 'good' category for learning implementation. This aligns with the success criteria for practicality in learning devices. The current score of the learning device under review meets this criteria, indicating that it is indeed practical. As a result, teachers and students can confidently utilize the learning tools developed. In summary, the learning device has fulfilled the expected practicality of a learning device, as seen in the study's findings.

Table 6. Observation Results of Implementation of Trial Learning Tools 2.

Value	Description
A Average Test Score	3,21
Description	Implemented well

Based on Table 6, it can be seen that the average observation score of the implementation of learning with learning tools using the Problem Based Learning learning model that was developed got a score of 3.21 at the level of learning implementation $3 \leq O_k < 4$ with the

criteria "well implemented". This score already meets the success criteria. The effectiveness of the developed Learning Devices.

4.2.3 The Effectiveness of the Developed

Learning tools is reviewed based on several aspects, namely: (i) classical student learning completeness and (ii) student responses.

a. Classical Mastery of Student Learning

After conducting a posttest analysis on both trial 1 and trial 2, it was discovered that the problem-solving aptitude in trial 1 fell short of the criteria for classical completeness. The completeness of student learning is reviewed from the ability of problem solving which is tested using tests that have been developed in the form of essays. In the first experiment, it was found that the average problem-solving ability of students' post-test scores was 79.26. In the second experiment, the average post-test score of students' problem-solving ability was 86.43.

Table 7. Description of the Result of Problem Solving Ability Trial II.

Score Max	Pre Test			Post Test		
	X_{min}	X_{max}	$\tilde{x}$	X_{min}	X_r	$\tilde{x}$
100	32,81	85,94	63,07	60,94	98,44	86,43

Figure 1 displays the percentage of completed classical mathematical problems in trial II.

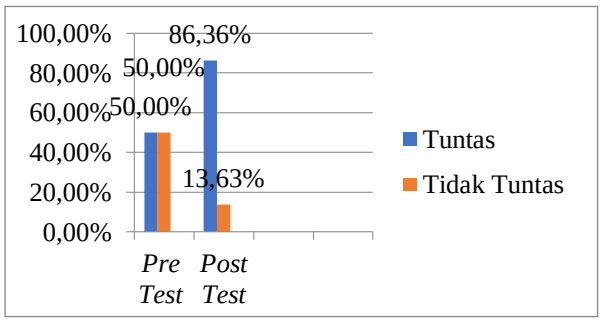

Figure 1. Percentage of Mastery Classical Pre Test and Post Test Problem Solving Ability Trial 2.

b. Student Response

The purpose of the student response data is to assess the degree of engagement, satisfaction, relevance, and comprehension of the educational resources that are currently being developed. Upon completing the posttest, a total of 22 pupils from Class X were requested to participate in a student response survey that centered on the application of learning tools and the implementation of educational materials. The student response information gathered from the survey was evaluated based on percentages. To calculate the percentage of each answer, the number of responses for each category was divided by the total number of students, and the

result was then multiplied by 100%. Learners have positive responses and negative responses. Student responses are positive if ≥ 85% of students who give the category agree. In trial 1 with an average student response of 90.54%. Judging from student feedback data, learning aspects were rated positively, indicating that the learning undertaken was interesting and not boring, making it easier for students to understand the material presented. In Experiment 2, the effectiveness of the developed learning tool met all established effectiveness criteria, with an average student rating of 95.97%.

Table 8. Data Results of Student Response Questionnaire Recapitulation.

No	Statement	Total Score
1	Students stated they were happy with the learning media components	95,45 %
2	Students stated that the learning components and activities were still new	88,99 %
3	Students expressed their interest in participating in mathematics learning in other materials such as the lessons they had learned	100 %
4	Students mention the language in the student book, The LKPD and tests are clear and easy to understand	97.72 %
5	Students expressed their interest in the display of student books and LKPD	97,72 %

4.2.4 Increasing Students' Mathematical Problem Solving Ability

The tools developed in this study are lesson plans, e-LKPD, e-books, and problem solving ability test questions. The learning tools developed were related to the PBL steps using Book Creator to improve students' problem-solving skills and confidence in line with the 2013 Curriculum. Based on the PBL grammar of Arends (2008), the learning steps are carried out in the following form: (1) providing students with problem orientation, (2) organizing students' learning, (3) helping students, students conduct investigations independently or in groups, (4) develop and display artifacts and exhibits, (5) analyze and evaluate problem-solving processes.

The stage of orienting students to problems, namely formulating problems from certain events related to students' daily lives, until students become clear what problems will be studied. To solve existing problems, students are trained to understand the problem without first knowing what concept to use.

The stage of organizing students for learning, namely analyzing the various things contained in the problem given. This step trains students to manage problem-solving strategies. After facing a problem, students will independently get the theory needed to solve the problem with the teacher's direction.

The stage of guiding individual and group investigations, namely the step where in this activity students will be able to practice high-order thinking skills through information analysis and conduct investigations to test the solutions to the problems they formulate.

The stage of developing and presenting the results of the work, namely making decisions about which strategies can be carried out and then implementing these strategies in order to get results according to the problem given. At this stage, students will be able to develop their creativity both in writing reports, and how to package the results of problem solving.

The evaluation stage is the stage where students are trained to independently evaluate/examine each problem-solving process. At this stage, it is carried out through presentations which are then given confirmation and affirmation by the teacher as well as reflection on the problem solving process. Confirmation and affirmation are carried out so that there are no mistakes and misunderstandings by students about a concept they have just learned.

It can be seen from the n-gain/normalized calculation that students' problem-solving abilities improved in Experiment 1 and Experiment 2. It can be seen from the n gain calculation that the students' problem-solving ability has improved, that is, the class value of Experiment 1 is 0.42, and the class value of Experiment 2 is 0.59. Increasing n achieves a gain value of 0.17.

4.2.5 Increasing Student Learning Independence

The device developed based on the PBL model assisted by the Book Creator in this research aims to help make it easier for students to learn opportunity material. Students can learn on their own without dependence on the teacher. Based on the results of the data analysis of the student learning independence questionnaire, it shows that there is an increase in good student learning independence.

The stage of orienting students to the problem, namely the stage where students seek information. Students try to understand the problem by seeking information about what is known and asked. At this stage, students show initiative in learning mathematics. If students construct knowledge independently, this knowledge will last a long time, make an impression and be memorable for students.

The stage of organizing students for learning, namely students can diagnose learning needs, choose strategies and control learning progress. After understanding the problem given, students can independently think about how or choose what strategies can be done to solve the problem so that students can diagnose needs in learning mathematics.

The stage of guiding individual and group investigations and presenting the results of the work, namely students are confident about themselves and students can choose friends who can be invited to compare the answers they are working on. At this stage, students view difficulties as challenges. Students can ask/discuss answers that are different or difficult to understand with teachers or friends by searching for and utilizing relevant learning resources.

The assessment stage is the stage where students evaluate the learning process and results. Students are trained to independently evaluate/verify learning outcomes.

The n-gain increase results calculated based on the results of the pre-test and post-test student learning independence questionnaires. In Experiment 1, the increase in n-gain was $g \geq 0.7$ and the high category was 13.3%. The n-gain increase was $0.3 < g \leq 0.7$. The medium category is 31.81%, and the low category 50% n gain increases to $g \leq 0.3$. In Experiment 2, the increase of n gain $g \geq 0.7$ in the high category was 36.36%, the increase of n gain $0.3 < g \leq 0.7$ in the medium category was 36.336%, and the increase of n gain $g \leq 0.3$ was 36.336%. The low category is

27.27%. Overall, Trial 1 had a mid-range average n-gain of 0.39 and a win rate of 39%, while Trial 2 had a mid-range average n-gain of 0.55. or a profit share of 55%. This indicates an increase in students' learning independence, although the mean n gains for Experiments 1 and 2 were in the medium category.

This is supported by the findings of Fadhilah, Edi, and Mulyono (2023), which showed an increase in research on developing PBL-based learning tools to improve students' learning independence, as the average of students' learning independence in the pre-survey questionnaire As the scores prove. -Test of Experiment 2, low category students up to 0 students (0%), adequate category up to 21 students (65.63%), medium category students up to 8 students (25%), high level achieved There are no students, and the maximum is 3 (9.37%). However, in the post-test, the results showed that 6 students (18.75%) secured the "High" category, 22 students (68.75%) secured the "Medium" category, 4 students (12.50%) secured the "Adequate" category and No student obtained low category (0%).

Based on the above description, it can be concluded that by developing learning tools based on the problem-based learning model, it can be expected to improve students' learning independence.

5 Conclusion

Based on the analysis and discussion results of this study, it is concluded that Book Creator should be used to develop a problem-based learning model learning device to improve students' ability to solve mathematical problems and their learning independence. Effective This learning tool falls into the category of effective and reliable, based on results verified by experts. After technical testing, it was deemed that the teaching materials could be used with minor modifications, and the applicability of the teaching materials fell into the "good" category. The project was declared effective due to compliance with classic standards of integrity and the positive response of students to the developed learning tools. And using the learning tools of the problem-based learning model with the help of Book Creator can improve the ability of mathematical problem solving and independent learning. This was evidenced by improvements in mathematical problem solving and learning independence in the mean n gain index categories.

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