



Validity Test of Development of Learning Devices Using Problem Solving Models on Genetic Material to Train Critical Thinking Ability

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Abstract. This study aims to look at the level of validation per learning abstract in the form of lesson plans, worksheets and critical thinking tests using the problem solving model on genetic material at SMA Negeri 3 Pematang Siantar. This type of research is research development or Research and Development (R&D). Learning Design is done by drafting learning tools, questions and product prototypes for developing critical thinking questions. Learning device validation was carried out by 3 expert lecturers in accordance with their scientific fields and then the learning devices were reviewed with the feasibility component, including basic competence suitability (KD), concept correctness, concept ambiguity and suitability with scientific developments. presentation validity using a Likert scale. The results showed that the quality of the products produced based on the validity of the lesson plans, worksheets and critical thinking tests met very valid and valid criteria with an average score of the validators ranging from 80 to 100%. Based on the results of the study, it can be concluded that learning tools using the problem solving model based on Dalihan Natolu on genetic material meet valid criteria for training students' critical thinking skills.

Keywords: Validity, learning tools, problem solving, critical thinking, genetics

1 Introduction

The Problem Solving learning model is a way of presenting lessons by encouraging students to seek information and solve a problem or problem in order to achieve learning objectives [1]. . Meanwhile, a series of learning activities that focus on solving problems scientifically is called the Problem Solving Model The Problem Solving learning model was chosen because this learning model can arouse students' interest, build intellectual abilities, increase understanding of the material being studied and train critical thinking skills [2]. This is in line with research conducted by through learning the Problem Solving model can improve students' critical thinking skills [3].

Based on the results of field observations and experiences regarding science learning that has been carried out at SMA Negeri 3 Pematang Siantar, it shows that the learning tools developed by the Biology teacher have not facilitated students to learn actively and independently. Learning strategies that are implemented in the Biology learning process have not carried out critical thinking skills to students. The learning model does not vary so that students tend to get bored and are not active in the learning process. In Biology material in class XII, it was found that there were some things that were very difficult for students to understand, one of which was Genetics material[9].

One subject that is still challenging for students is genetics. This is because the subject includes technical vocabulary and is not well-supported by facilities or infrastructure, making it tough for students to understand. Students struggle to come up with fresh ideas because they are unable to connect the principles they are learning to issue solving. Based on the percentage of genetic material evaluation results for the last two years, it was noted that in the 2021/2022 school year the percentage of incompleteness had reached 55%, while in 2022/2023 the percentage of incompleteness had increased to 70% (source: Pematang Siantar Methodist High School curriculum). The level of students' understanding of the material is still low and does not show satisfactory results. One of the factors causing low learning outcomes is that students are less trained to think critically in the learning process. This is evidenced by the average semester test scores, which show that the minimum completeness criteria (KKM) are far below the standards, where around 85% have not met the KKM standards in the 2021/2022 school year.

For this reason, students' critical thinking skills need to be trained. Critical thinking is not only useful for enriching and deepening learning experiences, but also for solving problems in everyday life and drawing conclusions. Practicing critical thinking in learning requires stages that provide opportunities for students to organize ideas into different thoughts. To improve the quality of Biology learning specifically, it is necessary to design learning designs, namely the development of learning tools using the Problem Solving model which facilitates teachers in the learning process and guides students in improving critical thinking skills with the aim of producing valid, effective and practical tools[10].

Based on the problems that have been described, the researcher is interested in carrying out research with the title Development of Learning Devices Using Problem Solving Learning Models of Genetic Materials to Train Students' Critical Thinking Skills.

2 Method

This research was conducted at SMA Negeri 3 Pematang Siantar in the even semester of the 2022-2023 academic year. This type of research is development research using the Plomp model which consists of 3 stages, namely preliminary research, development or prototyping phase and assessment phase [4]. At the preliminary research stage, needs analysis, student analysis, curriculum analysis, concept

analysis, and existing teaching material analysis were carried out. In the development or prototyping phase, the development and manufacture of prototypes in the form of RPP and LKPD are carried out for genetic material in class XII high school biology, and validation is carried out by experts to determine the validity of the products in the form of developed RPP and LKPD. In the assessment phase, a final assessment or evaluation is carried out on the biology learning tools that have been developed by conducting field tests[11].

Due to limited funds and time, this research was conducted only up to the development and prototyping phase (Development or Prototyping Phase) with a validity test.

Study of the literature that has been studied is related to the development of learning tools that are valid, practical and effective in use. Through this literature study, it is hoped that a theoretical understanding can be obtained about the development of learning tools using the problem solving model to train critical thinking skills[12]. A literature study was conducted to obtain an overview of the learning media used by subject teachers at SMA Negeri 3 Pematang Siantar

The way to collect information is by making learning tools to achieve learning goals. Data from students includes students' views about learning Genetics, the process of critical thinking skills that is studied in the process of teaching and learning activities. Learning Design is done by drafting learning tools, questions and product prototypes for developing critical thinking questions.

In products in the form of lesson plans, the aspects that will be validated are aspects of the components of lesson plans which are content validity and aspects of learning activities which are construct validity. As for learning tools in the form of worksheets, the aspects that will be validated based on modifications to the Instructional Materials Development Guide are didactic aspects, content aspects, language aspects, presentation and time. The validation process is carried out by experts or experts in accordance with the field of study. In this case there are 3 validators taken from 3 fields of study, namely 1 person for the field of biology, 1 person for the field of languages, and 1 person for the field of educational technology[14].

Suggestions and input from the validators became material for revising the learning tools that were developed.

Before being used in the teaching and learning process, validation sheets are given to the validator along with data about learning validation assessments (RPP and LKPD). Learning devices are reviewed from the suitability of learning devices using learning models and the feasibility of learning devices. These feasibility components include suitability of basic competencies (KD), concept correctness, conceptual confusion and conformity with scientific developments[15].

The data to determine product validity was obtained from the assessment of three expert lecturers, which will then be analyzed. To measure the validity of all research instruments, the following steps are carried out: Calculate the validity presentation using the following formula [5].

$$P = \frac{\sum x}{\sum xi}$$

Where P is Percentage, $\sum x$ is the number of respondents' answers in 1 item and $\sum xi$ is the number of ideal values in the item 100% = Constant Convert the average obtained into a Likert scale qualitative value based on the following assessment criteria.

Table 1. Validation criteria

Intervals	Criteria
81%-100%	Very Valid
61%-80%	Valid
41%-60%	Valid Enough
21%-40%	Invalid
0%-20%	Invalid

Source: Widoyoko dalam Hartini, et al. 2018

3 Result And Discussion

3.1 Results

Analysis of the overall validity of the lesson plan by the validator ranged from a score of 4 with a percentage of 80% in aspects 2, 3 and 7 with valid criteria. A score of 4.3 with a percentage of 86% on aspects 1, 4, 5, 6, 8, 10 with very valid criteria, a score of 4.6 with a percentage of 93% on aspects 11, 13 and 16. A score of 4.6 with a percentage of 93% on aspects 9, 14 and 18 then a score of 5 with a percentage of 100% on aspects 12, 15 and 17 which are assessed with very valid criteria. Therefore lesson plans using problem solving learning models are appropriate for use in the learning process.

Expert and user validators' evaluations serve as the foundation for the validity of learning devices. The assessment's findings are shown in table 2 below.

Table 2. LKPD Validity Analysis

Observed aspect	Average	Percentage (%)	infor- mation
LKPD can be used by all students	4,6	92	Very Valid
LKPD emphasizes the process of finding concepts so that it functions as a guide for obtaining information	4,3	80	Valid
LKPD provides opportunities for participants to write, solve problems and discuss	4,6	86	Very Valid
LKPD uses language appropriate to the level of development of students	4,6	90	Very Valid
LKPD uses clear and easy-to-understand sentence structures	4,6	92	Very Valid
LKPD provides sufficient space to give students the freedom to write or describe the things they want to convey	4,3	80	Valid

LKPD has clear learning objectives	4,6	90	Very Valid
Work steps are written systematically	4,3	80	Valid
Activities in LKPD contain critical thinking skills	4,3	80	Valid

Table 3. Analysis of the Validity of Critical Thinking Tests

Observed aspect	Average	Percentage	information
The language used is effective	3,3	66%	Valid
Writing according to EYD	3,6	72%	Valid
The words used do not have a double meaning	4	80%	Valid
The item contains a complete idea	4	80%	Valid
Clarity of each item	4,6	92%	Very valid
Clarity of question filling	4,6	92%	Very Valid
Language provisions with the level of development of students	4,3	86%	Very Valid
Items related to the material	4,3	86%	Very Valid

Based on Table 3, the overall critical thinking test validation analysis by the validator ranges from a score of 3.3 with a percentage of 66% on aspect 1 valid criteria, a score of 3.6 with a percentage of 72% on aspect 2 of valid criteria, a score of 4 with a percentage of 80% on aspects 3 and 4 valid criteria, a score of 4.3 with a percentage of 86% on aspects 7 and 8 with very valid categories and a score of 4.6 with a percentage of 92% on aspects 5 and 6 very valid criteria. Therefore, the critical thinking test questions using the problem solving learning model are appropriate for use in the learning process[16].

3.2 Discussion

The validity of the lesson plans.

Results of analysis of lesson plan quality Analysis of the overall validity of the lesson plan by the validator ranged from a score of 4 with a percentage of 80% in aspects 2, 3 and 7 with valid criteria. Score 4.3 with a percentage of 86% in aspects 1, 4, 5, 6, 8, 10 with very valid criteria, score 4.6 with a percentage of 93% in aspects 11, 13 and 16. Score 4.6 with a percentage of 93 % in aspects 9, 14 and 18 then a score of 5 with a percentage of 100% in aspects 12, 15 and 17 which are assessed with very valid criteria. In obtaining a very valid score, several suggestions and improvements have been made from expert validators, including: Writing sentences on the lesson plan from meetings 1 to 4, meetings 1 to 3 and meeting 4 have been corrected, the summary of the material has been shortened, and the learning objectives are appropriate with basic competence. This means that the RPP is also always concerned with estimates or assignments regarding what is needed and what will be done. Therefore, all criticism and suggestions from the validator are used by the author in rearranging the learning implementation plan (RPP) for the better, so that it can prepare what actions the teacher will take when carrying out learning activities using the Problem Solving learning model[17].

Maybe in practice it is not quite the same as what has been planned in the lesson plan, because the learning process itself is situational. However, if the RPP has been carefully prepared, the process and results will not be too far from what has been planned. For this reason, the most important thing in making lesson plans is the fulfillment of all the elements, principles and steps for preparing lesson plans in accordance with the Problem Solving learning model [6].

Student Worksheet Validation

Analysis of the overall quality of LKPD by the validator ranged from a score of 4 with a percentage of 80% on aspects 2, 6, 8 and 9 valid criteria, a score of 4.3 with a percentage of 86% on aspects 1 and 4 to a score of 4.6 with 92% participants on aspects 2, 3, 5 and 7 which are assessed with very valid criteria. Therefore, LKPD uses a problem solving learning model that is suitable for use in the learning process. Therefore, LKPD uses a problem solving learning model that is suitable for use in the learning process.

These suggestions and input become materials in improving the LKPD. This very valid and valid criterion occurs because learning uses the steps of the problem solving learning model which can motivate students to practice critical thinking skills. Student worksheets (LKPD) are one of the learning media that are used as a complement or supporting suggestion for the achievement of the learning process in the classroom. Using LKPD will open opportunities for students to be active and critical. The purpose of using LKPD in the learning process is to strengthen and support learning in order to achieve indicators and competencies that are in accordance with the curriculum [7]. In addition, the existence of LKPD can help teachers achieve learning objectives in the classroom[18]. Even with the LKPD in the learning process, the teacher's role still exists, namely as a facilitator in the sense that the teacher will be responsible for monitoring the work processes of students during the learning process in the classroom[19].

Critical Thinking Ability Test Validation.

Analysis of the overall critical thinking test validation by the validator ranged from a score of 3.3 with a percentage of 66% on aspect 1 valid criteria, a score of 3.6 with a percentage of 72% on aspect 2 of valid criteria, a score of 4 with a percentage of 80% on aspects 3 and 4 valid criteria, a score of 4.3 with a percentage of 86% on aspects 7 and 8 with very valid categories and a score of 4.6 with a percentage of 92% in aspects 5 and 6 criteria are very valid. Therefore, the critical thinking test questions using the problem solving learning model are appropriate for use in the learning process. The items have been adjusted to indicators of learning or critical thinking skills with very valid criteria, so the critical thinking test is appropriate for use as a test. Assessment is a very important activity in learning Genetics.

Teachers and students might benefit from positive comments from assessments. Students may find inspiration to do better from the assessment results. Because students often focus their learning efforts on the teacher's assessment as the aim, even assessment can have an impact on students' learning behavior. [20]. The quality of

learning outcomes assessment instruments has a direct effect on the accuracy of the achievement status of learning outcomes. Assessment instruments used by teachers to assess student learning outcomes on cognitive aspects are usually taken from various textbooks or collections of questions [8]. Questions can be in the form of descriptions or multiple choices. The types of questions asked or assignments given by the teacher greatly influence the development of students' critical thinking skills.

4 Conclusion

In this study, there are many aspects that become a reference for the implementation of learning tools using the problem solving learning model, namely validity. The learning tools in the form of lesson plans, worksheets and critical thinking tests that have been developed are feasible to apply in teaching environmental pollution material in class XII SMA Negeri 3 Pematang Siantar. The results of the validation of learning tools from all meetings have very valid and valid criteria. This shows that the learning tools developed in this study can be used in schools to become a reference material for teachers in the learning process in class.

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