

Validity of Video-Assisted Problem-Based Learning Tools to Improve Critical Thinking Ability

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Abstract - The aim of this study was to create a suitable video-assisted problem-based learning paradigm for use in teaching students to develop their critical thinking skills in physics. Elasticity and Hooke's law are the materials of physics that are used. The products developed are in the form of a syllabus, Learning Implementation Plans (RPP), teaching materials, Student Worksheets (LKPD), learning videos, and students' critical thinking skills test instruments. A total of 30 odd-semester XI MS 2 class students for the 2022/2023 academic year at SMAN 1 Kediri became research participants. Research and development (R&D) is the methodology employed, with the 4D model design consisting of define, design, develop, and disseminate. The method of data collection employed a validation sheet that was evaluated by three expert validators and three practitioner validators, and the percentage of validity was then calculated. The results of the validity of the product developed for the syllabus have a percentage of 90.83%, lesson plans of 90.90%, teaching materials of 88.54%, worksheets of 90.41%, learning videos of 89.06%, and test instruments of 90.10% with valid and reliable categories with an average percentage above 75.00%. So, it can be concluded that the resulting learning tools are valid for improving students' physics critical thinking skills.

Keywords: Validity; Problem-Based Learning Models; Critical Thinking Ability; Elasticity And Hooke's Law.

INTRODUCTION

Science's field of physics investigates natural occurrences and all the interactions that surround them. According to Khaeruddin, Amin, & Jasruddin (2018), physics is a subject that should be taught to students because it gives them the knowledge, understanding, and variety of skills necessary to continue their education at a higher level. Physics is also a vehicle for developing thinking abilities that are helpful for solving problems in daily life, as well as advanced science and technology. Especially at this time, it is emphasized that students must have several skills, which are referred to as 21st century skills.

According to Sari & Trisnawati (2019), the 21st century skills needed by students are abbreviated as 4C, namely critical thinking, collaboration, creativity, and communication. One of the 4C skills that students need to have is the ability to

think critically. According to Purwati, Hobri, & Fatahillah (2016), critical thinking is the capacity to assess and evaluate information gathered through observation, experience, reasoning, and communication to determine whether the information is reliable and draw accurate conclusions. Critical thinking is one of the skills that students must possess in order to process and analyze the information obtained, which also makes it easier to understand the material or concept being studied.

Based on the findings of interviews and observations made at SMAN 1 Kediri, it is known that conventional learning models employing the lecture technique continue to dominate learning activities. Student become boring and passive learners when conventional learning methods are used in the classroom; as a result, the teacher becomes the only source of knowledge for the student. Because the learning tools

employed by the teacher only take the form of a syllabus, lesson plans (RPP), and teaching materials, their usage throughout the learning process is not ideal. Students claim that while learning media can help in understanding teaching material, it is not utilized by teachers in learning. The use of learning media such as videos has never been used by teachers in teaching. And practicum activities have also never been carried out, so that student capacity to solve issues via trial and error or experimentation does not grow to its full potential.

Students' critical thinking skills, have never been measured before by the teacher. This is because students tend to be slower at understanding the subject matter in class. In addition, the ability of students to analyze questions is still low. This fact certainly affects the average learning outcomes of students in physics class XI MS (Interest in Science) SMAN 1 Kediri. Based on data obtained through teachers, there are still students who have PTS (Mid-Semester Assessment) scores below 75, which is the Minimum Completion Criteria (KKM) that has been set. Data on students' mid-semester assessment results can be seen in Table 1.

Table 1. Results of PTS class XI MS

Class	Average Score	KKM
XI MS 1	67,6	75
XI MS 2	68,2	
Overall Average	67,9	

(Physics teacher archives, 2022/2023)

So, teachers need to make efforts and innovations that help students better understand teaching material, become active and directly involved in learning activities, and grow and improve critical thinking skills. One way is to use a learning model that is able to involve students actively in learning activities in class so that learning objectives are achieved. A problem-based learning approach is one that teacher may make use of.

Problem-based learning (PBL) is a model that emphasizes student-centered learning, according to Nurqomariah, Gunawan, & Sutrio (2017). PBL can enable students to conduct investigations, combine theory and practice, and use their knowledge and abilities to create solutions or solve problems. Students' active participation in problem-solving is able to hone their critical thinking skills by developing their reasoning abilities. Learning results for students will be impacted by developing critical thinking abilities.

The success of a learning process, besides being influenced by the learning model, can also be influenced using learning media. In this study, learning videos were used as an alternative medium that teachers could use to carry out learning in class. According to Rozie (2013), video media is a type of learning medium that uses images, sound, and several animations as illustrations of events or real pictures of the material being studied by students. The use of video as a learning medium can be an intermediary for students to better understand the material and can create a better learning atmosphere. Yousef, Chatti, & Schroeder (2014) suggested that the video should be made as attractive as possible, such as at the beginning of the video, an introduction to the material is displayed so that students are interested in the video, then the material is shown in an organized manner and given a question in the video to make students active in generating their ideas.

Based on this explanation, it is necessary to carry out further research regarding the development of video-assisted problem-based learning models that are valid for use in learning to improve students' critical thinking skills. With the existence of learning tools that support learning activities, it is hoped that they can become a

guide for teachers in carrying out more effective learning for students, so that they are able to improve their critical thinking skills and are able to increase students' average scores so that they are above the KKM.

RESEARCH METHODS

Research and development (R&D) is the methodology employed, with the 4D model design consisting of define, design, develop, and disseminate by Thiagarajan & Semmel (1974). A total of 30 odd-semester XI MS 2 class students for the 2022/2023 academic year at SMAN 1 Kediri became research participants.

The type of data used in this study includes both quantitative data (measured as scores from the validation questionnaire for learning devices with a Likert scale of 1 to 4) and qualitative data (provided by expert and practitioner validators in the form of criticism, suggestions, or input as material revisions to improve the learning tools developed).

The research instrument used was a validation sheet to obtain a learning device assessment score from the validator and to obtain input for improving the learning device that had been developed. The expert validator is a lecturer in the Physics Education Study Program, Mataram University. Meanwhile, practitioner validators are physics subject teachers who have at least 5 years of teaching experience or have obtained a professional educator certificate. In this study, data were obtained from 6 validators.

The validation sheet includes validation sheets for the learning tools created (syllabus, lesson plans, teaching resources, worksheets, learning videos, and test instruments). A Likert scale was then used to examine the validity score that was

acquired. The validity % is calculated using the following formula:

$$P = \frac{f}{N} \times 100\% \tag{1}$$

Information:

P = Percentage.

f = Score obtained.

N = Maximum number of frequencies or scores

Response questionnaires to the use of the product have 4 options according to the aspect of the statement. Table 2 shows the results of converting the validator's evaluation from letters to scores based on the provisions using a Likert scale.

Table 2. Rating scores for the answer choices

Answer Choices	Skor
Good	4
Fair	3
Poor	2
Very poor	1

(Latifah, Setiawati, & Basith, 2016)

Assessment data obtained from the validator is then converted into learning device validity criteria in the form of a percentage. The validity criteria listed in Table 3.

Table 3. Learning device validity criteria

Score (%)	Criteria
85.01 - 100	Valid
70.01 - 85	Moderately valid
50.01 - 70	Less valid
0 - 50	Invalid

(Fatmawati, 2016)

In addition, the reliability test of learning devices that have been developed is carried out. Reliability, according to Sugiyono (2019), is the degree of consistency/determination of an instrument. The reliability of learning devices in this study was analyzed using the Percentage of Agreement (PA), which was formulated as follows.

$$PA = \left[1 - \frac{A-B}{A+B} \right] \times 100\% \tag{2}$$

Information:

A = Scores from higher validators

B = Scores from lower validators

A learning device is said to be reliable, according to Borich in Makhrus (2018), if the acquisition value is more than or equal to 75%. So, if a learning device receives a score between 75% and 100%, it can be considered reliable.

The examination of the learning outcomes of the students comes next. The results of the pretest and posttest are utilized to gauge the extent of improvement in the students' physics critical thinking abilities. The N-Gain test was used to examine how much students' critical thinking abilities in physics have improved. The N-Gain test may be computed using the following formula:

$$\langle g \rangle = \frac{\text{posttest score} - \text{pretest score}}{\text{minimum score} - \text{pretest score}}$$

The results of the N-Gain calculation are then interpreted using the classification as listed in Table 4.

Table 4. N-Gain classification

G Value	Interpretation
$g > 0,7$	High
$0,3 < g \leq 0,7$	Medium
$g \leq 0,3$	Low

(Hake, 1998)

RESULTS AND DISCUSSION

Result

1. Define

The define stage is a stage that seeks to learn more about the issues that come up when learning is being done, the curriculum that is being used, the learning tools, learning models, and teaching strategies that are being used by teachers, as well as the supporting materials that help teachers implement physics learning in the classroom. Based on the study done in this phase, conventional learning models that use

the lecture technique continue to dominate learning activities. Only a syllabus, lesson plans, and teaching materials are employed as learning resources during the learning process. Utilization of learning media is not optimal, and practicum activities have never been implemented.

2. Design

The design stage is the stage of designing the initial draft of the learning device that will be used in the material on elasticity and Hooke's law. The learning tools designed are a syllabus, lesson plans, teaching materials, worksheets, learning videos, and critical thinking test instruments.

3. Develop

The develop stage is the stage for producing a new product, which is carried out through validity testing by expert validators and practitioner validators. The validation test was carried out by six validators, consisting of three expert validators from lecturers of the Physics Education Study Program at Mataram University and three practical validators from physics subject teachers at SMAN 1 Kediri. The purpose of the validation test is to determine the validator's assessment of the resulting learning tools. The assessment obtained from the validator can be used to determine whether or not a learning device is appropriate for use in learning. Table 5 displays the results of the analysis of the validity and reliability of learning devices.

4. Disseminate

The disseminate stage is the stage of distributing learning tools that have been developed by giving them to physics teachers at SMAN 1 Kediri and MAN 2 Mataram, which are then distributed to other physics teachers.

Table 5. The results of the analysis of the validity and reliability of learning devices

Product	Validity	Category	Reliability	Category
Syllabus	90.83	Valid	94.40	Reliable
Lesson plans (RPP)	90.90	Valid	93.63	Reliable
Teaching materials	88.54	Valid	92.98	Reliable
Worksheets (LKPD)	90.41	Valid	93.93	Reliable
Learning videos	89.06	Valid	93.00	Reliable
Test instrument	90.10	Valid	93.58	Reliable

Discussion

According to Budiman (2021), one indicator of the feasibility of a device can be determined based on its validity and reliability values. The value is obtained through a validation procedure that is evaluated by the validator. Marthasari & Hayatin (2017) said that a feasibility analysis is needed to show whether the tool meets good measuring instrument standards. According to Makhrus et al. (2020), teachers can use valid and reliable learning tools as a reference when carrying out learning activities in class.

1. Learning Device Validity

The level of validity achieved serves to determine how feasible the instrument can be. The purpose of the validity test in this study was to make sure that the final output could be utilized for learning and measured appropriately.

Syllabus

The syllabus used in this study is in accordance with the revised 2013 curriculum, which was modified using a video-assisted problem-based learning model. Based on Table 5, the average percentage of syllabus validity is 90.83% with a valid category. This is because the syllabus contains a clear identity, the core competencies (KI) and basic competencies (KD) to be achieved are clearly explained, the teaching materials are in accordance with the results of the basic competency elaborations that are formulated, and the use of appropriate sentences. So that the syllabus

obtains a level of validity in its valid criteria for use in learning.

Learning Implementation Plan (RPP)

When carrying out learning activities in class that require many stages of learning, the lesson plan is used as a guide. The syntax in the lesson plan has been modified to suit the video-assisted problem-based learning model and provides time allocation for each activity. Based on Table 5, the validity value of the lesson plan is 90.90% in the valid category. This is because the prepared lesson plans contain clear identities for lesson plans and KI, learning steps adapted to the problem-based learning model used, provision of time allocation and time details for each learning activity carried out, as well as language in the lesson plans that is in accordance with the EYD. In addition, learning objectives have been adapted to the ABCD (audience, behavior, condition, and degree). According to Sahidu (2016), learning objectives have a very important role in determining the success of a learning process because they contain operational competence mastery that is targeted in the lesson plan.

Teaching Materials

Teaching materials is teaching resources that are organized logically and used by teachers and students as part of the learning process. According to Table 5, the validity value of the teaching materials was determined to be 88.54% and is included in the valid category. This is because the teaching materials developed are arranged in a coherent

concept, in accordance with basic competencies to assist teachers in achieving certain competencies, accompanied by pictures that can help students understand learning, and use simple and easy-to-understand language. The teaching materials developed in this case are a set of materials that are systematically arranged and obtained from various learning sources and are designed according to indicators in order to achieve learning objectives. This is in accordance with Magdalena's research (2020), which states that the teaching materials used to determine the success of the learning process are designed systematically and in accordance with the applicable curriculum and indicators.

Student Worksheets (LKPD)

According to Yusuf, 'Ardhuha, & Hikmawati (2022), LKPD is a sheet that contains experimental activities or discussions carried out by students. Because it teaches students how to identify problems and find their own solutions, the application of LKPD can also encourage students to actively participate in learning activities. According to Firdaus & Wilujeng (2018), students' knowledge and abilities are obtained through a combination of remembering facts and events as well as discovering a concept independently, so that it has an impact on student learning outcomes. Based on Table 5, it is concluded that the validity value of LKPD is 90.41% with a valid category. This is because the LKPD developed by researchers has an attractive appearance, contains a clear LKPD identity, is equipped with pictures and illustrations, has clear observation tables, and has questions related to experimental results that can train critical thinking skills.

Learning Video

Learning videos that are used as an introduction to teaching materials by teachers for students are the type of media used in this study. According to Fahri (2020), video is a learning medium that can help students understand concepts and teaching material because of the ease of repeating videos and presenting information systematically. Based on Table 5, the validity value of learning videos is 93.00% with a valid category, because the appearance of the learning videos is presented in an attractive way, the contents of the learning videos are arranged according to the teaching material; there are pictures, animations, and clear writing, as well as the language used to convey the material in a straightforward and easy-to-understand way.

Critical Thinking Ability Test Instrument

The test instrument is a tool that can be used to measure the achievement of learning competencies and to determine the extent to which students possess abilities. The developed test instrument consists of 10 descriptive questions adapted to indicators of critical thinking ability. There are 5 indicators of critical thinking skills (interpretation, analysis, evaluation, inference, and explanation), and each indicator consists of 2 questions. Based on Table 5, the validity value of the test instrument is 90.10% in the valid category. This is because the test instruments developed contain clear identification of the questions and the identities of the students, easy-to-understand instructions for working on the questions, clarity of the intent of the questions, suitability of the items with indicators of critical thinking, and the use of simple language so that students can easily understand them.

2. Reliability of Learning Devices

According to Wagiran (2013), reliability testing is carried out to ensure that a device or product has consistency in measuring what it is supposed to measure. In line with that, Marthasari & Hayatin (2017) stated that the reliability test was carried out to ensure the consistency of the measuring instrument and whether the instrument could be trusted and remained constant during repeated testing. The Borich method is used to test the reliability of learning devices by looking at the percentage agreement values between validators.

Based on Table 5, it is found that all the products developed meet reliable criteria with a reliability value greater than 75%. So from the results of the reliability analysis, it can be said that the learning tools developed are reliable and consistent in measuring what should be measured.

3. Analysis of Critical Thinking Skills

Before the device trial is carried out, students are given a pretest at the beginning of learning. And a posttest at the end of the lesson to determine the increase in critical thinking skills after using the learning tools that have been developed. The two tests use test instruments that have been developed previously.

The results of the N-Gain test for critical thinking abilities of class XI MS 2 students can be seen in Table 6. Based on Table 6, the class XI MS 2 students' average value of growing critical thinking abilities in physics is 0.57, which falls into the medium group. It can be said that the learning tools that have been developed and validated can improve students' critical thinking abilities in physics, although this improvement falls into the medium improvement category.

Table 6. Results of the N-Gain test for critical thinking abilities

Critical Thinking Abilities		Min Value	Max Value	Average Value	N-Gain	Category
	Pretest	10	43	24,6		
Posttest	52	80	67,9	0,57	Medium	

CONCLUSION

Based on the description that has been presented, video-assisted problem-based learning model learning tools can be used to teach students to develop their critical thinking skills with valid and reliable categories.

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