JPPIPA 9(3) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Learning Tools Quality of Problem-Based Learning Model in Contextual Teaching and Learning Approach on Elasticity and Hooke's Law Materials

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Received: January 30, 2023
Revised: March 19, 2023
Accepted: March 25, 2023
Published: March 31, 2023

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DOI: 10.29303/jppipa.v9i3.3127

Abstract: The purpose of this study was to describe the quality of physics learning tools using the Problem-Based Learning model with the Contextual Teaching and Learning approach on the material of elasticity and Hooke's law. The research was conducted at Muhammadiyah Batudaa High School, and the research sample used was class XI IPA1 using simple random sampling technique. This development research uses Research and Development (R&D) research with the ADDIE development model developed by Reiser and Mollenda which consists of the Analysis, Design, Development, Implementation and Evaluation stages. The results of the study show that the validation of the entire learning device is stated to be very valid. The practicality of learning devices is determined by the average percentage of the implementation of learning carried out during two meetings reaching 97.61% with very good criteria, then for teacher and student responses through questionnaires give positive responses. The effectiveness of learning devices is seen through student activity data which obtains an average percentage of 90.30% obtained very good criteria and student learning outcomes data on elasticity and Hooke's law show an increase in the N-gain value of 0.74 included in the high N-gain criteria. This study concludes that physics learning tools that use the Problem-Based Learning model with a Contextual Teaching and Learning approach on elasticity and Hooke's law are included in the valid, practical and effective criteria to be applied in the learning process in class.

Keywords: Contextual teaching and learning; Learning tools; Problem-based learning

Introduction

Current education should be able to provide provisions for students to understand various concepts related to science in a mature way, so that problems that arise can be anticipated. All factors that can be used by educators in learning activities so that the goals set are achieved are educational resources for the implementation of good teaching and learning activities (Amali et al., 2023). Therefore, in creating a superior generation, it is necessary to design a structured and systematic education (Ntobuo et al., 2023).

The development of the curriculum in Indonesia is increasingly developing. The curriculum in Indonesia continues to change following the changing times, developments in science and innovation, community needs and students' knowledge insights. Alluding to the changes in the revised 2013 education program, the aim of education in Indonesia is to plan Indonesian individuals to have the capacity to live as people and as citizens who are loyal, profitable, inventive, imaginative and emotional and can be actively involved both in society and the nation. and countries, as well as in world civilization. In order for this to be realized, the implementation of the 2013 curriculum education

How to Cite:
Buhungo, T.J., Supartin, S., Arbie, A., Setiawan, D.G.E., Djou, A., & Yunus, M. (2023). Learning Tools Quality of Problem-Based Learning Model in Contextual Teaching and Learning Approach on Elasticity and Hooke's Law Materials. *Jurnal Penelitian Pendidikan IPA*, *9*(3), 1092–1098. https://doi.org/10.29303/jppipa.v9i3.3127

program was carried out as a learning guide in carrying out learning in schools. Learning that is oriented towards the 2013 curriculum is a learning concept that is competence in nature by strengthening correct learning and evaluating forms in order to realize cognitive, affective and psychomotor competencies (Abdjul et al., 2022; Payu et al., 2023).

Learning activities are a teacher's condition in conveying information, organizing, and creating natural frameworks with different strategies so that students are able to actively and productively carry out teaching and learning activities so that the results obtained by students are maximized (Sugihartono, 2013). The purpose of learning physics itself is in accordance with the rules that exist in the 21st century which requires students' abilities in terms of creativity and development, communication, cooperation, basic considerations and handling of problems (Ibrahim et al., 2020).

The science that studies solving problems through human observations and descriptions is the science of physics (Lesmono et al., 2021). Physics is a learning material that contains reality, concepts, speculation, standards and laws that discuss the general framework. Science that examines physics is physics, in physics it means that it must be based on logical discoveries that occur around it (Utami et al., 2017). Physics is a science that not only seems to contain speculation and equations that must be memorized, but physics requires an understanding of concepts that are centered on methods of forming information through disclosing and introducing information (Mahardika et al., 2012).

The learning model is in the form of a conceptual design and framework that functions as an effort to provide direction to teachers in compiling and actualizing learning activities and functions for students to organize learning material (Mahardika et al., 2012). Learning can be said to be good, of course, attention must also be paid to how information, abilities, and mindsets can be obtained by students. Learning that focuses on students' ability to obtain information in their actions is a Problem-Based Learning (PBL) model.

Problem-Based Learning is a set of learning models that use problems as the main topic to develop case-solving competencies, learning materials, and self-regulation (Sumayow et al., 2022). PBL learning is learning that supports the involvement of students in learning activities and helps students in solving problems validly. Students are trained so that they can learn how to compile a problem framework, classify and investigate the problems obtained, carry out data analysis, organize the facts obtained, compile solutions to solve the problems obtained, in solving problems students are able to work both individually and in groups to, to obtain data or information as well as developing an understanding of each topic presented (Rahyubi, 2012).

PBL learning is a learning that is able to stimulate student activity to find and respond to the information obtained by themselves, as well as build their own knowledge to solve problems. The steps contained in PBL can direct students to find their knowledge through coherent scientific method procedures so that students are expected to be active during the teaching and learning process taking place (Hamalik, 2008). Learning through problems can stimulate students to find solutions effectively and actively participate in learning process activities (Huda, 2015).

The characteristics of PBL are asking questions or problems and generating solutions to solve problems (Arends, 2008). Problems in the learning process activities in the class will arise, if in solving problems students do not carry out observation activities on a real event and do not make hypotheses. Investigative activities in solving problems will be easy to do if students are able to make temporary guesses from the problems that have been proposed. This is important because in the teaching and learning process in physics lessons students are expected to be able to solve physics problems in real life that are around them. The activity of making observations and submitting hypotheses is not found in the PBL syntax.

Effective education is education that involves abstract and concrete learning. An effort to teach and learn activities which focus on the learning process whose goal is to encourage students to obtain learning material independently through phenomena in their daily lives is learning that uses a contextual approach (Sanjaya, 2014). Contextual learning is a student-centered learning where students are stimulated to obtain subject matter independently.

Learning that connects scholastic substance with events that exist in real life in accordance with the brain to produce meaning is contextual learning (Rusman, 2013). So Contextual learning aims to enable students to actively use skills without losing their usefulness, as they attempt to learn various existing concepts while applying and correlating them in their life experiences.

Learning that connects material with real life is important to be realized in teaching and learning activities so that the information obtained is stored for a long time in memory so that the information obtained will be internalized and able to be linked in work life. This is also in line with what was explained by Afriani (2018) about contextual learning that this learning can be a learning tool that emphasizes maximum student assistance methods so that students are able to independently translate the material obtained to their life experiences.

Contextual learning has seven main components namely constructivism namely building students'

understanding through new experiences and their initial knowledge and beliefs, asking (questioning) namely the use of questions with the aim of guiding students to think, finding (inquiry) namely learning that begins with observation, learning community namely groups of students who are interrelated in learning activities so that deeper learning occurs, modeling namely showing examples to students so that students can think work and study, reflection namely the aim is for students to rethink what they learned or did during learning activities so that students find meaning from each other's personal and, actual assessment (authentic assessment) namely the process by the teacher to collect information about student learning progress. This assessment is needed to determine whether students really learn or not (Hasibuan, 2014).

The models and methods used in the learning process must be adapted to the characteristics of the material to be taught. One of the effective models and methods used to increase students' understanding of concepts in learning Elasticity and Hooke's Law is the Problem-Based Learning (PBL) model and the experimental method (Toe et al., 2020).

Problem-Based Learning Contextual Teaching and Learning approach is a learning model that uses an approach that involves students to acquire new knowledge by associating their knowledge with real-world situations in solving problems and encouraging students to find and build their own concepts they learn. Based on the advantages possessed by CTL which are able to support learning activities using the PBL learning model, therefore the learning carried out is able to create learning experiences that are quite interesting for students. PBL with the CTL approach will provide a learning experience for students so they can always practice in problem solving activities that are around students' lives constructively through the PBL learning model using the CTL approach.

Based on the explanation that has been described, the purpose of this study is to describe the quality of physics learning tools with problem-based learning models with contextual teaching and learning approaches on elasticity and Hooke's law.

Method

This development research uses Research and Development (R&D) research with the ADDIE model developed by Reiser and Mollenda whose goal is to develop learning tools that are tested based on their quality and are feasible to implement. The development of the ADDIE model consists of the analysis, design, development, implementation and evaluation stages. A learning device is said to be of high quality if it meets valid, practical, and effective criteria.

To find out the level of validity of the developed learning device, a product assessment is carried out using a validation sheet instrument that is given a validator to be assessed and commented on. Learning device validation was carried out by 2 validators using validation sheets. Products that are validated are in the form of syllabus, lesson plans, teaching materials, students' worksheet, assessment of learning outcomes.

The practicality test of the device using an assessment sheet for the implementation of learning required an assessment from the teacher and students through a teacher and student response questionnaire. For its implementation, it will be carried out in class XI-IPA-1 Muhammadiyah Batudaa High School in the odd semester of 2022/2023 academic year by determining the research subject using a simple random sampling technique. To find out the percentage of the implementation of activities in all aspects of learning, the formula is used:

$$\% \text{ Implementation} = \frac{many\ steps\ have\ been\ taken}{planned\ number\ of\ steps} \text{ x } 100\% \quad (1)$$

The effectiveness of learning devices can be seen from the activities through observation sheets in viewing student activities during learning activities, as well as student learning outcomes after participating in learning activities. The percentage of student activity in learning through observation sheets is analyzed using the equation:

$$\%\text{Student activity} = \frac{the\ total\ score\ obtained\ (A)}{Maximum\ score\ (N)} \text{ x } 100\% \quad (2)$$

Then to see the percentage of student learning outcomes after participating in learning is analyzed using the equation:

$$\% \text{ Learning outcomes} = \frac{the\ total\ score\ obtained\ (A)}{maximum\ score\ (N)} \text{ x } 100\% \quad (3)$$

Result and Discussion

Result

This research succeeded in producing quality learning tools from a valid, practical, and effective perspective.

Validity

The validity of the learning device is seen through the assessment given by experts on the validation sheet. The learning devices that will be used must be validated by experts or validators to see whether the learning devices are valid or not. The learning tools used were validated by two validators with the validated tools including syllabus, lesson plans, teaching materials, student worksheets, and learning outcome test. The validation results can be seen in Table 1.

Table 1. Learning Device Validation Results

Validators	Percentage (%)				
	Syllabus	Lesson plan	Teaching materials	Student Worksheets	Learning Outcome Test
I	90.00	95.00	97.00	97.50	98.00
II	92.50	95.25	97.00	97.50	98.00
Average	91.25	95.12	97.00	97.50	98.00

Based on Table 1, the learning tools developed are stated to be very valid for the syllabus obtaining a percentage of 91.25%, lesson plans obtaining a percentage of 95.12%, teaching materials obtaining a percentage of 97%, Student Worksheets obtaining a percentage of 97.5%, Learning Outcome Test obtaining a percentage of 98%.

Practicality

The practicality of learning tools is seen through the implementation of learning according to the steps contained in the lesson plan and also seen through the responses of teachers and students. The results of the implementation of learning are seen in Table 2. Based on Table 2, shows the percentage of learning implementation for 2 meetings reached very good criteria.

Table 2. Implementation of Learning

Meeting	Performance Presentation (%)	Criteria
1	95.23	Very good
2	100.00	Very good
Average	97.61	Very good

Table 3. Teacher Responses Questionnaire Results

Indicator	Teacher Response Percentage (%)	Criteria
1	80	Good
2	80	Good
3	80	Good
4	80	Good
5	80	Good
Average	80	Good

Table 4. Student Response Questionnaire Results

Indicator	Teacher Response Percentage (%)	Criteria
1	80	Good
2	82	Good
3	81	Good
4	77	Good
5	86	Good
Average	81.20	Good

The practicality of the learning tools was also seen from the teacher and student response questionnaires to the learning tools that were developed. The results of teacher and student responses are seen in Table 3 and Table 4. Based on Table 3, it can be seen that the results of the teacher's response questionnaire for all indicators are 80% and are included in the good category. Based on Table 4, it can be seen that the results of the teacher's response questionnaire for all indicators were 81.20% and included in the good category.

Effectiveness

The effectiveness of learning tools is seen through student activity data during learning activities and student learning outcomes on elasticity and hooke's law. The results of student activities can be seen in Table 5.

Table 5. Percentage of Student Activity

Meeting	Student Activity (%)	Criteria
1	90.30	Very Good
2	90.29	Very Good
Average	90.30	Very Good

Based on Table 5. shows the percentage of student activity data while participating in learning which consists of 2 meetings. For the first meeting the percentage of student activity data showed 90.30% with very good criteria. Then the second meeting, the percentage of student activity data showed 90.29% with very good criteria. Based on the average of the two meetings is 90.30% obtained very good criteria based on the criteria according to Arikunto (2010).

The effectiveness of learning tools is also seen through data on student learning outcomes on elasticity and Hooke's law. Data on student learning outcomes, namely cognitive competence in the form of questions totaling 10 items in the form of essays. The test consists of pretest and posttest. To see an increase in learning outcomes, N-gain analysis is used. The average results of the pre-test scores, post-test scores, the difference between pretest and posttest and their N-gain values are presented in Table 6.

Table 6. Average Pretest, Posttest, Difference, and N-gain

Respondents	Pretest	Posttest	Difference	N-gain	Criteria
33	15.39%	78.19%	62.80%	0.74	High

Based on Table 6 it shows that the pretest value is 15.39% while the posttest value is 78.19% with a difference of 62.80% with an increase in the N-gain value of 0.74 ($\langle g \rangle \geq 0.7$) including high N-gain criteria based on Hake (1999).

Furthermore, the increase in student learning outcomes based on cognitive competence for each improved aspect is presented in Table 7.

Table 7. Improvement of Learning Outcomes Indicators in the Cognitive Domain

Aspect	% Pretest	% Posttest	N-gain	Criteria
C1	11.40	84.10	0.82	High
C2	30.60	74.10	0.73	High
C3	1.69	74.10	0.73	High
C4	21.60	64.60	0.54	Medium

Discussion

Whether or not the learning device to be used is valid or not is determined through professional opinion through a review of the instrument per item and as a whole of the learning device being developed. Aspects assessed by experts or validators include construction, content, readability, language, and appearance. The results of the review by experts are used as input and revision material in perfecting the learning tools that will be used. The learning tools developed are syllabus, lesson plans, teaching materials, student worksheets, and learning outcomes tests. Based on the validation that has been carried out, the result is that the learning device is included in very valid criteria and can be used in learning. In line with research conducted by Dariani et al. (2022), Buhungo et al. (2021), and Jaapar et al. (2021) which stated that the results of the validation of all learning tools were declared valid with minor revisions.

The practicality of learning devices is seen through the results of the implementation of learning as well as teacher and student response questionnaires. Based on the results of observations of the implementation of learning carried out by observers on learning carried out by teachers using learning tools that were developed that the implementation of learning is in accordance with the steps contained in the lesson plans so that it is practical to apply in the learning process. As is the case with research conducted by Arbie et al. (2021), Djou et al. (2022), and Susilawati et al. (2022) which states that the implementation of learning is very good category.

Teacher and student responses regarding the learning process were seen from several indicators and received positive responses. Therefore, learning using the problem-based learning model with a contextual teaching and learning approach can foster student enthusiasm in the learning process because students are directly involved in learning activities. from the positive response given by the teacher and students, the learning tools developed are said to be practical in their implementation in the classroom. In line with research conducted by Lantowa et al. (2022), Rahmana et al. (2021), and Sahidu et al. (2018) which states that the devices developed are in a good category that can be used to support physics learning.

The quality of learning tools seen from the effectiveness is reviewed based on student activities and student learning outcomes. There are 7 aspects observed by observers to see student activity in learning during 2 meetings. Based on the 7 activities of students who were observed during 2 meetings, they obtained very good criteria based on criteria according to (Arikunto, 2010). In line with research conducted by Mustapa et al. (2022) which states that the percentage of student activity in learning activities that use learning tools that have been developed reaches high criteria.

Comparison of the average posttest > pretest scores on the achievement of individual student learning outcomes has a difference of 62.80. Therefore, it can be said that there is a significant increase in student learning outcomes, thus the learning tools are included in the very effective criteria. Likewise, seen from the gain value, the score obtained was 0.74 for the meeting. Based on the division of the gain scores according to (Hake, 1999) the learning devices are included in the high category. So, it is certain that the learning tools that use the PBL model with the CTL approach developed are very effective. In line with research Putri (2017) which states that based on the results of their research, Problem-Based Learning can increase the value of students' knowledge.

Conclusion

Based on the results of research regarding the development of learning tools using the Problem-Based Learning model with the Contextual Teaching and Learning Approach on elasticity and Hooke's law material conducted at Muhammadiyah Batudaa High School, seen from the feasibility level of the validation results through expert assessment, it is classified as a very valid category and feasible to use. Judging from the level of practicality of the learning device with very good criteria, the teacher's response and student response gave a positive response. The level of effectiveness can be seen through the activities of students who get very good criteria, as well as the assessment of student learning outcomes that get an average score of all students > 75 (is above the minimum completeness criteria). Meanwhile, the N-gain score includes high N-gain criteria. Therefore, the learning device is declared valid, practical, and effective.

Acknowledgments

Thank you to SMA Muhammadiyah Batudaa for supporting the implementation of this research.

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