Developing of simple props using local materials to support natural sciences learning

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Abstract. This study aims to describe the validity, practicality, and effectiveness of simple props. The props developed using the model analysis, design, development, implementation, evaluation (ADDIE) were tested on students of class VIII Junior High School in Banjarbaru using One-Group Pretest-Posttest Design. The data in this study were obtained through validation sheets, questionnaires, and learning outcomes tests. The results of this study indicate: 1) the validity of simple props was valid, and the validity of the student worksheet category is very valid, with the results of validation of 3.19 and 3.40. 2) the practicality of simple props was very practical with the results of the questionnaire calculation of 4.38. 3) The effectiveness of simple props was a very effective category of learning outcomes tests with test results gain of 0.71. It was concluded that simple props use local materials to support natural science learning feasible to be used in the learning process in the subject matter of solid pressure and liquid pressure.

1. Introduction

The Regulation of the Minister of National Education Number 16 of 2007 states that one of the teacher's competencies is that the teacher must be able to carry out learning that educates with core competencies to form a complete learning design. The complete learning in question is good for activities in the classroom, laboratory, and field. Also, using learning media in accordance with the characteristics of students. Therefore, teachers are required to make learning more innovative, which encourages students to learn optimally both in independent learning and in the classroom learning [1].

The existence of teacher roles and functions is a very significant factor. Some teachers prefer to explain verbally and provide materials to students without any props that support them. In addition, due to lack of props learning in school due to the high price of props and lack of funds to purchase these props. The unavailability of adequate infrastructure facilities in several schools, especially for supporting physics practicum [2–5]. More specifically, the results of interviews with science subject teachers in one of the state junior high schools in Banjarbaru have shown that during the learning process they rarely use teaching props.

The use of props in learning activities is an effort to improve teaching methods that are still encountered in the present study. As a support to the implementation of the learning process enjoyable necessary to provide adequate props [6–8]. With the help of props, the learning experience will be better and more real. Teacher creativity is needed in choosing the right learning media to understand material concepts that are abstract in nature [9]. Props are used to be able to overcome the difficulties of delivering abstract material [10,11].
Limitations props in learning physics, especially for a pressure of the material Solid and liquid pressure can be overcome with the development of props. Props are intended to mobilize the senses as much as possible to an object so as to facilitate perception [9]. The use of props in the learning process is expected to help teachers demonstrate related science concepts so that learners more easily understand the key concepts [2,12–14].

The science learning props developed are utilizing local materials. The local material in question is the use of wood materials, especially meranti and ulin, as tools and materials that are easily available in the neighborhood around the State Middle School in Banjarbaru. This can be seen in the number of factories or trading businesses that produce various types of wood so that wood as the main material used is easily available in the surrounding environment.

Because of the importance of teaching aids in learning, teaching aids with local materials were developed. Making props with local materials is still not widely done, especially for pressure material. The props are expected to be feasible, namely valid, practical, and effective, to be used to improve student learning outcomes. Therefore, research has been carried out with a focus on describing the feasibility of solid pressure and liquid pressure props using local materials to support science learning.

2. Method

The research conducted was research and development. The research and development carried out was the development of a form of solid pressure and liquid pressure props. The steps in this study were the ADDIE model (Analyze, Design, Development, Implementation, Evaluation).

The stages of analysis in this study were identifying competency standards, analyzing teaching materials, and analyzing student characteristics. The design phase was the selection of material in accordance with the characteristics of students and the demands of competencies, learning strategies and methods of assessment and evaluation used. Namely the development stage props develop, implement validation tools. Stages of the application were tested on a class of eighth-graders one Junior High School Banjarbaru, using props that had been developed. The props developed in this study were teaching aids using local materials to support science learning using the direct instruction model. The evaluation phase was the formative evaluation carried out at each stage.

The instruments used in this study were validation sheets, student response questionnaires, and test results. The results of validation calculations from experts and practitioners used an average score (X); the average score obtained was adjusted to the validity criteria [15]. The practicality of the props using the student response questionnaire consisted of twelve statements; the average value for each aspect obtained was adjusted to the practicality criteria. The effectiveness of teaching aids was measured using a learning outcome test, then analyzed using a normalized gain test formula [16].

3. Result and Discussion

3.1. Solid Pressure And Liquid Pressure Props

The props developed can be used to carry out several experiments, including: 1) Experiments of solid pressure, 2) trials of hydrostatic pressure, 3) observations of Pascal's law, 4) experiments of related vessels, and 5) trials of Archimedes' Law. The props that have been made can be opened from the front and side where on the front there is a wood load arranged and the side of the kit there are injections, hydrostatic pressure, and instructions for the use of props, while the pressure props are solid and liquid side the upper side is fixed left closed so that it has a function to hang funnels and spring balance. Archimedes' Law Trial uses ironwood. This is because ironwood has a special feature that is resistant to attacks by termites and stem borers, resistant to changes in humidity and temperature, and resistant to seawater so it is not easily weathered. In the props of solid and liquid pressure materials, all tools prioritize tools that can be made from meranti wood and ironwood, which adjust the environmental characteristics of one of the Banjarbaru Junior High Schools.

The solid pressure and liquid pressure props products that have been made can be seen in Figure 1 below:
The tools that can be made from meranti and ironwood are experiment kits, wooden containers for platinum, wood loads of various sizes, buffer boards for hydrostatic pressure and related vessels, other buffer boards for Pascal's law and hanger for spring balance on Archimedes' legal trial in the kit. Besides supporting tools for solid pressure and liquid pressure, namely: clear hose, plasticine, water, ruler, injection, spring balance, measuring cup, funnel.

3.2. Props validation
Validation of props of solid pressure and liquid pressure was assessed by 3 validators, both academics, and practitioners. Validation considers four aspects, namely aspects of production considerations, aspects of consideration of students, aspects of consideration of content and aspects of teacher consideration. The results of the props validation can be seen in Table 1.

| Aspect Validation          | Average | Category    |
|---------------------------|---------|-------------|
| Considerations of production | 3.19    | Good        |
| Consideration of students  | 3.25    | Very good   |
| Consideration of content   | 3.33    | Very Good   |
| Consideration of teacher   | 3.00    | Good        |
| Validity                   | 3.19    | Valid       |
| Reliability                | 0.74    | Medium      |

Table 1 shows that the results of the average overall teaching aids validation are 3.19, which means valid. The results of the average study props validation on aspects of production considerations, consideration of students, consideration of content and consideration of teachers included in the good category.

3.3. Validation results of student worksheets
Student worksheets are validated by three validators. Student worksheets validation considers five aspects, namely aspects of content eligibility, aspects of work procedures, aspects of language use,
aspects of questions, and aspects of physical appearance. The results of validating student worksheets can be seen in Table 2.

**Table 2. Results of validating student worksheets**

| Aspect Validation       | Average | Category   |
|-------------------------|---------|------------|
| content eligibility     | 3.53    | Very good  |
| work procedures         | 3.00    | Good       |
| language use            | 4.00    | Very good  |
| questions               | 3.00    | Good       |
| physical appearance     | 3.50    | Very good  |
| Validity                | 3.40    | Very Valid |
| **Reliability**         | 0.82    | High       |

The results of the validation of the props and worksheet students obtained valid and very valid validity, respectively. The reliability of the props and worksheet students obtained moderate and high levels of reliability. It shows that the props and students of the worksheet are feasible to use. The overall teaching aids and worksheet students showed that the props and students of the developed worksheet were valid and could be used in the pilot phase at school. Props are tools used to clarify certain concepts/theories/ways of working in the teaching and learning process, which means that the props developed are expected to become learning media that can achieve learning goals and be able to improve student learning outcomes [17]. Validation props and student worksheets conducted to determine whether or not the props used in the learning process [6]. It is also done in this study is validation props use local materials to determine how feasible the props used in the learning process.

### 3.4. Validation results from learning outcomes tests

The questions used for the pretest and posttest were also validated by two validators from academics. The pretest and posttest questions used included four questions for the matter of solid pressure and hydrostatic pressure, five questions for Pascal's law and related vessels, and three questions for Archimedes law. Each question is all in the form of an essay. The results of the validation of learning outcomes tests can be seen in Table 3.

**Table 3. Validation results from learning outcomes tests**

| Aspect Validation      | Average | Category   |
|------------------------|---------|------------|
| General Construction   | 3.42    | Very good  |
| Validity of item       | 3.31    | Very good  |
| Validity               | 3.34    | Very valid |
| **Reliability**        | 0.90    | High       |

In table 3, the results of the validity of the learning outcomes test are 3.34 which is included in the excellent category or which means very valid. After the test results are validated, small revisions are made according to the suggestions from the validator so that they can be used by students to measure the effectiveness of student learning outcomes tests. the learning outcome test that is made is in accordance with the standards of competence and learning objectives, so the learning outcomes test is very valid. These results indicate that the test of student learning outcomes can be used and tested to measure the effectiveness of the props developed.

### 3.5. The practicality of props

Practicality props measured using student questionnaire responses. The results of the practicality of the props can be seen in Table 4.
Table 4. Results of the practicality of props

| Indicator                  | Average | Category    |
|----------------------------|---------|-------------|
| Benefits                   | 4.38    | Very good   |
| Ease of use                | 4.37    | Very good   |
| Efficiency of learning time| 4.40    | Very good   |
| X                          | 4.38    | Very practical |

Table 4 shows the average results of student response calculations of 4.38 which are included in the very practical category. The results of the analysis show that material props of solid pressure and liquid pressure using local materials can be said to be very practical to use when learning in the classroom by students and make it easier for students to understand the concepts or things raised by the teacher. The props developed are said to be practical if they can be applied in classroom learning and are related to the level of ease of use of the learning media [8,18,19]. Props are said to be practical if the results of the study meet practical criteria to be very practical. In this study the results of the practicality of the props were obtained in a very practical category so that it can be said that the props using local materials developed were very easy to use during the learning process.

3.6. Effectiveness of props

Learning outcomes tests are used to measure student learning outcomes before and after the use of teaching aids. The results of the pretest and posttest were then analyzed using N-gain. The results of the gain test can be seen in Table 5.

Table 5. Result of gain test

| Average of pretest | Average of posttest | $g$ | Category |
|--------------------|---------------------|-----|----------|
| 24.4               | 77.8                | 0.71| High     |

Based on table 5, the gain test value is 0.71 which is included in the high category. The props will be declared effective if the gain value is at least medium. Therefore, this means of exercise means it is effectively categorized. Thus, these props otherwise are able to achieve the learning objectives that look at improving student learning outcomes.

The use of props will greatly affect the effectiveness of the learning process provided by the teacher [20]. Learning is said to be effective if the teaching and learning process runs well in accordance with the learning objectives. This result is similar to the results of previous studies stating that props have an effect on improving student learning outcomes [2,4,18,21,22,5–10,13,14].

Props have uses that are very important for students [23,24]. One of the difficulties in learning physics is a concept that is so abstract and complex, that it creates serious difficulties [11]. Props, in the form of learning media, act as the means of channeling information from information sources to recipients of information [25].

To be able to carry out practical activities in physics learning in schools, of course, media props are needed [26]. Props for physics lessons help teachers realize many objects in our daily lives [27]. Props are learning media that can facilitate students because students can directly see, observe and understand the actual process of events [24]. Teaching aids help students so that students can see first hand how the process is happening inside [12]. Thus, it will better understand material concepts and students can improve learning outcomes.

4. Conclusion

The props use local materials to support science learning, in the matter of the pressure of solids and pressures of liquids is feasible to use. Thus, these props can be used as a medium of learning in junior high school level. The teacher can use props using local materials on the material of solid pressure and
pressure on the liquid because this tool is valid and practical in its use. Also, props have been effective in improving student learning outcomes.

Further research is needed on the effectiveness of these props, in particular about the skills and abilities of students that are more specific. In addition, further research to solve various problems in the class (action research) can use props that have been developed.

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