

Validity and Reliability of Learning Tools Based on Discovery Learning Model to Improve Creative Thinking Ability and Concept Understanding

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Abstract

This study aimed to describe the validity and reliability of the based discovery learning models to improve creative thinking ability and students' conceptual understanding of harmonic vibrations. The type of research used is research development (Research and Development) with the research design being developed is 4D Models. The subject of this research is the based discovery learning models to improve creative thinking ability and students' conceptual understanding of harmonic vibrations. Retrieval of research data using validation sheets which were assessed by 3 expert validators consisting of 3 physics education lecturers. The research data is in the form of qualitative and quantitative data from the validator's assessment of the learning tools developed. The learning tools include syllabus, learning material, lesson plans, student worksheet, creative thinking ability test, and conceptual understanding test. This study conducted a validity test to determine the feasibility and validity level of the learning tools. The validity data obtained a value of 3.39 for the syllabus, 3.41 for the learning material, 3.27 for the lesson plan, 3.41 for the student worksheet, 3.37 for the creative thinking ability test and 3.33 for the conceptual understanding test. So that the average validity of learning tools is in the very valid category with a validity level of 3.36. Furthermore, the reliability test, the coefficient interval results obtained are 0.973 for the syllabus, 0.939 for the learning material, 0.976 for lesson plans, 0.982 for student worksheet, 0.958 for creative thinking ability test and 0.963 for conceptual understanding test. So that the average reliability coefficient interval is 0.965 with the reliable category. The conclusion is that the learning tools are valid and reliable for use in learning activities.

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INTRODUCTION

Physics is a branch of science as well as the nature of science. Science can be viewed as a scientific process, product and attitude (Makhrus, 2012). Science as a product in the form of facts, concepts, principles, theories, and laws. Science as a process is seen as physical scientific information that can be obtained by making observations, measurements, investigations and publications (Latifa, 2017). The shift from learning physics to learning mathematics is what is often found today. The learning given is more directed at mathematical calculations, namely by displaying several equations. Helmi (2017) states that teachers have a tendency to introduce a number of equations (formulas) to related phenomena. This fact fosters a perception in students that physics is filled with formulas, thus making physics learning less attractive and less liked by students which also

results in low thinking skills in students. Students need a lesson that can hone their creative thinking skills.

Preliminary studies conducted by researchers through observations at a school in the city of Mataram, where physics is often considered a difficult subject so that many students do not understand the concept of physics. Students assume that what is learned is only accepted material without having to be applied because it has nothing to do with events that exist in real life in their environment. The teacher emphasizes more on learning that allows students to have limited ability to answer questions so that students' creative thinking skills and understanding of concepts are low. One of the efforts that can be made to actively involve students, foster creative thinking skills and improve conceptual understanding is by developing discovery learning model learning tools. Karim in Ariyanto (2019) argues that the discovery learning model is a way to convey ideas through the process of finding, in this process students try to find concepts, formulas and the like with teacher guidance.

Discovery learning is a discovery-based learning model where the teacher as a facilitator directs students in finding and proving a concept or principle on problems that exist in everyday life related to physics lessons through the stages (syntax) stimulation, problem identification, data collection, data processing, evidence to draw conclusions. The advantage of discovery learning-based learning tools developed by Munandar (2016) is that the learning process will be student-centered, because students play an active role in obtaining and collecting information in learning activities. The learning process will guide students to be trained in processing data based on the information obtained to answer the worksheet given. Students are also able to improve their predictive abilities, because students can analyze their thoughts in making choices and drawing conclusions well. Damanik (2018) states that the discovery learning model is proven to be able to improve students' creative thinking skills which is supported by student activities that provide positive responses and play an active role in learning. Anggraini (2019) states that the stages of the discovery learning model that are able to train students to think creatively include stimulation and problem identification. In this stage, students are trained in two indicators of creative thinking, namely fluent and flexible. The next stage is data collection and data processing, where students are trained to have one indicator of creative thinking ability, namely original thinking. The next step is to prove and draw conclusions. Students are trained to have indicators of creative thinking, namely elaborative or detailed thinking. Suparman and Husen (2015) state that creative thinking skills can be honed by understanding students' concepts in learning activities, so that by increasing students' conceptual understanding, it is expected that students' creative thinking skills can develop well.

Concept understanding is a very important ability for students. Researchers in the field of education explain that understanding concepts does not only present knowledge in an existing form. Rahmadani (2017) states that learning using discovery learning-based learning tools can foster student interest and interest in motivating themselves in learning physics so that it has a positive impact on learning outcomes, especially students' ability in understanding concepts. The development of discovery learning model learning tools consists of syllabus, teaching materials, lesson plans, worksheets, creative thinking ability test instruments, and concept understanding test instruments. The syllabus is a reference for preparing the learning framework for each subject study material or as a reference for preparing lesson plans. Lesson plans are face-to-face learning activity plans for one or more meetings that are developed from the syllabus to direct student learning activities in an effort to achieve basic competencies. Learning activities to be carried out need teaching

materials and worksheets to facilitate students in learning activities. Worksheet is a student guide that is used to carry out information gathering activities and to assess the final activity in the learning process using creative thinking ability and concept understanding test instruments. Based on the description above, the development of discovery learning model tools in the learning process has an important role in increasing creative thinking skills and understanding concepts. The objectives to be achieved in the research are to describe the validity and reliability of learning tools based on discovery learning models to improve students' creative thinking skills and understanding of concepts on harmonic vibrations.

METHOD

This research is a type of research development or Research and Development. The research design applied in this study is the 4D research and development model by Thiagarajan (1974). The research model developed is 4D Models which consists of four stages, namely defining, designing, developing, and disseminating. The research used until the development stage was due to conditions that were not possible due to the covid-19 pandemic which made all schools in Indonesia conduct online learning at their respective homes. The complete research design is described as in Figure 1.

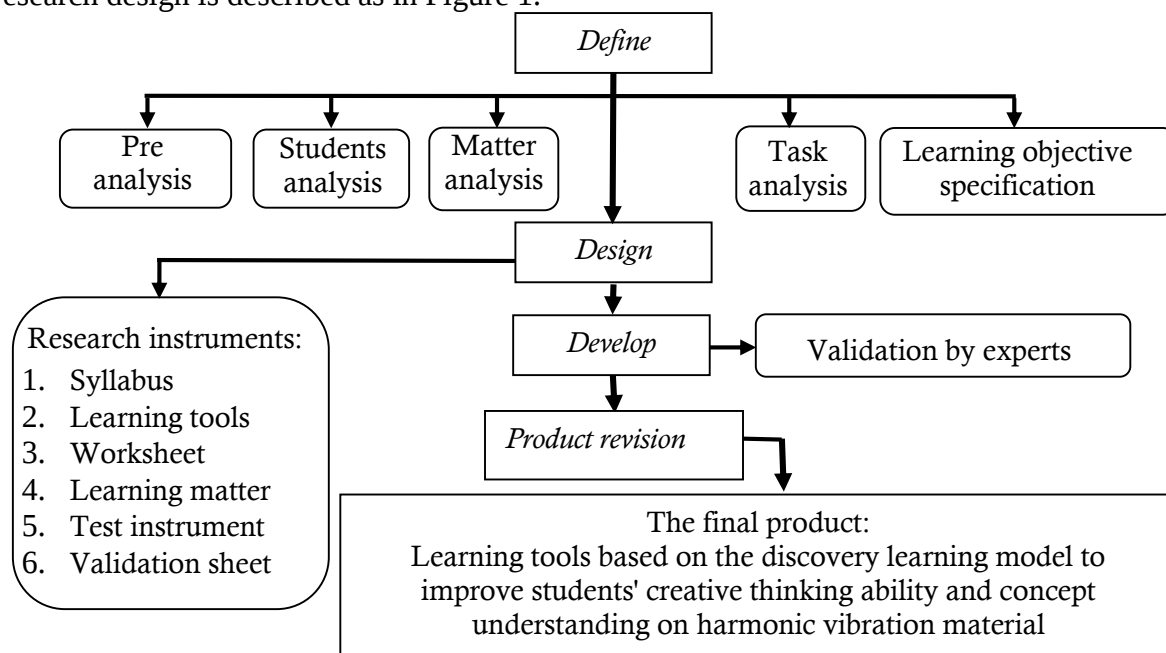


Figure 1. Research Design

The instruments in this development research consist of physics learning tools and data collection instruments. Learning tools are equipment that must be prepared by teachers before carrying out learning which includes syllabus, teaching materials, lesson plans, worksheet, test instruments. Meanwhile, the data collection instrument consisted of a validation questionnaire. The data is then processed to determine the validity and reliability of the product being tested.

Learning Tool Validity

Calculating the average value of the validity of the validator with the modified equation Sugiyono (2017).

$$NA = \frac{V_1 + V_2 + V_3}{3}$$

Annotation:

NA = validity averages

V_1 = score of 1st expert validator

V_2 = score of 2nd expert validator

V_3 = score of 3rd expert validator

Then the average validation score is converted to the assessment criteria as in Table 1.

Tabel 1. Validity assessment criteria

Interval	Category
1.00 – 1.75	Not Valid
1.76 – 2.50	Enough Valid
2.51 – 3.25	Valid
3.26 – 4.00	Very Valid

Ratumanan & Laurens (2011).

Learning Tool Reliability

Reliability in this study uses the Borich method, known as the Percentage of Agreement (PA), which is the percentage of agreement between raters which is a percentage of the suitability of values between the first rater and the second rater. Percentage of Agreement (PA) can be formulated:

$$PA = \left(1 - \frac{A - B}{A + B} \right) \times 100\%$$

Where A is the higher scorer and B the smaller score. The larger score (A) is always subtracted from the smaller score (B). The instrument is said to be reliable if the percentage value of the agreement is more or equal to 75%. If it yields less than 75%, it should be tested for clarity and approval by observers.

RESULTS AND DISCUSSION

This study aims to develop learning tools and test the validity and reliability of learning tools. The product produced in this development research is a product in the form of learning tools consisting of a syllabus, teaching materials, lesson plans, worksheet, creative thinking ability test instruments and concept understanding. The development of learning tools in this study refers to the 4D model which consists of the stages of defining, designing, developing, and disseminating. The results of the development of learning tools in this study were carried out until the development stage, namely the assessment of experts due to the pandemic conditions so that limited trials and the dissemination stage could not be carried out. The result of defining is to define and define learning needs by analyzing the objectives and limitations of the material. Based on the results of observations, one of the problems that occur is the ability to think creatively and students' understanding of concepts is still lacking because learning is still informative by the teacher. A lesson not only aims to understand and memorize a concept but also provides an understanding of how the concept can occur so that students will have knowledge as well as the ability to solve a problem creatively. The material in the research that will be designed is harmonious vibration and is equipped with indicators of creative thinking ability and concept understanding. The result of the design is to design learning tools in

the form of syllabus, lesson plans, worksheet, teaching materials and evaluation instruments. Learning tools designed based on the discovery learning model. The evaluation instrument is also designed in the form of a description test based on indicators of creative thinking ability and concept understanding which are sorted from the lowest level to the highest level. The results of the development (develop) in the form of learning tools based on discovery learning models to improve students' creative thinking skills and understanding of concepts on harmonic vibration material. The learning tool is assessed by an expert validator. Learning tools that have been validated are then revised based on input/suggestions from expert validators to produce a final product.

This syllabus was developed based on the learning steps of the discovery learning model. So, with the development of this syllabus, it is hoped that it can be used as a guide in developing lesson plans, in addition to following the steps of learning the discovery learning model, this syllabus is also developed with an assessment technique that is able to measure students' creative thinking skills and understanding of concepts, so that the test instrument will be compiled based on this technique. assessment on the syllabus. The lesson plan developed in this study is a lesson plan based on discovery learning. The learning steps in this lesson plan are adapted to the learning steps of the discovery learning model. The teaching material developed is a student book based on the discovery learning model to improve creative thinking skills and understanding concepts on the material of harmonic vibrations. The difference in the format of teaching materials in this study is the addition of discovery learning syntax with supporting presentations in the form of worksheet to improve students' creative thinking skills and understanding of concepts.

The developed worksheet is a harmonic vibration material worksheet in the form of a practicum. This worksheet is prepared by taking into account the indicators of creative thinking ability and concept understanding. Each question item made on the worksheet is developed so that students can practice their creative thinking skills and understanding concepts. The test instrument compiled consisted of a creative thinking ability test in the form of a description of 8 questions and a concept understanding test in the form of a description of 6 questions. The development of this test instrument is expected to be used to improve students' creative thinking skills and conceptual understanding after completing the learning activities. The results of the validation of learning tools can be seen in Table 2 and a recapitulation of the level of reliability of the products that have been developed based on the validation results can be seen in Table 3.

Tabel 2. Validity test results

Learning tools	Validator assessment			NA	Category
	V ₁	V ₂	V ₃		
Syllabus	3.18	3.36	3.27	3.39	Very Valid
Learning matter	3.67	3.33	3.25	3.41	Very Valid
Lesson plan	3.33	3.33	3.17	3.27	Very Valid
Worksheet	3.37	3.37	3.50	3.41	Very Valid
Creative thinking test	3.57	3.28	3.28	3.37	Very Valid
Concept understanding test	3.50	3.25	3.25	3.33	Very Valid
Averages				3.36	Very Valid

Tabel 3. Reliability test results

Learning tools	Validator assessment			NA	Category	PA	Category
	V ₁	V ₂	V ₃				
Syllabus	3.18	3.36	3.27	3.39	Very Valid	0.973	Reliabel
Learning matter	3.67	3.33	3.25	3.41	Very Valid	0.939	Reliabel
Lesson plan	3.33	3.33	3.17	3.27	Very Valid	0.976	Reliabel
Worksheet	3.37	3.37	3.50	3.41	Very Valid	0.982	Reliabel
Creative thinking test	3.57	3.28	3.28	3.37	Very Valid	0.958	Reliabel
Concept understanding test	3.50	3.25	3.25	3.33	Very Valid	0.963	Reliabel
Averages				3.36	Very Valid	0.965	Reliabel

Learning tools are said to be valid if they meet the predetermined validity criteria. Arikunto (2014) explains that a learning tool is said to have validity if it is able to measure what is desired. The resulting syllabus is in accordance with the K13 syllabus format, which consists of basic competencies, learning materials and learning activities. The differences or advantages of the developed syllabus are in the form of learning activities using discovery learning syntax, the presence of indicators of creative thinking skills and indicators of concept understanding, as well as cognitive assessment in the form of a description test. This is in accordance with Sahidu's argue (2017) which states that the syllabus is a learning plan for one and/or certain subject groups that include basic competencies, learning subject matter, learning activities, indicators of competency achievement, assessment techniques, time allocation and learning resources. This is also supported by the results of Purohita's research (2020) which states that the addition of indicators to the syllabus is very important to adapt to assessment techniques and learning activities.

The resulting teaching materials have the same format as teaching materials in general, which consist of material analysis and cognitive tests. The advantage is that the material analysis developed follows the syntax of the discovery learning model and is equipped with worksheets and questions to achieve the learning objectives of creative thinking skills and understanding concepts. This is in accordance with Akmal's argue (2018) which states that teaching materials or learning materials generally consist of scientific knowledge, skills, and attitudes that students must learn in order to achieve predetermined competency standards. This is also supported by the results of Damanik's research (2018) which states that the use of discovery learning models in teaching materials can improve students' creative thinking skills. The syntax of discovery learning in teaching materials strongly supports indicators of creative thinking skills berpikir.

The resulting of lesson plan has the same format as the lesson plan in general, which consists of basic competencies, indicators of competency achievement, learning objectives, and learning steps. The advantages are indicators and learning objectives based on the ability to think creatively and understanding concepts, the core activities follow the syntax of the discovery learning model. The syntax in the core activity has 6 phases with the use of worksheet media in phase 2 to phase 6 to improve creative thinking skills and understanding concepts. This is in accordance with Sahidu's opinion (2017) which states that the steps for preparing a learning implementation plan (lesson plan) are to include identity, include learning objectives, include learning materials, include learning methods, learning techniques, media, learning tools and resources, and steps -step learning. This is also supported by Damanik's research (2018) which states that the use of the discovery learning model syntax in the steps of learning activities is able to clarify the methods and learning techniques used.

The worksheet also adapts to the discovery learning model and contains questions that direct students to improve their creative thinking skills and conceptual understanding. This is in accordance with the opinion of Benedikta (2013) which states that a worksheet is a sheet containing tasks that must be done by students where the tasks carried out on the worksheet must be clear about the basic competencies to be achieved. This is also supported by the results of Anggraini's research (2019) which states that the use of discovery learning models on worksheets is very supportive to improve students' creative thinking skills consisting of fluency, diversity, authenticity, and detail. An evaluation instrument to measure students' creative thinking skills and conceptual understanding, so that the questions contained are based on indicators on creative thinking skills described by Suparman and Husen (2015) and indicators of concept understanding using Bloom's revised taxonomy. This is in accordance with the opinion of Widoyoko (2014) which states that the evaluation instrument is a measuring tool to obtain information on student learning outcomes that require answers. This is also supported by the results of Anggraini's research (2019) which states that the creative thinking ability evaluation instrument is made in the form of a description and is based on indicators of creative thinking ability. The results are varied so that they are able to adjust the indicators of creative thinking skills in the form of fluency, diversity, originality, and details/decomposition. Another thing is also supported by the results of Rahmadani's research (2017) which states that to increase understanding of the concept it can also be seen from each indicator which is sorted from low to high level. And this form of description supports students to write concepts in their own language.

The average value of the percentage of agreement (PA) for learning tool is 96.5%, namely at the coefficient interval 0.75 with a reliable category. This is in accordance with the opinion of Anggraini (2019) which states that the learning tool is said to be reliable if two validators provide similar or consistent results, so that the learning tool to be used can be trusted. This is also supported by the results of Purohita's research (2020) which states that the learning tool is said to be reliable because the learning model used is consistent, which reflects the steps of the discovery learning model. The steps of the discovery learning model are stimulation, problem identification, data collection, data processing, verification and drawing conclusions. Learning tools also contain indicators of creative thinking skills (fluency, diversity, originality, and detail) and indicators of concept understanding (remembering, understanding, applying, analyzing, evaluating, and creating). The evaluation instrument which is arranged in the form of a description test is in accordance with the indicators of competence achievement of creative thinking skills and understanding of concepts. This form of description test will produce a variety of answers, not only focusing on one correct answer. So the assessment will vary. Based on the description above, the learning tools that have been developed are reliable for use in learning activities.

CONSLUSSION

From the development research that has been carried out, it can be concluded that the results of the validation of physics learning tools by expert validators from all aspects are 3.36 which are in the very valid category and based on analysis of the percentage of agreement values for syllabus, teaching materials, lesson plan, worksheet, creative thinking ability tests, and concept understanding tests are at the level of 96.5% so that the tools are declared reliable.

RECOMMENDATION

In this study, learning only uses Harmonic Vibration teaching materials, therefore it is hoped that there will be similar studies using other learning materials.

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