DEVELOPMENT OF PROBLEM SOLVING SKILLS TEST ON DYNAMIC FLUID MATERIAL IN PBD CADET HIGH SCHOOL MEDAN

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ABSTRAK

This research focuses on the development of physics problem solving skills test instruments on dynamic fluid material in class XI SMA. The purpose of this research is to find out how to develop problem solving-based test instruments on dynamic fluid material and to determine the feasibility of problem solving-based test instruments on dynamic fluid material. The type of research used in this research is R & D (Research and Development) development research using the ADDIE research model which has a research design through four stages, namely the Analysis, Design, Development, Implementation and Evaluation stages. The test sample in this study were students of class XI SMA Taruna PBD Medan with a total of 29 students with the assumption that all classes were homogeneous. The research instrument used was a test based on Problem Solving skills which amounted to 7 items in the form of essays. The results of the trial were obtained from the Problem Solving ability test instrument in the validation test conducted by 3 validators who had a very high category score which was included in the category worthy of use with revision.Translated with DeepL.com (free version). Analysis of the Problem Solving ability instrument that has been given to 29 students with the results obtained in the validity and reliability trials obtained that all test instruments are valid and reliable. In the trial the difficulty level of five questions is classified as moderate, one is classified as easy and one is classified as difficult. Furthermore, in the test of the differential power of the seven questions in the category of very good. Thus the test instrument developed is feasible to use as many as five questions. So it can be concluded that the development of instruments based on students' Problem Solving ability is feasible to use to measure students' thinking skills.

Keywords: *Test instrument, Problem Solving skills*

INTRODUCTION

Education is a process of interaction carried out by educators and students to achieve predetermined educational goals. Education functions to help learners develop their potential. Education can be achieved because there is learning. The learning process can be said to be successful when the learning outcomes are in accordance with the expected results. Learning outcomes can be known through evaluation. Evaluation is very important because it provides useful feedback for students and for teachers. To carry out an evaluation, an assessment result is needed, to get the results of the assessment, measurement is carried out. In making measurements, a valid and reliable instrument is needed (Sani, 2020). The 2013 curriculum requires students to have the ability to think at the level in order to organize the ability to solve a problem by evaluating, analyzing and creating or creating an idea, idea or concept that can build smart humans with high intellectual abilities (Solekhah, 2018). In Indonesia, learning is expected to develop thinking skills, this also applies to physics learning in high school. In physics learning, students are expected to have higher order thinking skills. The results of TIMSS

(Trends in International Mathematics and science study) Indonesia is ranked 40 out of 42 countries in terms of achievement of higher order thinking skills in physics learning (Daulay, 2020). Results from PISA (Programmer of International Students Assessment) In 2019 Indonesia's reading score was ranked 72 out of 77 countries, then the math score was ranked 72 out of 78 countries, and the science score was ranked 70 out of 78 countries (Aulia, 2021). Indonesia is a country with low thinking skills. This is caused by several factors, one of which is that students in Indonesia are still poorly trained in completing tests that demand analysis and creativity. to overcome this, development is needed in various aspects. Based on the initial observations of researchers at SMA PBD Medan, it was found that 79.4% of students said that students still had difficulty in understanding the exercise problems when the use of the language of the example problems with the exercise problems given by the teacher was different, 85.7% of students were unable to solve a physics exercise problem about its application in everyday life and 97% of students had difficulty in solving a problem in physics problems given by the teacher. This is also in line with the results of interviews with teachers who stated that students have difficulty in understanding a problem even though an example problem has been given. For example, when the use of language in sample problems and practice problems is changed. This is due to the limited instruments used by teachers and students' difficulties in solving HOTS (Higher Order Thingking Skill) physics problems because teachers are not accustomed to giving HOTS-shaped physics problems to students but still give HOT-shaped physics problems. Based on the above problems, the researchers concluded that the test instruments used by teachers are still simple and limited. One of the causes of the above problems is that the questions tend to test more aspects of memory that do not train students' higher order thinking skills, the ability to think scientifically in Indonesia is still considered low. This problem is also caused by students in Indonesia not being trained in solving HOTS questions (Damanik, 2020).

RESEARCH METHODS

This research uses the R & D (Research and Development) development method, which is a type of research method used to produce certain products or test the effectiveness of certain products (Purwanti, 2015). This research was conducted at Taruna PBD Medan High School in the even semester of the 2022/2023 school year. The population in this study was class XI. The research design used in this study is the ADDIE model (analysis, design, development, Implementation, Evaluation). The procedure for developing the ADDIE design test instrument is as follows:

1) Analysis Stage
   a. The purpose of the analysis stage is the step of collecting information needed to develop a product that is useful in solving a problem faced by the school. The activities in this stage are needs analysis, material analysis and learner analysis.
   b. Needs analysis
      What is done in this research is to collect information and data about the basic problems needed in Medan Taruna PBD high school, especially on the need for a test instrument based on problem solving skills in physics.

c. Material analysis

Material analysis is done by comparing the concept of a material with other relevant materials. So that the conclusion is found material that will be tested to students.

d. Learner Analysis

In this activity, what is done is to consider the thinking ability and experience of each learner.

2) Design stage

At this stage the things that are done are determining the basic competencies that can be used to make problem solving skills questions, designing the form of test instruments and compiling test grids.

a. Determining Basic Competencies and Problem Indicators

In this case the researcher first analyzes the basic competencies that already exist in the learning syllabus of class XI SMA Taruna PBD Medan which is in accordance with problem solving skills on Dynamic fluid material.

b. Designing the form of the instrument

The form of question instrument that will be developed is the form of essay questions. Completion of essay questions is made based on indicators at the stages of problem solving according to Polya Theory (Polya, 1945).

c. Making a test grid

The form of the problem solving test lattice made is a tabular form where the contents of the table to be made are 6, namely basic competencies, problem indicators, subject matter, submaterial, and instrument form as well as determining the number of questions on each sub-material.

3) Development Stage

At this stage, the things that are done are making instruments and conducting expert validation.

a. Making instruments

In this study, the number of problem solving skills questions on dynamic fluid material was 7 essay questions.

b. Expert Validation

The question instrument that has been prepared will then be validated to the validator, namely two Medan State University physics expert lecturers and one Medan Taruna PBD high school physics teacher.

4) Implementation Stage

This stage is the testing stage after the right product is produced.

a. Small group trial

The implementation of this small group trial involved 10 students of class XI SMA Taruna PBD Medan. After being tested, the test instrument will be revised again in order to get a better instrument.

b. Large group trial

The large group trial was conducted after the test instrument had been revised. The implementation of this large group trial consisted of 34 students of class XI SMA Taruna PBD Medan.

5) Evaluation Stage
The purpose at this stage is to assess and conclude whether the developed problem solving ability test instrument is suitable for use or not.

The instruments in this study were test instruments, expert validation sheets and student response questionnaires. Data analysis techniques used in this study are validation of test instruments by experts, test validity, reliability, difficulty level, differentiating power and analysis of student responses to questions.

ANALYSIS
The results of the analysis found that students when given a different problem from the sample problem, students will have difficulty in working on it and students rarely get questions that address thinking skills, especially thinking skills in solving a problem and physics material for class XI SMA Taruna PBD Medan used in the problem solving skills test is dynamic fluid material.

DESIGN
The result of the Design stage is a test instrument design in the form of an instrument grid designed in accordance with the basic competencies of dynamic fluid material. The basic competencies used in the problem solving skills instrument are basic competency 3.1 Apply dynamic fluid principles in technology. The basic competencies are then adjusted to the indicators of problem solving skills on dynamic fluid material. The form of the instrument used in this study is an essay form of 7 questions.

DEVELOPMENT
The development stage is the next stage carried out. at this stage, the skill test instrument is made based on the lattice of test instruments. Then after the test instrument is made, the test instrument that has been developed is validated by the validator. What is assessed by the validator of the test instrument used includes material, construction and language.

IMPLEMENTATION
The implementation stage includes small group trials and large group trials. The results of the assessment from the validator were then tested on 10 students to determine the readability of the problem solving skills questions. The results of the small group trial validation can be seen in table 1.

Table-1. Small group test validation results

Question Number	rCount	rTable	conclusion
1	0.137525395	0.632	invalid
2	0.044881761	0.632	valid
3	0.298995598	0.632	valid
4	0.720414134	0.632	Valid
5	0.737343408	0.632	Valid

| 6 | 0.810090464 | 0.632 | Valid |
| 7 | 0.928783442 | 0.632 | Valid |

Based on the validation results in table 1, questions number 1, 2 and 3 still need to be revised before conducting a large group trial. After the revision of the large group trial stage, it can be tested on 29 students of class XI SMA Taruna PBD Medan. The validity results of the large group test stage are as follows.

Tabel-2. Large group test validation results

No. Soal	Rhitung	Rtabel	Status
1	0.696588743	0.3674	Valid
2	0.372929104	0.3674	Valid
3	0.696588743	0.3674	Valid
4	0.779318489	0.3674	Valid
5	0.857377556	0.3674	Valid
6	0.710538505	0.3674	Valid
7	0.780949048	0.3674	Valid

The reliability result obtained from the problem solving skills test instrument is 0.8079 which indicates that the test instrument that has been developed is reliable. A reliable test instrument produces fixed and consistent results if used from time to time.

Tabel-3. Large Group Test Reliability Results

assigned value	cronbach alpha value	Conclusion	assigned value
0.795711121	0.795711121	Reliabel	0.795711121

The test instrument is said to be good if the test instrument is not too difficult and not too easy. The higher test difficulty index indicates that the questions are getting easier, on the other hand, if the test difficulty index is lower, the questions are more difficult. The results of the data analysis of the level of difficulty of the questions in the large group test can be seen in table 4.

Tabel-4. Large group test difficulty results

assigned value	difficulty index	Description
1	0.651724138	Medium
2	0.562068966	Medium
3	0.748275862	Easy

4	0.520689655	Medium
5	0.386206897	Medium
6	0.5	Medium
7	0.279310345	Hard

The results of the analysis of the differential power carried out in the large group coa test were that the 7 items of problem solving skills were included in the excellent criteria. The results of the data analysis of Differentiability in the large group test can be seen in table 5.

Tabel-5. Differential Power Results Large group test

Question Number	Distinguishing Power	Criteria
1	3.833333333	Excellent
2	0.99047619	Excellent
3	3.185714286	Excellent
4	3.247619048	Excellent
5	2.742857143	Excellent
6	3.095238095	Excellent
7	5.880952381	Excellent

EVALUATION

The next stage is the evaluation stage, which is to determine the quality of the problem solving skills test instrument that has been developed. At this stage is to conclude which instruments are suitable for use. Based on the data analysis that has been done, five questions are declared feasible to use.

CONCLUSIONS

The test instrument developed is feasible to use as many as five questions. The process of developing problem solving skills test instruments in physics subjects at Trauna PBD Medan High School goes through 5 stages, namely the first stage, namely the analysis stage (needs analysis, student analysis, material analysis), the second stage, namely the Design stage (determining basic competencies and problem indicators, designing instrument forms, making test grids), the third stage, namely the Development stage (making instruments, conducting expert validation), the fourth stage, namely the Implementation stage (small group trials, large group trials), and the fifth stage, namely the Evaluation stage. To develop and optimize problem solving skills, it is recommended to teachers that students be more accustomed to working on problems that hone students' skills in solving a problem in physics material.

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