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Development of Science Process Skills Assessment Instrument in Physics Learning at Dr.Wahidin Sudirohusodo Junior High School Medan

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Abstract

This study aims to produce a valid and reliable Science Process Skills (KPS) assessment instrument in learning Physics temperature and heat material. The research is a Research and Development study with the ADDIE model. The research was conducted at Dr. Wahidin Sudirohusodo Junior High School in Medan. The sample in the study came from 2 physics education lecturers and 3 physics teachers. The instruments in this study were a 15-item multiple choice KPS test sheet and a validation questionnaire. Data collection techniques in the form of tests and validation questionnaires. The KPS indicators studied were observing, formulating hypotheses, identifying variables, interpreting data, communicating, and applying concepts. Data analysis is quantitative and qualitative data analysis with the help of the SPSS version 21 application. The results validation value of 34%, language validation of 31% and validation of 35% with decent criteria, reliability of 0.862 high criteria. This finding explains that the KPS instrument is very valid and reliable to be used in learning physics temperature and heat material

Keywords: *Assessment instrument, science process skills, physics*

Introduction

The Minister of Education, Culture, Research and Technology of the Republic of Indonesia Nadiem Makarim has changed the Indonesian education curriculum to the Merdeka Belajar Curriculum. Previously, the curriculum used was the 2013 Curriculum (Fiangga et al., 2023). Although the implementation of Merdeka Belajar Curriculum has not been fully implemented in all regions in Indonesia, the majority of educational institutions, especially those in big cities, have switched to Merdeka Belajar Curriculum (Sauliyusta & Rekawati, 2016). Merdeka Curriculum or often referred to as Merdeka Belajar Curriculum is a curriculum with diverse intracurricular learning (Sari et al., 2023), where the content presented to students will be optimized with the aim that students can have enough time to explore concepts and strengthen competencies. In Merdeka Curriculum, teachers have the flexibility to choose various teaching tools, so that

learning can be tailored to the learning needs and interests of students. The Merdeka Curriculum uses a project base to strengthen the achievement of the Pancasila learner profile (Kuntoro Aji1, 2023).

This project is developed based on a specific theme set by the government (Elfira et al., 2023). Projects are not directed to achieve specific learning outcome targets, so they are not tied to subject content. Based on the attachment of Permendikbud Number 66 of 2013 concerning Educational Assessment Standards, educational assessment is the process of collecting and processing information to measure the achievement of student learning outcomes which include knowledge, skills, and attitudes. Referring to these two things, a teacher is directed to design learning that can develop students' thinking skills and the assessment that is carried out also emphasizes the competence of hard skills and soft skills. Assessment is a systematic and continuous process or activity to collect information about the process and learning outcomes of students in order to make decisions based on certain criteria and considerations (Fahlevi, 2022; Anggelia et al., 2022). Assessment functions as a performance monitor for the components of the teaching-learning process activities in achieving the expected goals and is developed based on the principles of being comprehensive, sustainable, oriented towards indicators of achievement, and in accordance with experience. One of the principles is oriented towards indicators of achievement that have been determined based on basic abilities and competency standards. This means that the assessment is adjusted to the approach used in learning.

Based on the results of observations made at Dr.Wahidin Sudirohusodo Medan Junior High School, it is known that the learning carried out by the teacher has been innovative because the teacher has implemented a model based on a scientific approach, which is a learning process that asks students to observe, explain, and make conclusions based on what students observe. However, when looking at the assessment instruments used by teachers, they still only measure cognitive. In fact, the learning process with scientific steps can train students' science process skills (KPS). KPS consists of observation, classification, measurement, setting the correlation of numbers and space, predicting, organizing data, formulating models, interpreting, identifying variables, formulating hypotheses and finally experimenting (Feyzioglu, 2009). According to (Nugraha et al., 2017) KPS needs to be trained so that students can define problems that exist around, observe, analyze, experiment, conclude, generalize, and connect the information that students have with the necessary skills.

Learning objectives should be directed to train students' KPS so that learning activities must use a model that can support the training of KPS,. Assessment is a set of systems related to goals. Furthermore, Permendiknas Number 16 of 2007 states that assessment is one of the elements of learning that must be mastered by teachers and educators (Johari. et al., 2014). Educators who are able to carry out assessments well, are able to determine the achievement of learning outcomes and evaluate them.

(Melita Rahardjo, 2019) ccience process skills invite students to process new information through concrete experiences such as practicum activities. Practical activities provide opportunities for students to experience themselves, seek the truth, or try to find a law or postulate, and draw conclusions on the process they experience. That many teachers know about KPS but do not

understand it, so they do not apply it in the learning process or evaluation. Therefore, there needs to be a test instrument made to measure students' KPS. So based on these problems, the research was conducted by developing a test instrument that can measure students' KPS in physics material.

Previous research oleh Budiman & Jailani, (2014) stated that the development of a valid assessment instrument can improve students' thinking skills. Astuti et al., (2014) stated that the development of assessment instruments can improve students' science literacy. Research by Novalia et al., (2015) development of assessment instruments that are valid and reliable in improving student performance in learning. Based on these problems, the research aims to develop assessment instruments for students' science process skills in physics learning.

Methods

The research method used in the development of this KPS assessment instrument is a type of Research & Development research with the ADDIE model.). In the ADDIE model there are five stages of development namely Analysis, Development, Implementation, and evaluation. This research was conducted at Dr. Wahidin Sudirohusodo Junior High School in Medan. The research sample came from 2 Physics education lecturers and 3 Physics teachers. Data collection in this study was through tests and validation questionnaires. The test aims to determine the science process skills of students in physics learning. The questionnaire aims to determine the feasibility of KPS questions. The instrument used in the validation questionnaire consisted of 10 statement items which were analyzed with the Microsoft Excell.

KPS assessment indicators are: observation skills, classifying, interpreting, predicting, asking questions, formulating hypotheses, planning experiments, using tools/materials, applying concepts, and communicating. Data analysis was obtained by analyzing the validity of the instrument and the reliability of the instrument. Instrument validity consists of content, language and material validity tests. To perform content validity using the Gregory formula with criteria can be seen in table (1). Furthermore, the reliability of the instrument was calculated using Cronbach's Alpha formula.

Result and Discussion

Research on the development of science process skills assessment instruments is a step taken to produce a student process skills assessment instrument in the form of multiple choice. The types of science process skills selected are observing, formulating hypotheses, identifying variables, interpreting data, communicating, and applying concepts. The results of the development of KPS instruments in learning physics temperature and heat material. The first stage of needs analysis, curriculum analysis and analysis of student evaluation questions in temperature and heat material. The second stage makes the design of the KPS instrument in accordance with the Basic Competencies (KD) and Core Competencies (KI) of temperature and heat material (Santosa et al., 2023). Furthermore, the third stage is Develop. At this stage, the instrument was validated by content, language validation and material validation by lecturers and physics teachers. The results of the validation of the KPS instrument in learning physics temperature and heat material can be seen in the following graphic 1.

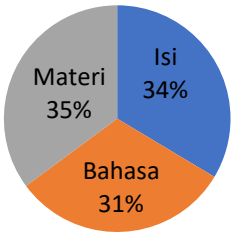

Diagram 1. Instrument Validation Results

Based on Table. 3 explains that the content validation score is 34%, language validation scores 31% and material validation 35. These results explain that the instrument Therefore, the developed science process skills test is very feasible as a science process skills assessment instrument is very feasible to be developed in physics learning. The next stage is implementation. At this stage the instrument that has been validated by experts and revised is then carried out a limited trial on students by giving KPS questions The results of the limited trial validation can be seen in grafik 2.

Table 1. Limited Trial KPS Instrument Validation Results

Index	Kriteria	Uji Coba Produk Trebatas	
		Frekuensi Butir Soal	%
0.81 - 1.00	Very Hght	7	47
0.61 – 0.80	Hight	4	26
0.41 – 0.60	Simply	3	20
0.21 – 0.40	Low	1	7
0.00 – 0.20	Very Low	0	0
Total		15	100

Based on Table 4. Shows the results of limited instrument trials of KPS in learning physics temperature and heat material there are 7 (47%) questions that have very high validity 4 (26%) questions have high validity, 3 (20%) questions have sufficient validity and 1 (7%) has low validity. From the results of the limited trial of the KPS instrument in learning physics temperature and heat material is very feasible to use in learning temperature and heat material. Furthermore, from the results of the limited test of the KPS instrument, the lowest rcount was 0.270 with low criteria while the KPS instrument obtained the highest rcount of 0.818 with very high validity. With an average score of 0.813 with valid criteria. Furthermore, the results of the reliability test of the KPS instrument in learning physics temperature and heat material can be seen in Table 2. Melita Rahardjo (2019) stated that a valid science process skills assessment instrument will help teachers in evaluating student learning outcomes.

Table 2. Reliability Test Results

Try the Product	α	Criteria
Uji Coba Produk Terbatas	0.862	Very Hight

Based on Table 5. Explaining the results of the reliability test of the KPS instrument in the limited product trial obtained α = 0.862 with very high criteria. This shows that the KPS instrument is very valid and reliable to be developed in learning physics temperature and heat material. The development of KPS instruments in learning physics of temperature and heat material is very feasible to be developed (Yudha & Masrukan, 2014;Suratmi et al., 2020). The aspects of process skills measured in the implementation of the assessment of Temperature and Heat material include observing skills, classifying, interpreting, predicting, communicating, proposing hypotheses, using tools / materials, planning experiments, and applying concepts. (Borja , 2018)said that, science process skills test questions can be constructed by presenting information in the form of images, diagrams, graphs, data in tabular form or descriptions (Laisema &

Wannapiroon, 2014; Sari et al., 2018). The science process skills test was developed in the form of multiple choice questions. The number of alternative answers used is as many as 5 (five) alternative answers. Alternative answers as many as five choices are the best situation, because it does not harm students and is also not easy for students to guess (Fajrina et al., 2021). The science process skills test questions developed have relatively homogeneous answer alternatives (khalick & Lederman, 2017), so they are not easily guessed by students. This is indicated by the distribution of student answers that are scattered in each alternative answer. According to (Treffinger et al., 2018)questions with relatively homogeneous alternative answers can distinguish students who are good and those who are not good, so that the developed science process skills test has good differentiation. The development of science process skills assessment instruments has a positive impact on training students' cooperation in learning (Srirahayu & Arty, 2018.;Nurhayati et al., 2019).

Simpulan

Based on this research, it can be concluded that the KPS instrument has a content validation value of 34%, language validation of 31% and validation of 35% with feasible criteria, reliability of 0.862 high criteria. This finding explains that the KPS instrument is very valid and reliable to use in temperature and heat material. So, the KPS instrument is very feasible to be developed in learning physics in temperature and heat at school

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