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Uji Kelayakan Instrumen Penilaian Kemampuan Pemecahan Masalah Menggunakan Multimodus Representasi Berbasis Kearifan Lokal Papua

Feasibility Test of Assessment Instruments for Problem Solving Ability Using Multimode Representation Based on Papuan Local Wisdom

Merta Simbolon*, Anderias Henukh

Universitas Musamus, Department of Physics Education, Merauke, Papua 99616, Indonesia

*Corresponding author: simbolon_fkip@unmus.ac.id

ABSTRAK

Tujuan penelitian ini adalah mengukur kelayakan instrumen penilaian berorientasi pemecahan masalah menggunakan multimodus representasi berbasis kearifan lokal Papua yang memiliki validitas, reliabilitas, tingkat kesukaran, daya pembeda, dan keterbacaan yang memenuhi kriteria sebagai soal yang baik. Penelitian ini adalah penelitian kuantitatif sedangkan instrumen penilaiannya dikembangkan dengan model 4-D. Model ini terdiri dari empat tahapan pengembangan yaitu *define* (pendefinisian), *design* (desain), *develop* (pengembangan), tanpa tahap *disseminate* (penyebaran). Subyek penelitian ini yaitu siswa kelas XI IPA yang telah mempelajari materi suhu dan kalor dengan jumlah 10 orang sebagai uji coba terbatas. Teknik analisis data yang digunakan adalah teknik analisis kuantitatif validitas, reliabilitas, tingkat kesukaran, daya pembeda dan keterbacaan. Hasil dari penelitian ini adalah produk instrumen penilaian berorientasi pemecahan masalah menggunakan multimodus representasi pada materi suhu dan kalor. Hasil validasi Ahli dari 13 item soal terdapat 12 item soal valid. Hasil uji validitas isi memperoleh t hitung>0,632, reliabilitas memperoleh 0,984, sehingga produk kategori tinggi. Hasil tingkat kesukaran memperoleh 4 sukar, 6 sedang, 2 mudah, rata-rata produk 0,50 kategori sedang. Hasil daya beda memperoleh 3 jelek, 9 cukup, rata-rata produk 0,22 kategori cukup. Hasil keterbacaan instrumen penilaian memperoleh rata-rata persentase 86% kategori tinggi. Jadi dapat disimpulkan instrumen penilaian yang dikembangkan memenuhi sebagai kriteria soal yang baik.

Kata Kunci: Pengembangan, instrumen penilaian, Multimodus Representasi

ABSTRACT

This study aimed to measure the feasibility of a problem-solving-oriented assessment instrument using multimode representation based on Papuan local wisdom, which has validity, reliability, difficulty level, distinguish level, and readability that meet the criteria as a good question. This research is quantitative research and the instrument was developed using 4-D model. This model consists of four development steps: define, design, and develop without the disseminate step. The subjects of this study were students of class XI IPA who had studied the material on temperature and heat with a total of 10 people as a limited trial. The data analysis technique used is a quantitative analysis technique of validity, reliability, difficulty level, distinguished level, and readability. This research is a problem-solving-oriented assessment instrument product using a multimode representation of temperature and heat material. Expert validation results from 13 item questions, there are 12 valid item items. The results of the content validity test obtained t count> 0.632, reliability obtained 0.984, so the product is in the high category. The results of the difficulty level obtained 4 difficult items, 6 moderate items, 2 easy items, the average product was 0.50 in the medium category. The results of distinguish level obtained 3 bad, 9 adequate, the average product was 0.22 sufficient category. The results of the readability of the assessment instrument obtained an average percentage of 86% in the high category. Therefore it can be concluded that the assessment instrument developed meets the criteria for a good question.

Keywords: Development, assessment instrument, Multimode Representation

1. Introduction

Skills needed in nowadays era of globalization are high order thinking skills. High order thinking skills are the ability to connect, manipulate, and transform the knowledge and experience already possessed to think critically and creatively to make decisions and solve problems in new situations [1]. High order thinking skills can make an individual interpret, analyze or manipulate the information obtained. High-order thinking skills can be seen in students' analysis, evaluation, and creative abilities. In addition, high order thinking skills not only require the ability to remember, but in practice, they also require critical thinking skills, problem-solving skills, and creativity [2]. One of the essential high order thinking skills for students is the ability to solve problems. This ability is stated in Permendikbud number 24 in 2016 concerning KI and KD curriculum 2013, which states that knowing, applying understanding facts, concepts, steps in science, technology, art, culture, humanity, nationhood, statehood, progress in the environment, and applying knowledge in the field occupied according to interests and talents used in solving problems. This means that solving problems is an essential competency to train students.

The quality of education can be known after conducting an evaluation in learning. In order to measure the level of students' problem-solving abilities after going through the learning process, an evaluation or assessment is needed [3]. Evaluation is one of the systematic processes to measure the level of ability or quality that is adjusted based on specific criteria in making decisions [4]. Assessment is a process in making decisions based on measurements and established criteria where both are interrelated [5]. Therefore, appropriate and accurate assessment instruments will significantly affect students in measuring problem-solving abilities after the learning process.

The assessment instrument developed must accommodate the different representational abilities of students in understanding the questions. Representation is the act of presenting or describing something, either a person, event, or object, in the form of a sign or symbol. Representations can be in the form of pictures, words, graphs, diagrams, simulations, mathematical equations, and others [6]. Some students can understand problems using text representations, but others can use image representations, mathematics, graphs, and other representations. Therefore, to cover the different representational abilities of students, several representations are used in presenting the problem or called multi-representation [7]. Multi-representation is a model that re-discusses theory in several other formats [8]. These representations must be integrated so that they are easily understood by students or what is commonly called a multimode representation [9]. Multimode representation is a topic or subtopic explanation that presents several steps for students to interpret and understand scientific ideas [10].

The instrument of problem-solving skills required must also be contextual in nature according to daily life and surrounding circumstances. This will help improve students' understanding of the problems presented in the questions. In this developed assessment instrument, questions are presented using local Papuan wisdom, such as problems related to tifa, namely traditional Papuan musical instruments, the tradition of burning stones, and the living habits of the Papuan people. Learning must begin to be associated with the habits or cultures of an area occupied by students [11]. It can also make education an effort to increase the human potential to inherit, cultivate, and build future culture [12].

2. Research Method

This type of research is quantitative research. The instrument was developed using 4-D model steps, which consists of 4 steps, namely the define step, design step, develop step, and disseminate step. The sampling technique used a purposive sampling technique for students who had studied temperature and heat. The instruments used in this study were questionnaires and question instruments. Questionnaires were given to 3 material expert validators to assess the feasibility of the assessment instrument before being tested for students. The validation instrument contains a material assessment of 13 statement items and language of 10 statement items. After revisions were made following the validators' suggestions, the assessment instrument was tested on students to assess

validity, reliability, distinguish level, difficulty level, and readability of the questions. The sample in this study were 10 high school students in class XI IPA who had studied temperature and heat. The results of this trial determine the level of feasibility of the assessment instrument and determine the items worthy of being used as questions.

3. Results and Discussion

The feasibility of this assessment instrument includes several categories, namely validity, reliability, distinguish level, and difficulty level of the questions. This is the category of a good assessment instrument.

a. Question Validity by Validator

The validation results from 3 validators were calculated using the Content Validity Ratio (CVR) and Content Validity Index (CVI) equations. The results obtained are presented in Table 1.

Table 1. Assessment Instrument Vali dation Results

Category	Items	Percentage
Valid	12	94%
Invalid	1	6%
Total	13	100%

The data presented in Table 1 showed that the number of questions that have been declared valid is 12 items with a percentage of 94%. On the other hand, items declared invalid amounted to 1 item with a percentage of 6%. The results of questions validation obtained from the validators are then used to improve the items under the comments and suggestions.

An instruments' validity is categorized as a good level of validity if the instrument provides a test device with questions that reflect the overall ability to be measured [13]. For example, based on the analysis and comments from the validator, item number 13 was declared invalid because it was influenced by several factors, including the items that were not following the indicators of making questions, the items tested were not in accordance with problem-solving, the arrangement of sentences in the items was messy and difficult to understand, the items tested were only to measure the cognitive level. A good instrument and declared valid was needed as an exercise for students to practice their high order thinking skills. The type of questions or tasks given by the teacher significantly affect the development of students' thinking skills, therefore the questions or assignments given must be able to trigger analytical, evaluative, and creative thinking so that they can think at higher levels [14].

b. Content Validity

The testing results of the assessment instrument to students were then calculated content validity using the product-moment equation. The validity results for the problem-solving-oriented assessment instrument were presented in Table 2.

Table 2. The results of data analysis for content validity of each question item

Question	t-count	t-table	Note
1	0,972	0,632	Valid
2	0,890		Valid
3	0,868		Valid
4	0,954		Valid
5	0,887		Valid
6	0,969		Valid
7	0,982		Valid
8	0,959		Valid
9	0,963		Valid

10	0,937		Valid
11	0,897		Valid
12	0,837		Valid

Table 2 showed that all items are declared valid based on interpretation using the r-product moment value table. If the value of t-count > t-table, then the item can be revealed to be valid. All questions have a value of t-count > t-table, so it can be concluded that all questions are valid. Several factors can affect the validity of the instrument, namely: the item has language that is easy to understand, the time given in doing it is sufficient, the level of difficulty of the items is following the material received by the students, students cannot predict the answers to each item. A question can be said to be valid if the item has a value of t-count > t-table, where using 10 respondents, the t-table with an interval of 0.05 is 0.632 [15]. The results of the problem-solving-oriented question analysis that have been compiled as a whole have a t-count value > 0.632, which means that the overall item is valid. Based on the problem-solving structure of the Problem Sheet, all items have a difficulty level according to the material received by students. This assessment instrument is an instrument in the form of an essay so that students cannot guess the answers to the questions given. The development of research instruments has two kinds of requirements that must be met, namely good validity and reliability [16].

c. Reliability

The reliability analysis results on the problem solving assessment instrument showed a coefficient value of 0.984, which means that the assessment instrument is declared reliable according to the reliability interpretation from Miller, which states that the coefficient of 0.984 is included in the high category [17]. Researchers used SPSS.23 software to determine the level of reliability coefficients following Table 3 presented.

Table 3. Results of Assessment Instrument Reliability Analysis

Reliability Statistics	
Cronbach's Alpha	N of Items
0.984	12

The overall question instrument consisting of 12 items was declared reliable because it had high consistency. This is in line with Arifin (2017), which states that if the test instrument has high consistency, then the instrument is accurate to the same testing opportunity [18]. Assessment instruments that have been declared valid and reliable can then be used to measure the students' HOTS.

d. Difficulty level

The trial result was also analyzed for the difficulty level of the questions. Each learning outcome test item can be declared a good item if the level of difficulty of the item is sufficient or moderate. The results of the difficulty level analysis are presented in table 4.

Table 4. The results of the analysis for the difficulty level of each question

No Question	Difficulty Level	Criteria
1	0.72	Easy
2	0.58	Moderate
3	0.61	Moderate
4	0.28	Difficult
5	0.59	Moderate
6	0.57	Moderate
7	0.56	Moderate
8	0.72	Easy

9	0.26	Difficult
10	0.25	Difficult
11	0.25	Difficult
12	0.63	Moderate
Avarage	0.50	Moderate

The level of difficulty with moderate criteria with a value of 0.31 - 0.70 can be declared good [17]. The results of the analysis for difficulty level of each items showed that 2 items were easy category, 6 were medium category, 4 were difficult category. Questions that have an easy category are questions that discuss concepts in daily life so that students can easily answer questions. On the other hand, question items with the difficult category are questions whose level of analysis forces students to think until they feel like giving up, this is proven by the acquisition scores that are far from expected.

A good question is a question that is neither too easy nor too difficult. Students do not try to improve solving because the questions are easy, on the contrary, students will be desperate and not enthusiastic about difficult questions because they are beyond their abilities [19]. High order thinking skills are not just the ability to remember, but their application requires critical and creative thinking skills. Students who can develop themselves in making decisions, assessing, and solving problems appropriately are students who can think creatively and critically [20].

e. Distinguish level

The analysis of distinguish level of items can be seen in the interpretation with categories from Miller [17], the analysis results of distinguish level for questions can be seen in Table 4.9.

Table 4.9. Analysis results of distinguish level for Questions

No Question	Distinguish Level	Criteria
1	0,28	Sufficient
2	0,17	Poor
3	0,22	Sufficient
4	0,19	Poor
5	0,23	Sufficient
6	0,22	Sufficient
7	0,22	Sufficient
8	0,28	Sufficient
9	0,16	Poor
10	0,23	Sufficient
11	0,21	Sufficient
12	0,22	Sufficient
Avarage	0,22	Sufficient

The analysis results showed that 3 items have poor distinguish level, namely numbers 2, 4, 9. 9 items have sufficient distinguish level, namely numbers 1, 3, 5, 6, 7, 8, 10, 11, 12. The average of distinguish level was 0.22 for sufficient category. Questions that have poor distinguish level category are questions that have high and low levels of difficulty, this is because the scores of all students are not much different. The overall assessment instrument developed based on the discriminatory power index was categorized as sufficient. Questions are discarded if the results of the discriminatory analysis are negative (-) [17]. Therefore, the final analysis of the problem-solving-oriented assessment instrument using multimode representation with sufficient distinguish level was still feasible to use.

f. Readability of Assessment Instruments

Readability analysis data was obtained by using a readability instrument. The rating scale used in the instrument is the Likert scale. The results of the readability analysis can be seen in Figure 1 which has been presented.

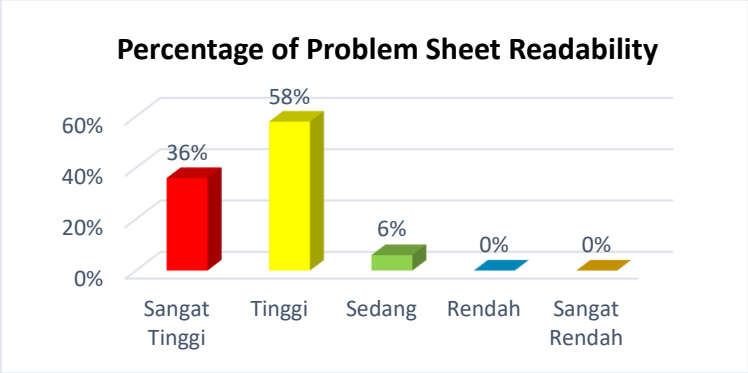

Figure 1. Percentage of Question readability categories

Figure 1 showed the results of the classification for readability category of Problem Sheet oriented to student problem solving with a response of 36% for a very high category, 58% for a high category, 6% for a medium category, no student response (0%) for a low and very low category. The overall analysis results showed that the average percentage for the readability of questions with a total of 10 students was 86% or stated for a high category. Language and visual factors influence the excellent or insufficient level of instrument readability. The language factor concerns word choice, sentence structure. At the same time, the visual factors include lettering, attractive image layout, graphic layout, and the neatness and density of word lines. Making HOTS test items, among others, uses pictures, graphs, tables, and others that direct students to the level of application of educational goals and involve higher cognitive processes.

Based on the results of the readability data analysis of the questions, overall, it showed average readability with a percentage of 86% and was included for a high category. This is because the problem-solving-oriented assessment instrument has more than one representation. For example, the language factor is supported by text representation on the questions, and the visual factor is supported by image and graphic representations so that this assessment instrument is under the preparation of a good level of readability.

4. Conclusion

The results of problem solving-oriented research and development that have been developed can be declared valid to be used to measure students' problem-solving abilities. The analysis results of the readability of the problem-solving-oriented assessment instrument with the number of respondents of 10 students showed that the average percentage was 86%, which means that the assessment instrument was included in the high readability category.

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