Development Of Pisa-Based Questions For Fluid Materials In SMA

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Abstract. The research aims to develop a PISA-based test for high school students on fluid material that meets good qualifications (standard test) including validity, reliability, level of difficulty, discriminatory power and effectiveness of distractors. This type of research is development research, using the ADDIE model. The data analysis technique used is qualitative and quantitative. The results of the quantitative analysis of the quality of the PISA-based test are good. Analysis of 38 items in the small group test obtained 32 items were accepted and 6 items were rejected. In the large group test, 30 items were accepted and 2 items were rejected.

Keywords: PISA, Fluida

1. Introduction

The world is in the 21st century, the era of the industrial revolution 4.0. The era where information technology and robotics are the basis in every sphere of human life. One of the challenges in this era of industrial revolution 4.0 is to prepare human resources who have basic cross-disciplinary skills to be able to compete globally [1]. In the era of the industrial revolution 4.0, mastery of literacy and thinking skills is needed. The development of this industry causes a tremendous impact on the job opportunities that can be obtained by school and college graduates. The world of education must also change the education system to survive in the future [2]. Based on this, education has an important role in producing quality human resources. Through the learning process, personal learners can always experience developments and changes towards more advanced in science, social, moral, and other sciences.

Changes in this era cannot be avoided by anyone so adequate preparation of human resources is needed to be ready to adapt and be able to compete on a global scale. Improving the quality of human resources through educational channels ranging from primary and secondary education to higher education is the key to being able to follow the development of the industrial revolution 4.0 [3].

AISTEEL 2022, September 20, Medan, Indonesia

DOI 10.4108/eai.20-9-2022.2324824

Scientific literacy is perceived as a key competency and is defined in the form of an interactive ability to master information sources and technology so that a person can move himself to interact with the outside world and within a wider range of use [4]. According to the Organization for Economic Cooperation and Development (OECD) scientific literacy is a person's ability to solve problems using the scientific method [5]. The stages of problem-solving start from identifying problems, solving problems based on sequential evidence, understanding and making decisions. The decisions taken will affect nature and changes in human activities. Measurement of scientific literacy is important to determine the extent of students' literacy of the science concepts they have learned [6].

The results of the Program for International Students Assessment (PISA) research in 2018 with the focus of the theme being scientific literacy competence show that scientific literacy skills in Indonesia are still relatively low, ranking 9th from the bottom, namely 71 out of 79 countries [7]. Indonesia's ranking in PISA has always been in a lower position, and this constant result since the first time PISA was conducted, namely in 2000 until now the PISA assessment in 2018. Several assumptions place the PISA report as one of the strongest reasons for a country's education to change or make improvements. to systems and programs as well as everything that exists in education. Indonesia uses the PISA assessment report as the basis for making improvements to the existing curriculum [7].

The low results of students' scientific literacy are most likely because they are not used to working on scientific literacy-type questions. The questions given by the teacher are usually in the form of problem-solving questions of the type of calculation. Students are used to only memorizing, equations (formulas) without understanding the meaning of the equations they use [8]. This is what teachers often use in learning carried out at school. Facts in the field also show that students are very good at memorizing, but less skilled in applying their knowledge. Evaluation instruments based on scientific literacy need to be developed [9]. Students who are familiar with problem solving based on scientific literacy, make scientific literacy embedded in students. This will make it easier for students to solve problems using the scientific method as desired in PISA.

Based on the description above, it is necessary to develop a PISA-based scientific literacy measurement tool to suit the conditions of education in Indonesia, so that our achievements will be the same as the average achievements of OECD countries considering the rapid development of science and technology. So in this study, the author wants to conduct a study with the title: Development of PISA-Based Objective Tests for Fluid Materials in SMA.

2. Methods

Research and development (R&D) is a basic research activity to obtain information on user needs (needs assessment), then continued development activities to produce products and assess the effectiveness of these products [10]. Based on the opinions of several experts, development research is research on products that will be developed based on these findings by conducting field trials according to the background where the product will be used and revising the results obtained from field trials. This model consists of 5 main phases or stages, namely :-Analyze, -Design**,** -Development**,** -Implementation, -Evaluate [11].

The ADDIE concept is applied to form performance-based learning. Branch [12] also posits that the ADDIE model is a fundamental process for creating effective learning resources. The

ADDIE model has a design that makes it easy to be active, multi-functional lies in an inspirational approach to learning. The concept of ADDIE development is described in figure 1.

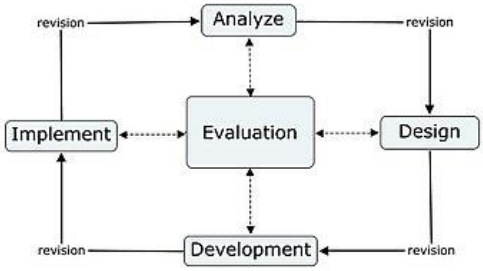

Fig. 1. Concept of ADDIE development

3. Result and Discussion

3.1 Analysis Stage

There are several activities carried out in the analysis stage, namely needs analysis, material analysis, and literature analysis.

3.2 Design Stage

The assessment design of the PISA-based objective test instrument that is carried out is in the form of multiple-choice questions. The relevance between test instruments and the theory is to link PISA-based test instruments and the theory of science literacy ability based on indicators developed from basic competencies in fluid matter

3.3 Development Stage

The PISA-based test instruments that have been compiled are then validated by expert validators. Validators are asked to provide an assessment of the PISA-based objective test instrument that has been developed based on the items on the assessment sheet and provide criticism and suggestions. Valid instruments based on validators will be implemented in small groups and large groups.

3.4 Implementation Phase

Small Group Trials

Validity

Based on the results of the analysis of the 38 question items, it can be seen that the questions that fall into the valid category amount to 32 question items (84.21%). while the questions that fall into the invalid category amount to 6 items (15.78%). Can be seen on the graph **Fig.2.**

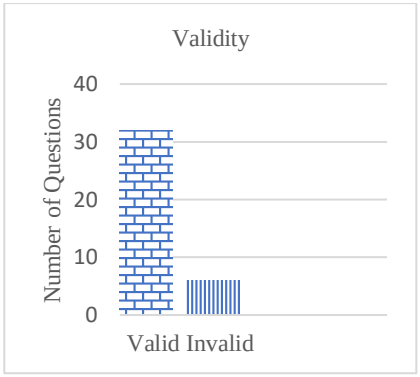

Fig. 2. Calculation Results of the Validity of Small Group Trial Questions

Reliability

The reliability of the questions of 0.898 means that the PISA test was used already.

Difficulty level

Based on data analysis, questions were obtained with a difficult category of 3 questions (7.89%), an easy category of 15 questions (39.47%), and a medium category of 20 questions (52.63%). Can be seen on the graph **Fig.3.**

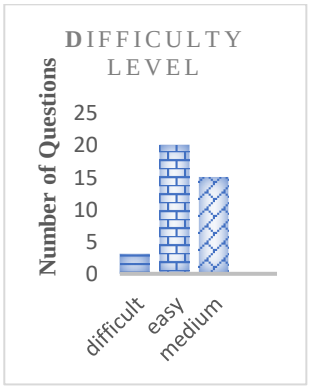

Fig. 3. Calculation Results of Difficulty Level of Small Group Trial Questions

Differentiating Power

Based on the results of data analysis, 2 questions with very good categories were obtained,26 questions (5.26%), questions with good categories totaling 22 questions (57.89%), questions with sufficient categories totaling 10 questions (26.31%), and questions with bad categories totaling 4 questions (10.52).

Effectiveness of Deception

The number of effective questions is 32 questions out of the 38 questions tested.

Large Group Trials

Validity

Based on the results of the analysis of the 32 question items, it can be seen that the questions that are in the valid category amount to 30 questions (93.75%), while the questions that are in the invalid category are 2 questions (6.25%). Can be seen on the graph **Fig.4.**

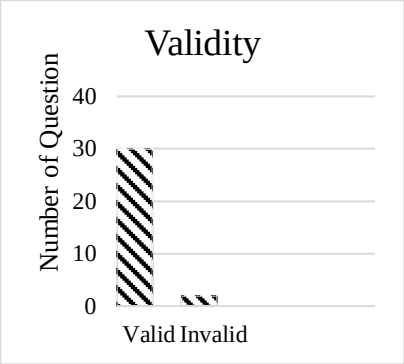

Fig.4. Calculation Results of the Validity of Power Group Trial Questions

Reliability

The reliability of the questions of 0.854 means that the PISA test used already has a reliability with a very high category.

Difficulty level

Based on data analysis, questions with difficult categories totaled 6 questions (25%), questions with medium categories totaled 15 questions (56.25%), and questions with easy categories totaled 11 questions (18.75%). Can be seen on the graph **Fig.5.**

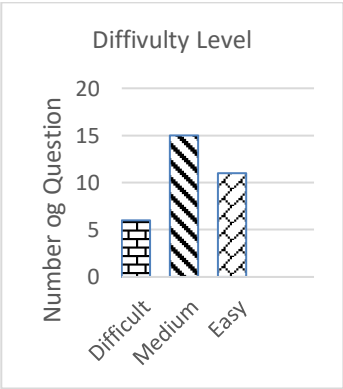

Fig.5. Calculation Results of Difficulty Level of Power Group Trial Questions

Differentiating Power

Based on the results of the data analysis, 6 questions with very good categories were obtained (18.75%), questions with good categories totaled 22 questions (68.75%), questions with

sufficient categories totaled 4 questions (12.5%), and questions with bad categories totaled 0 questions.

Effectiveness of Deception

The number of effective questions is 30 questions out of the 32 questions tested.

3.5 Evaluation Stage (Evaluation)

Evaluation of the Suitability of the Test Instrument to the Characteristics of the Question Item.

The results of the small group trial obtained questions that were following the characteristics of the question items were as many as 22 questions from the 38 question items tested. The results of the analysis obtained have not all instruments met the criteria for a good test so revisions are needed for questions that are not good. The revised questions amounted to 10 questions. Furthermore, the rev questions were used in large group trials where the number of questions was reduced from 38 points to 32 questions.

Furthermore, large group trials were carried out, quantitative analysis of the results regarding validity, reliability, difficulty, differentiating power, and the effectiveness of deceivers. The results of the large group trial obtained questions that were by the characteristics of the question items were as many as 30 questions from the 32 question items tested. The results of the analysis obtained have not all instruments met the criteria for a good test so revisions are needed for questions that are not good. The revised questions amount to 2 questions. Furthermore, the revised questions are stored in the question bank of PISA-based test instruments on Fluid material in high school with a total of 30 questions.

Evaluation of Factors of Inconsistency characteristics of the Question Item.

The failure of the first question item lies in the difficulty of the question that is too easy or too difficult. The second cause of failure lies in the differentiating power of the question which means the inability of the question item to distinguish students who have mastered the subject matter from students who have not mastered the subject matter and the cause of the last failure lies in the validity and effectiveness of the deceiver in the question item.

4. Conclusion

Pisa-Based Test Instruments on Fluid material in high school are declared feasible and meet the criteria as valid and effective questions, The reliability of PISA-based test instruments on Fluid material in SMA has been categorized as having very high reliability. The differentiating power of PISA-Based Test Instruments on Fluid material in SMA is in a good category. The level of difficulty of PISA-Based Test Instruments on Fluid material in SMA is good and is in the moderate category. The effectiveness of the PISA-Based Test Instrument deceiver on Fluid material in high school has functioned well and can outwit students.

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