Development of a PISA-based Electrical Problem Instrument at SMA N 1 Beringin

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Abstract. It is necessary to improve test equipment in learning because usually only low-level questions are available, so students are not ready to discuss and understand material for selection in scientific standards. This study aims to develop a PISA-based test instrument with objective types of questions for the subject of Electricity in SMA, in accordance with good test proficiency standards in terms of validity, reliability, discriminating power, level of difficulty, and distractor effectiveness. This study uses research and development using the ADDIE design with analysis, design, development and evaluation. The research sample was class X students of the Ministry of Home Affairs, State Medical Academy 1 Beringina, who were selected using the simple random sampling method. At the analysis stage, the results showed that there was no difference in grades, and students still lack pisa-based physics questions, especially on electricity. The physics material developed includes static and dynamic electricity. The design stage produces 50 questions based on PISA's scientific literacy competencies, which are classified into three competency standards, namely: explaining scientific phenomena, assessing and planning scientific research, and interpreting scientific data and evidence. The validators in this study were two lecturers and two teachers. Reality uses Cronbach's alpha formula, and qualitative research is carried out by asking for expert opinions covering aspects of educational material, design, and language.

Keywords: PISA, electricity

1. Introduction

Literally, literacy means "literacy" and science means knowledge of nature. PISA defines scientific literacy as the ability to use scientific knowledge, question and draw conclusions from evidence to understand and make decisions about nature and its changes due to human activities (OECD, 2003). Meanwhile, the National Academy of Sciences (1996) argues that the emphasis on scientific literacy is not only on aspects of knowledge and understanding of scientific concepts and processes, but also focuses on how one can make decisions and participate in social and cultural life. and economic growth.

OECD (2013) defines scientific literacy as (1) individual scientific knowledge and the ability to use that knowledge to identify problems, acquire new knowledge, explain scientific phenomena,

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and draw conclusions from data about scientific questions; (2) understand the basic characteristics of knowledge built on the basis of human knowledge and research; (3) sensitive to how science and technology shape the material, intellectual and cultural environment; (4) there is a willingness to participate in issues and ideas related to science. This understanding was then simplified again by Toharudin et al. (2013), who defines scientific literacy as a person's ability to understand science, communicate science (oral and written), and apply scientific knowledge to solve problems so that they have a high attitude and sensitivity to themselves and their environment when making decisions based on scientific evidence. consideration.
According to PISA 2006 (Astuti, 2016), scientific literacy can be described as consisting of four aspects that need to be obtained, namely: 1). Be aware of life situations related to science and technology. This is the unit context and assessment elements; 2) understand nature, including technology, based on scientific knowledge, including knowledge of nature and knowledge of science itself; 3) competence includes formulation of scientific questions, explanation of scientific phenomena, use of scientific data as arguments in conclusions and decision making.
According to Hayat and Yusuf (2010) PISA scores are different With Other values in Terms as the Next this one) PISA uses approach literacy innovative , _ _ concept learning related _ With ability students _ per apply knowledge and skills in the eyes lesson key accompanied With ability per learn , let 's reason and report it with thereby efficient too _ solve and interpret problem in different situation .

2) PISA is policy oriented design and method evaluation and reporting individual With needs for each PISA member country lamp pulled lesson about political who has done by the participating countries through comparison of available data .

3) Application score in PISA by way of regularly in cover time condition which allows participating countries per progress monitor They according to With destination look for know what 's installed four) Draft study in PISA is With draft study through alive , that is draft look for know what is wrong is limited by the student 's competency rating according to With curriculum and concept Cross curriculum but also motivation _ learn , concept I alone They self they own and learning strategies them .

5) Application ball PISA scores are very broad , covering 49 participating countries plus 11 countries that joined in 2006 , among others one third from world population .

Latest PISA 2018 results based on ability literacy knowledge ranked 71st out of 79 participating countries in PISA. The results of studies conducted by PISA show What ability Indonesian students compete at the international level Permanent owned by low . Indonesian students with achievement check literacy knowledge around < 400 points method new capable remember knowledge scientific based on fact simple (e.g. name , fact , term , formula only) and use knowledge scientific General per pull or evaluation something conclusion (Rustaman , 2011).
The low PISA test score for Indonesia is because students are not yet sufficiently prepared to solve PISA questions, and the questions available in physics class are generally still limited by the LOTS criteria. From the results of observations and conversations with several students and physics teachers at SMA No. 1, Beringin received information that the questions posed to students were still memorized and calculated, not questions related to life and the world of technology. The training resulted in students becoming familiar with questions that lead to measuring scientific literacy, especially scientific literacy questions in PISA. this fact convincing _ Researcher per Doing study With develop Student-customer test kit based on PISA can again know , practice as good used to I alone in the face about PISA. _

2 . PISA scientific literacy

PISA divides scientific literacy into three main dimensions, namely: content/knowledge science, scientific competence/process and context of application of science (OECD, 2001). Since 2006, PISA has divided the field of scientific literacy into four main areas, namely science content, science competencies/processes, science application contexts, and attitudes. (OECD, 2007).
one) The content of science refers to the key concepts of science needed to understand natural phenomena and changes introduced to nature as a result of human activities (Sciati, et al., 2013). This may help explain aspects of the physical environment. Questions that can be asked from various fields of science, such as the concepts of physics, chemistry, biology, earth science and space.
Process science refers to mental processes that involve answering questions or solving problems, such as identifying as good interpret evidence and explain conclusions (Rustaman, 2011). The abilities tested in the science process include; 1) identify scientific questions 2) identify evidence; 3) interesting conclusion; 4) communication of findings; 5) understanding of scientific concepts.
3) The context of applying science places more emphasis on everyday life and applying science to solving real problems.
four) An attitude consisting of support for scientific research, self-confidence, interest in science and a sense of responsibility towards resources and the environment.

Judging from its four dimensions, scientific literacy is closely related to the nature of science itself, namely science as a process of science, science as a product of science, and science as a scientific approach (Carin & Sund, 1997 in Naruta, 2018).). . Science as a scientific process implies that Science represents certain steps in studying a problem, for example: observation, hypothesis development, experiment design and execution, data interpretation, measurement, etc. Science as a scientific product can be interpreted in such a way that there are facts in science, principles, laws and theories that are accepted as truth. Science as a scientific attitude contains values and morality, including: high curiosity, critical, creative, humble, open-minded, etc. (Narut, 2018).
PISA *(Program for International Student Assessment)* is an international education assessment program. Originally created by OECD *(Organization for Economic Cooperation and Development) countries* in response to their own needs, PISA has now become an educational policy tool for non-OECD countries. PISA (Program for International Student Assessment) is a program that measures the achievement of 15-year-old children in math, science and literacy skills. Assessments conducted by PISA are held every 3 (three) years with a focus on education in the country (Hewi, 2020). PISA measures three dimensions, namely mathematical literacy, scientific literacy, and reading literacy, with the following details (OECD, 2019):

a. literacy *(* mathematical *literacy)* , including the ability to define and understand , use the basis of mathematics in life that a person needs in the face of life every day.
b. scientific literacy , cover the ability to use knowledge, identify problems in life within the framework of understanding facts and make solutions about the nature and changes in life._ _ _
c. Reading Literacy *(reading literacy),* closes the ability to understand, use and reflect in writing._ _

C . PISA goals

The age of 15 years was chosen as the PISA target group because in many countries compulsory schooling ends at this age. In addition to assessing facts and knowledge, PISA assesses students' ability to use scientific knowledge to solve real-world problems. Therefore, the term " literacy " is used because it implies not only domain knowledge but also the ability to apply that knowledge. The main objectives of PISA are:

a. Assess real knowledge and skills, as well as students' readiness for lifelong learning and adult participation in society;
b. Ensure internationally comparable student performance in key areas at or near the end of compulsory schooling;
c. Provide a wider context for countries to interpret the results;
d. Determine the nature and extent of the relationship between school and student factors and achievement outcomes;
e. Check trends in each subject area over time;
f. Provide direction on the development of educational policies.

3 Research methods

This study uses research and development methods (*Research & Development*). According to Sugiyono (2018), the development research method is a research method used to produce certain products and test product effectiveness. in. The study was carried out in 3 stages: analysis, design and development. The flow of research procedures can be seen in Figure 1 below:

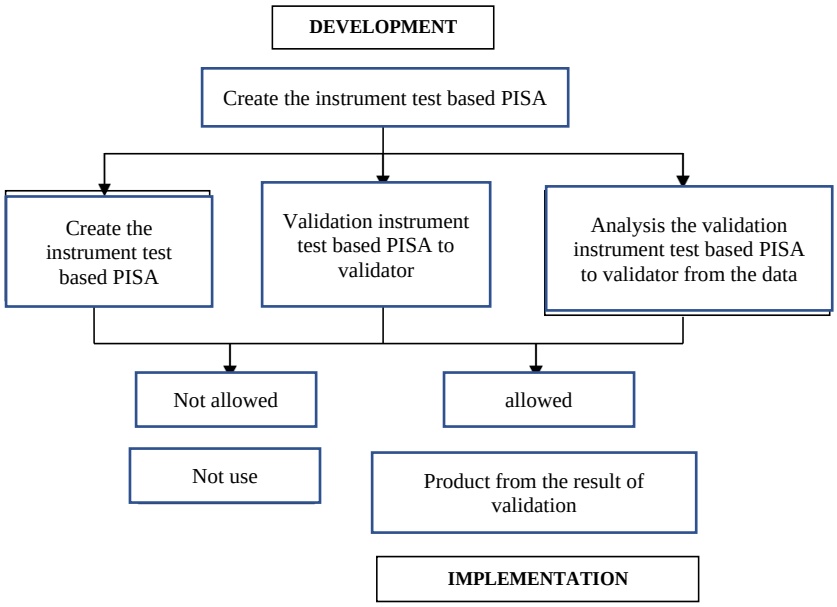

Figure 1. PISA-based test design

4 Discussion

1. Analysis Phase (*Analysis*)

- ***Need analysis***

The results of the analysis are based on interviews with the physics teacher at GMA Negeri 1 Beringin that the teacher has never assessed student learning outcomes using similar test kits or based on scientific literacy or based on PISA. The lack of variety in assessments makes students less able to develop scientific literacy skills , and students are also less socialized with PISA-based questions. Based on an interview with one of the students at SMA Negeri 1 Beringina, students have never been given PISA-based questions, especially electricity. Usually students are given multiple choice questions or descriptive questions which are used as examples of questions posed on the blackboard, and usually the level of the questions is simple or clear. Thus, students never know the form of PISA questions and what are the advantages, disadvantages or similarities to PISA questions.

Up to this point the researchers found that students of SMAN 1 Beringin, especially class X IPA, generally never completed PISA-based tests related to scientific literacy in physics learning, especially in the electricity subject. This is because the PISA-based test kits have not been used in schools and the questions used in schools are still formulaic and conceptual. The lack of variety in assessments makes students less able to develop scientific literacy skills , and students are also less socialized with PISA-based questions. The tool developed is a PISA-based test tool on electricity in SMA. about PISA.

- ***Material Analysis***

This learning material is electricity material , the selection of material is based on the needs of students who rarely get questions PISA material electricity . Except What Theory rick list _ be very careful _ application in life every day . Lots of trouble common _ occurs in related life everyday _ _ With rick list . _ Proficiency in the material used in learning is an indicator derived from competence literacy . knowledge evaluation PISA namely; explain _ scientific _ phenomenon ; evaluate and design scientific research ; and interpret data and evidence scientific .

- ***Study of literature***

Literature studied With look for information accurate ___ guys through book or publication scientific about PISA, about list of PISA materials _ , various questions used _ in PISA and validators .

2. Stage Design (*Design*)

The outcome of this PROJECT is an initial blueprint for an objective PISA-based electrical testing tool for SMA. The design of the tool consists of a grid of test questions, 40 questions, and an assessment guide. Results of Test Question Grids Based on Material Analysis and Literature Study, the results of the PISA-based objective test instrumental grids on Electrical Materials in High School with characteristics and scores related to Pisa literacy-based competencies for Phenomenon and Nature of Wave Topics (Sahyar et al., 2020) .

The initial planning step is to determine the purpose of the test and determine the appropriate form of the test for analysis. The design analysis phase is completed, after which a table of questions related to the indicators of achievement of scientific literacy competencies that have been set is created. The purpose of the test developed is to teach students to solve scientific literacy-based questions that are usually asked in PISA competitions. The form of the test instrument used is *multiple choice* , seeing the benefits of multiple choice tests, the researcher believes that this test will be better and can be used to measure the level of understanding or

ability of students related to scientific literacy in electrical material . because this test has great difficulty, heavy in choosing the most appropriate answer among the other answer choices. The indicators developed are indicators of scientific literacy objective tests in the PISA competition.

3. Development stage (*Development*)

This stage aims to design a scientific literacy test tool that functions to measure students' electrical science literacy abilities. Activities at this stage include:

- ***Test Equipment Training based on scientific literacy***

  At this stage, scientific literacy-based test kits are prepared which consist of: a grid of questions, scientific literacy-based test questions, and an assessment guide .

- ***Score Validators***

  The validator was asked to assess the scientific literacy test tool developed based on scorecard items, as well as provide criticism and suggestions. The validation carried out is the completeness and feasibility of the material content, structure and grammar that have been developed. This validity was carried out by asking for advice or consideration from experts, namely 5 people.

  The results of the assessment are given by the validator will grouped in 3 levels important that is not replaceable (3), useful but Not significant (2), and no required (1) and calculated the reality With use *Ratio Formula Content* Validity , namely :

$$CVR = \frac{n_e - \frac{N}{2}}{\frac{N}{2}} \quad \text{(one)}$$

Description :

n_e = estimate the number of SMEs of the same subject important

n = the number of SMEs that score

CVR interpreted with thereby relatively in the range -1.0 to with +1.0. All items with negative CVR must excluded , whereas element with a positive CVR can used . category validity can seen from table 3.1. Next that are :

Table 1 . Content Review Criteria

CVR	Category
0.5 - 1.0	Legitimate
0.1 - 0.4	legal , obligatory header plan
-0.1 – 1.0	Invalid , replaced

The results of the tests carried out on the following test equipment are shown in Table 3:

Table 2 . Content Check Results

Category	Inquiry number	Quantity
Received	1,2, 3, 4, 5, 6, 7, 8, 9, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,	34
Fixed	10, 11, 12, 13	four
Rejected	39.40	2
Number of questions		40

Table 3 . Qualitative Results Corn Question

No	Qualitative Corn Question	Corn Question	Quantity	Percent
one	validity	2,6,14,16,22,25,27,30	eight	21.05%
2	Level Problem	1,3,5,7,8,9,10,13,16,17,20,23,24,25,26,27 , 30,34,35,36,38	21	55.26%
3	Strength differentiator	2,3,5,6,7,9,10,12,14,16,20,23,24,25,27,30 , 32.38	eighteen	47.37%
four	efficiency cheater	2,6,14,16,22,25,27,30	eight	21.05%

High School Electrical PISA based on peer review in terms of material, construction and language aspects Objective Tests based on Sound Waves PISA SMA is in very good condition. category (90.9%). From the results of an analysis of the 40 public test items, namely small group tests and large group tests, 30 items were obtained that were acceptable and stored in the question bank for objective testing based on PISA sound waves in secondary schools that met the requirements. for a good proficiency test (standardized test). , 10 questions were rejected and could not be used because they did not meet the criteria for validity, difficulty level, discriminatory ability, and distractor effectiveness.

The questions that were declared valid in the PISA objective test "Electricity" at the State Medical Academy No. 1 "Beringin" consists of 30 questions out of 40 questions developed . The reliability of the PISA -based objective electrical test at CMA # 1 Beringin already has high reliability. PISA-based objective electrical test difficulty level at CMA No. 1 Beringina is good and is in the medium category. The discriminating power of the PISA-based objective electrical test at CMA No. 1 Beringin is in the category good.

5 Conclusion

Based on these data, it is known that 30 items can be accepted and stored in the PISA-Based High School Objective Test Question Bank because they have good suitability, validity, difficulty level, discriminating ability, and detractor performance . The advantage of this research is that researchers can develop objective questions based on PISA (program per international student assessment) for high school level with scientific literacy competencies , such as explaining scientific phenomena, assessing and designing scientific research, and interpreting scientific data and evidence. The materials developed are electrical materials that have never been developed by previous researchers. And the analysis of research results was analyzed not only with the help of Excel software , but also using the SPSS 24 application, and the calculations were checked manually, so that the accuracy of the calculations was high.

The similarities in the questions developed in this panel are more related to activities in daily life, so that students can get more benefits from learning physics, and the development of test questions is to get a value of validity, reliability, discriminatory power, level of difficulty. and efficiency

The limitations/weaknesses in this study were that the questions were designed only on the basis of objective questions, while the international PISA questions were in the form of multiple

choice questions, true-false questions, short answer questions, and other forms of questions. This research also has a limited number of questions and a limited number of respondents, the researcher really hopes for further research to further enrich the question bank, and respondents and students should repeat the material tested before the research, if necessary in order to better understand the questions asked during the test. The time allocation given during the test must be adjusted to the number of questions to be tested.

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