DEVELOPING PISA MODEL INSTRUMEN FOR INTEGRATED NATURAL SCIENCES SUBJECT PHYSICS CONTENT TO ASSES REASONING GRADE IX JUNIOR HIGH SCHOOL

Tarida N Sinaga, Sardianto S, Waspodo
University of Sriwijaya
E-mail : taridansinaga@yahoo.com

Abstract

The ability of Indonesia categorized scientific literacy is low. PISA rankings proved to always be at a lower level. One of reasons was students less familiar with the matter PISA models. Instruments about the physics still be remembering formulas ang using mathematical formulas for solutions. Researchers felt the need to develop about PISA science physics content.This research aimed: to create a valid and practical assessment in science with physic content based on PISA model to see and to discover the potential abilities of grade IX junior high school 9 Palembang students toward physics contents. This research is development research,   used Rown Tree model and Formative evaluation Tessmer's model . The subjects were students of grade IX 8 junior high school 9 Palembang .The techniques to compile the data are walkthrough, documentation and test. Walkthrough is used to understand the instrument validity in terms of content, context, and language. Documentation is used to know the instrument, while test is conducted to see the potential effect to science instrument, physics contents (PISA) model on student's critical thinking.The results of this research show that : (1) the research has produced a set of valid and practice PISA model instrument for integrated natural sciences subject physics content to assess reasoning of grade IX junior high school students. The validity is reflected from the result of experts assesment which states that over all of the instruments have been good in content, construct, and language .The practicality of the instruments has been show from the result analysis one to one and small group. (2) PISA model instrument for integrated natural sciences subject physics content have potential effect to assess reasoning of grade IX junior high school students. This ilustrated by the results of students responses, where such instruments can be used to explore students ability in reasoning science. In addition, based on the result of student's interview was obtained that by doing the instruments is able to practice student's reasoning, creative and critical thinking. Reasoning skills students are referred to in this study are as follows :(1) Identify the physics problem, (2) Makea pattern connection model, (3) explain scientific method, (4) make statment of support or refute argument.

Keyword : development research, instruments of PISA, reasoning.

INTRODUCTION

Students Indonesian people should be able to compete with students from various countries in the era of globalization. Various tests are conducted internationally can be used as a benchmark to determine the extent to which students are able to compete Indonesia . The participation of Indonesia in the Programme for International Student Assessment (PISA) is an effort to see how far the development of educational programs in our country compared to other countries in the world .

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Programme for International Student Assessment PISA is here in after abbreviated literacy study aimed to examine the ability of students regularly about the age of 15 years (class IX or Class X junior high school) in reading , mathematic, and science. Research conducted PISA has conducted five periods, namely 2000, 2003, 2006, 2009 and 2012. Study PISA conducted by the Organisation for Economic Co -operation and Development (OECD) and UNESCO Institute for statistics that measure the ability of the students at the end of compulsory school age to determine a student's readiness to face the challenges of (knowledge society) today.

Scores achieved for the Indonesian nation in scientific literacy in PISA 2000, 2003 , 2006, 2009 and 2012 , respectively, 393 , 395 , 395 , 383 and 382 with an average score of above 500 . If we look at the achievement scores above shows the ability of the nation we are far below average , literacy of our nation in the category of low scientific literacy

Many factors lead to low scores in PISA scientific literacy Indonesian students include: students are less trained in solving problems PISA as more use of rote learning and students are more accustomed to working on the problems in accordance with the examples given by teachers and students in physics used to the matter of counting but not yet applied to the cases with respect to the environment and technology . The problem faced is the lack of availability of teacher questions that require reasoning designed (reasoning) in the answer .

In the study conducted by (Jurnaidi , 2012) on the PISA mathematics to show that the concept developed about potentially having an effect because after the test field test is able to measure the results of analytical reasoning of students with 21 students from 28 tests have good reasoning abilities . In a study conducted by (Zahara , 2012) in the analysis of scientific literacy achievement in high school biology concepts in terms of PISA related to reasoning shows that most students claimed tests biology scientific literacy in PISA given concept difficult to understand and require a high analysis . However, 38.33 % of students stated that such type of love working on the science literacy test on biology concepts , 70 % of students stated that they can apply biological science in everyday life and more than 50 % of students stated matter of biology that require analysis of the rote .

Based on the description above , the authors looked at the questions need to be developed teaching science content PISA physics models that can be used simultaneously to see the reasoning abilities of students .Issues that will be examined are : How about the development of a valid and practical matter PISA model of physics teaching science content to determine the ability of reasoning junior class IX students, and determine the potential effects and distinguishing features about the model and the level of difficulty of the PISA science subjects integrated physics content to determine the ability of a class IX student reasoning that has been developed

This study aims to : Generate a model about teaching science PISA integrated physics content valid and practical for know the reasoning ability of high school students of class IX first . Knowing how potential effects and distinguishing features about the model and the level of difficulty of the PISA science subjects developed an integrated physics content of the reasoning abilities of students in junior high school class IX 9 Palembang.

This study is expected to provide benefits for students , teachers and other researchers such as : to help students get to know the problems of reasoning in integrated science teaching physics in particular PISA models , improving the learning evaluation instrument that can be used to train students' reasoning abilities , as an input to develop more questions Integrated Sciences physics content using the PISA model of learning .

LITERATURE REVIEW

Learning is an activity undertaken by a person that has competence in the form of skills and knowledge require. Evaluation of learning outcomes is a process that needs to be done to determine the success of students in achieving the learning objectives. Learning outcomes can be assessed using tests and assessment .

Programme for International Student Asssesment (PISA)

PISA assessment ((Yusuf, 2010,p . 199) can be distinguished from others in terms of assessment : PISA oriented design policies and methods of assessment and reporting tailored to the individual needs of participating countries in PISA that can easily be drawn lessons on policies that have been made by the participating countries through a comparison of the data provided . PISA uses an innovative approach to literacy , a concept related to the learning capacity of students to apply knowledge and skills in the subjects accompanied with the ability to review, giving the reason and communicate effectively , and solve and interpret problems in a variety of situations . concepts learned in PISA relate to the concept of lifelong learning is to learn a concept that is not limited to assessment of student competence in accordance with the curriculum and concepts across the curriculum but also the motivation to learn , their self-concept and learning strategies are applied.

Literacy Science (Science) and its components Science literacy is the ability to use science capabilities , identify problems and draw conclusions based on the evidence in order to understand and make decisions about the nature and changes to the nature through human activity . (Joseph , 2010) PISA identifies three major dimensions of science literacy , which is the process of science , science content and context of the IPA application .

Procedural Knowledge is knowledge about the concept and is an important procedure in the scientific investigation that supports the collection , analysis and interpretation of scientific data. Epistemic Knowledge is a process of building science and justify knowledge produced .

Cognitive demands

(OECD , 2013) There are three levels of the means provided in the cognitive demands are : Low, execute the procedure steps such as memorizing facts (recall) , term , principle or concept of finding a point of information from graphs or tables . Medium, the use and application of conceptual knowledge to describe or explain phenomena , choose the appropriate procedure which involves two steps or more , set the display data , interpret or use a simple set of data or graphs. High, the analysis of complex information and data , synthesize , or evaluate the evidence , the reasons given to justify a variety of sources , developing a plan or sequence of steps to resolve the problem.

Reasoning

Understanding the reasoning in general Indonesian dictionary is a mental process in developing the minds of some facts or principles(Kamus Besar Bahasa Indonesia , 2011) , Shurter and Pierce (cited Sumarmo , 2003) gives a sense reasoning is speaking there are two types of reasoning deductive reasoning and inductive reasoning .

Suriasumantri (2005 : 42) reasoning is a thinking activity in making a conclusion that a knowledge. Reasoning is the thought process of observation opposite senses (empirical observation) that generates a number of concepts and understanding (http://id.wikipedia . org) . From the definition above that reasoning a systematic process to obtain a conclusion in the form of knowledge .

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From the explanation above reasoning , reasoning researchers used indicator in this study are : to identify problems , create a pattern of relationship with the concept of appropriate knowledge , create , deny and supporting arguments , and explaining phenomena scientifically

PISA and curriculum 2013

Curriculum 2013 emphasizes modern pedagogical dimension in learning is to use a scientific approach . Scientific approach in study referred to include observing , asking and reasoning , trying to establish a network for all subjects
(Kemendikbud , 2013) .

RESEARCH METHODS

The research was done in the second semester of academic year 2013/2014 . The subjects were IX.8 grade students of SMP Negeri 9 Palembang . This study uses research or development research with the development of the model combines Rowntree and Tessmer models for evaluation (formative evaluation) .

Research procedures

Planning Phase

At this phase the researchers also analyzed the students , and the curriculum analysis and guide books and materials about the PISA analysis as a basis to develop an integrated model of the PISA science questions .

Design

At this phase the researcher set about designing an integrated IPA content of PISA physics model based on the information and knowledge gained at this phase of the analysis . This phase produces the problem card, question and answer questions .

Phase of eormative Evaluation .

Self Evaluation , at this stage the researchers conducted an assessment of the problems generated by the researchers themselves based on the characteristics of the model about PISA . Expert Review , the test phase is usually referred to expert validity test , a product that has been designed to be assessed and evaluated by experts . The experts will examine the content , and language constructs of the prototype . The suggestions of the experts will be used to revise the questions that have been developed . One to one , at this stage the researchers asked some students to read and work on the problems that have been designed . Students are taken to represent the characteristics of students who are capable of low, medium and high . After working on the research students were asked to comment and these comments will also be used to revise the design of PISA subjects soalmodel Integrated Sciences physics content which has been designed researchers . The results of the first prototype developed with reference to the Self Evaluation will be given to the expert (expert review) and student (one to one) in parallel . The results of both will be used as a revision . The results of the first prototype named revision to the second prototype

Small Group

The results of this second prototype will be tested on a small group (6 people) . The six students were taken to represent the characteristics of students who will be the target of research . At this stage the researcher will ask the students to complete six questions based on the PISA science subjects of physics Integrated content that has been designed .

After working on the researchers asked students to comment on the matter at the PISA model of Integrated Science subjects physics content . Taking into account the results of the test and this comment too, the product will be revised and corrected . But before tested to field test , researchers made the analysis of the grain problem . Based on test results , commentary and analysis items were then researchers will be revised to form the third prototype.

Field Test

Aafter getting the third prototype , the researcher will conduct field trial to test. This stage trials conducted in SMP Negeri 9 Palembang .

Data Collection Techniques

Walkthrough .

Walk throughs made to the expert (the expert) and used to see about covering content (content) , and the construct of the language used and must be in accordance with Enhanced Spelling (EYD) , the use of words and sentences should be clear and straightforward so it is easy to understand students .

Documents

To obtain the data and look at the practicality of the model PISA questions on physics

Tests questions integrated model of IPA content physics model of PISA.

To obtain data on students' ability to solve the problems of integrated models of IPA content physics in PISA. This test is done to see the reasoning ability of the students to the questions on the content of PISA model of physics is given based on the criteria that have been made .

Data Analysis Techniques

Analysis of Data Validation Expert

To analyze the data used descriptive analysis of expert validation by means of revising the record based validator . The results of the analysis are used to revise the questions created by the researcher .

Practicality Data Analysis Problem

To analyze the data practicality PISA -type questions in physics content used descriptive analysis . Data analysis is based on documents obtained test results of students in working on the problems of type PISA on the physics content of the analysis results are used to revise the questions created by the researcher .

Tests Data Analysis Problems PISA model of integrated science physics content

To see the students' reasoning ability can be determined based on the results of the test questions in the PISA model of integrated science physics content provided to the students . Furthermore done scoring the students' answers and the scores obtained by students were analyzed by descriptive qualitative and grouped in categories according to the conditions set .

RESULTS

Results Development of Instrument

The results of the development of integrated models PISA science questions for the physics content is used to determine the junior class IX student reasoning and has been developed as many

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as 15 questions that have been validated by expert reviews , test one to one and small group as well as a field test .

Planning

At this stage the activities undertaken is to analyze the students , curriculum analysis , analysis of PISA science questions of physics content , as described below :

Analysis students

Based on the analysis the researchers did in Junior High School 9 Palembang which is the subject of the study, information was obtained that the number of students who will be the subject of study totaling 25 students with heterogeneous ability levels . The information obtained from the deputy head of the school curriculum is Mrs. Komalawati , S.Pd.

Analysis Curriculum

At this stage of the analysis of the curriculum that has been established by SMP 9 for three years starting from the curriculum of class VII , VII and IX to science this unified field of physics . From the analysis of the curriculum , the researcher choose a topic rectilinear motion , force , energy , heat , acid base and magnetism . Reasons for the selection of topics based on the topic of the PISA framework and curriculum at SMP N 9 Palembang .

Analysis of Problems of PISA Science Physics Content

Researchers analyzed the PISA framework of Science for 2015 and PISA science questions physics content . The results of the analysis are detailed researchers learned about the characteristics of the PISA science in general and about the characteristics of reasoning in PISA .

Development

At this stage the researchers conducting the preparation and development of problem - oal PISA science for class IX physics content based on the knowledge gained yangelah researcher at the analysis stage . The results obtained at this stage is the instrument that consists of : matter grille , card key questions and answers , as well as issues of integrated IPA content of PISA models of physics for class IX students know the reasoning .

The resulting instrument device at this stage of the development of the first prototype is called the total 15 items were . In designing the research question refers to the theory and framework of PISA questions that refers to the implementation of knowledge in everyday life and technology . In addition the model about the PISA science reasoning refers to the students , namely : identify problems , create patterns of relationships with the appropriate knowledge concept , create, deny and supporting arguments and explaining phenomena scientifically .

Evaluation

Self Evaluation

The results of the development of a first prototype totaling 15 questions examined and assessed solely by the researcher .

Expert Reviews

At this stage , about the validity of dikunsultasikan and examined qualitatively based content , and language constructs by thesis supervisor , Dr. .Sardianto Markos , M.Sc. and Prof. M. Pd . Waspodo . M.A. Ph.D. In addition, the supervisor asked the opinion of several professors and colleagues who are experienced in the field of education . The validators are:

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1 . Dr. . Aloysius Rush , M.Sc , . He had been a lecturer ITB and now lecturer of Physics at the University of Parahyangan Bandung pure and part-time lecturers on postgraduate UPI Bandung . He was very concerned of the education in Indonesia, particularly in physics and physics teacher trainers .

2 . Dr. . Ketang Wiyono , M Pd , Sriwijaya University lecturer . He is a lecturer of the Department of Physics FKIP .

3 . Sulistiawati , S. Pd , M.Sc. PGRI University Lecture Palembang and she is currently S 3 in UPI Bandung and her dissertation on PISA Science .

4 . Ida Ramelan , M, Pd , a senior Indonesian Teacher at senior High School 1 Indralaya who are alumni of the Master of Education Language Sriwijaya University .

At this stage of expert reviews mostly addressed issues EYD , the sentence in question , a matter of command , the theory of knowledge that researchers revise as suggested by the validator

One to one

At this stage the problems that developed in the first prototype was tested to 3 students with high ability level , medium and low . Implementation of phase one to one focused on clarity , ease of use , practicality matter developed , and student interest in the given problem . Therefore, the researchers asked three students to give opinions , comments and the given (suggestions and comments attached) . It is intended that the researcher can observe the response and the constraints faced by students when working on the problem.

Tabel. 1. Result one to one phase

Question	Name's Student		
	Nur haura	Choirul Alfan	Putri Nabila
Soal 1	X	X	X
Soal 2	X	V	V
Soal 3	V*	X	X
Soal 4	V	V*	V
Soal 5	V	X	X
Soal 6	V*	V	X
Soal 7	V	X	X
Soal 8	X	V	X
Soal 9	X	X	X
Soal 10	X	X	X
Soal 11	V	V	V*
Soal 12	V	V	V
Soal 13	V	V	X
Soal 14	V	V	V
Soal 15	V	V	X

Source: Researcher 2014

From the analysis of the student answers can be explained that : high-ability students can solve a given problem on time , although there are some questions that are less precise answer . Ability students were able to complete only 9 questions correctly and low-ability students can complete the 5 questions correctly .

From the analysis of students' answers in general students can find out about the problem only limited students to connect concepts so that students know that they are difficult to resolve the matter . And finally students can not be explained scientifically .

Small Group

The questions that have been revised based on expert reviews and one to one called prototype II . The questions tested on small groups consisting of 6 persons of SMP N 9 Palembang with different abilities , ie two students with low ability , two students with the ability to moderate and two high ability students . Implementation of small group trial conducted on Monday, March 24, 2014.

Based on the assessment scores of students in small group stage , it appears that if converted into a maximum score of 100 adalh 68 and the lowest was 43 . From the analysis of actual student answers the students have understood the intention of matter , it is marked on the responses of the students but some students are not able to make the pattern of relations with knowledge or have ever studied physics concepts .

For the validity of the use of the product moment correlation Karl Pearson , and used Cronbach Alpha reliability matter . Data validity and reliability of the calculation results are shown in Table 2

Tabel 2. Result of validity and realibility

Question	r-count	r- tabel	
Soal 1	0,661	0,444	Valid
Soal 2	0,527	0,444	Valid
Soal 3	0,509	0,444	Valid
Soal 4	0,447	0,444	Valid
Soal 5	0,713	0,444	Valid
Soal 6	0,710	0,444	Valid
Soal 7	0,568	0,444	Valid
Soal 8	0,746	0,444	Valid
Soal 9	0,738	0,444	Valid
Soal 10	0,557	0,444	Valid
Soal 11	0,446	0,444	Valid
Soal 12	0,744	0,444	Valid
Soal 13	0,470	0,444	Valid
Soal 14	0,568	0,444	Valid
Soal 15	0,509	0,444	Valid

From the results of testing the validity and reliability seem that the problem is in compliance with the criteria developed valid (r - count > r - table) . As for the reliability of the results obtained koefisian reliability of 0.710 , so the matter can be said to be reliably developed . Revisions based on the analysis of the results and comments about the items on the stage small group of students , who produced three prototypes to berjumalh 15 questions that will be tested in the field test stage .

Field Test

At this stage the question about the IPA content of PISA physics models to determine the students' reasoning on the third prototype was tested in the study subjects are students of class IX SMP 9 Palembang . The questions given to students during the 120 minutes that was held on Thursday 27th March 1014 . During the process of the researcher observed the students to see the difficulties that might be able to figure out the problem occurs so that the students in answering questions.

DISCUSSION

1 . Integrated Problem IPA Content Physics Models of Pisa To Determine the Reasoning Ability of Junior High School Students of Class IX Are Valid and Practical .

The questions were developed can be categorized valid and practical . Problem is declared invalid after validation through multiple validators that contribute to the improvement suggestions and comments on the matter both in terms of content , and language constructs . Based on the results of the revision of the comments , suggestions students from stage one to one and small group shows yan is developed practical matter . The matter of practical categorize drawn from observations and small group trial , in which all students can use the questions well . Problem is developed in accordance with the reasoning of students, easy to read, and do not give rise to multiple interpretations .

Field tests taken for 1 day at SMP N 9 Palembang , the number of students 23 . Field test aims to look at the potential effects of matter . The questions are given at this stage comprises 15 questions are valid and practical . Before the implementation of the field test researchers gave a briefing regarding the implementation of test procedures and to facilitate students with a set of questions that the answer sheets .

Potential Effects Integrated Problem IPA Content of Physics Models PISA To Learn Reasoning of Students .

Prototype models of reasoning about PISA has been categorized valid and practical , then tested in subjects that students study class IX SMP N 9 Palembang . In field tests the researchers analyzed the reasoning ability of students who can be seen in the answers given student.

From the analysis of students' answers to the 15 questions PISA models , most of the students can show indicators of reasoning is to identify problems , create a pattern of relationship with the concept of appropriate knowledge , create , deny and supporting arguments and explaining phenomena scientifically . There are a few students have been able to identify the problem but difficult to make a pattern of relationships with the appropriate knowledge concepts students consequently difficult to explain a phenomenon or scientific problem .

Data obtained from the interviews that all matter can be understood , pictures and graphs clearly visible and , resolving this problem lure students to thinking and reasoning even though there are some students who are still having problems in resolving a matter .

Distinguishing Power and Difficulty Level Model of the PISA Content of PISA Science To Determine Class IX Student Reasoning

At this stage of the test field investigators determine distinguishing features and level of difficulty . By using the formula derived tables distinguishing features and the level of difficulty as shown in Table 3 dan 4 .

Tabel.3. Result of distinguish power and difficult level

Question	Daya Pembeda	Keterangan
Soal 1	0,64	Very good
Soal 2	0,78	Very good
Soal 3	0,69	Very good
Soal 4	0,58	Very good
Soal 5	0,78	Very good
Soal 6	0,74	Very good
Soal 7	0,62	Very good
Soal 8	0,8	Very good
Soal 9	0,73	Very good
Soal 10	0,74	Very good
Soal 11	0,54	Very good
Soal 12	0,6	Very good
Soal 13	0,7	Very good
Soal 14	0,69	Very good
Soal 15	0,73	Very good

Source: The results of researcher analysis, 2014

Tebel.4.Result of difficult level

Soal	Tingkat Kesukaran	Keterangan
Soal 1	0,60	Medium
Soal 2	0,22	high
Soal 3	0,29	High
Soal 4	0,63	medium
Soal 5	0,30	high
Soal 6	0,33	Medium
Soal 7	0,35	Medium
Soal 8	0,39	medium
Soal 9	0,24	High
Soal 10	0,49	Medium
Soal 11	0,63	Medium
Soal 12	0,63	medium
Soal 13	0,31	Medium
Soal 14	0,57	medium
Soal 15	0,79	medium

Source: The results of researcher analysis, 2

The data in the above table obtained from the calculation using the formula to find the distinguishing power and difficulty level manually . From the above data it appears that this problem has developed an excellent distinguishing features , meaning that this matter can distinguish students who are proficient and less proficient count r > 0.30) .. No matter the difficulty level was varied , easy and difficult . From the analysis of the above table , that about 1.4 , , 6.7 , 8,10,11,12,13,14 , and 15, including the medium category . As for 2,3,5 and 9 difficult (r count < 0.3) , about 15 nomo easily categorized . The level of difficulty of the problem is not in accordance with the level of difficulty at the level of PISA . This is because the students have not been able to create a pattern of relationship with the concept of appropriate knowledge .

CONCLUSION

1 . Prototype is developed and practically considered valid .

2 . Based on the obtained development process that has been developed about the potential effects on students ' reasoning abilities , it is seen from the analysis of students' answers . Basically the students were able to identify both the problem premises but students still find it difficult to make the pattern of the relationship with the concept of appropriate knowledge .

3 . Problems have developed an excellent distinguishing seen quantitatively by calculation of the results of students' answers . The level of difficulty of this problem varies developed there are easy, medium and difficult .

SUGGESTION

Based on the research results and conclusions of this study , it is suggested :

1 . Those students , in order to train the ability of reasoning through problems integrated IPA content of PISA physics models to determine the reasoning . Especially on the pattern of relationship indicators makes the concept of knowledge as appropriate. It is also hoped to be able mengulandan students learn more deeply the concept of the knowledge that has been learned so that when the recall back to create a pattern of relationships can be done right .

2 . Those physics teacher , so that the matter can develop PISA models for an integrated science of physics content as an instrument for the improvement of the students' assessment. It is expected that teachers can develop not only a matter of math course but about who makes the child to reason and finally students can think critically which is a high-level thinking.

3. Those of other researchers, the device is able to provide input about to examine more deeply about the PISA science questions. Researchers also hope to be able to develop about PISA PISA competency involving all due to this problem sperangkat researchers develop that competence is a matter of explaining phenomena scientifically.

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