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Development Pisa Problems With Cultural Context Of Bengkulu

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Abstract

Mathematical literacy helps one to understand the role and usefulness of mathematics in life and can be used in solving the problems faced. Mathematical literacy skills can be developed through education in school mathematics. PISA is one of the institutions that measure mathematical literacy of students under the age of 15 years. Matter contained in the PISA contest in addition to measure students' mastery of subject matter competence also measure how students use their skills competence in solving problems. This research aims to generate questions that standardized PISA problem-solving and cultural contextual Bengkulu.

Development model of this research is the development of a model 4-D (four D), which consists of 4 stages. The instrument used to collect data in this study is to measure the problem is validation sheet about the validity of the qualitative, aimed at five expert review that three lecturers and two mathematics education mathematics teachers in junior high, as well as the comments of the students at the time of validation legibility problems. Data obtained from the expert review is analyzed and used to revise the questions that have been designed. Math Sheet Instrument Type PISA with Context-Based Bengkulu used to determine the practicality of the matter is developed. After the trial was conducted at SMPN 2 Bengkulu to see the effectiveness of the matter was developed.

Results of research development for the math problems based on the type of mathematical reasoning abilities in the context of Bengkulu PISA produces about 14 non-objective shape description (open-response construct) a valid, practical and effective. These issues have the characteristics of the three PISA content: Geometry (shape and space), algebra (change and relationship), and the number (quantity); three components of the PISA (reproduction, connections and reflection); PISA four types of context (private, public, education / employment, and of science).
Keyword: PISA problems, culture context of Bengkulu

INTRODUCTION

The quality of learning outcomes mathematics in Indonesian standardized by two international studies that Trends International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA). The results of TIMSS in 1999 put Indonesia ranks 34 of 38 countries, in 2003 put Indonesia ranks 34 of 45 countries, and in 2007 to rank 36 of the 49 countries. The TIMSS results positioning Indonesia ranks third down. If the assessment was made in both criteria, sufficient and less, then the achievement of Indonesia is located in the poor category. In addition, based on the results of PISA 2000, Indonesia was ranked 39 of 41 countries, 38 of 40 countries in PISA 2003, and 50 of the 57 countries in PISA 2006, and 61 of the 65 countries in PISA 2009 Similar to the results of the TIMSS , Indonesia's performance on PISA also shows the same thing, always ranked third from the bottom.

TIMSS and PISA results show that Indonesia has been ranked 10th from the bottom. This is due not because Indonesian students do not have the ability for it, but generally poorly trained Indonesian students in solving the problems with the characteristics of the TIMSS and PISA. As expressed by Ward and Rumiati (2011) that the Indonesian students are less familiar in solving mathematical problems which reasoning, arguing, solving problems, estimating a situation and bring creativity in making conclusions.

Problems in Indonesia still exercise (drill) which is substantially less associated with the context of life faced by students. For example, in the process of mathematics learning, the teacher gives an example: 2 + 3 = 5, then in the given test problems with the same type, 5 + 6 = 11 As a result, students do not get the questions that can reveal the process of thinking and arguing in solve the problem. The situation was not in line with the characteristics of the questions on the substance PISA contextual, requires reasoning, argumentation and creativity in the finish.

PISA Problem contains three components namely (1) the content or the content of mathematics; (2) a process that needs to be done when students observe a phenomenon, linking phenomena at math, and then solve the problems that he observed; and (3) the situation and context used in a math problem. The content is divided into four sections: space and shape, and the relationship changes (change and relationships), number (quantity), and uncertainty associated with statistics and probability are often used in the information society (OECD, 2009).

For example in problem "During these 3 months the exchange rate had changed from 4.2 to 4.0 ZAR per SGD. Was it in Mei-Ling's favor that the exchange rate now was 4.0 ZAR instead of 4.2 ZAR, when she changed her South African rand back to Singapore dollars? Give an explanation to support your answer", examined the three components that include: content (quantity), process (reflection), and context (general). According to Sri Wardani and Rumiati (2011, p.34) This problem-based reasoning as meet some of the indicators of mathematical reasoning is the ability to recognize reasoning and proof as fundamental aspects of mathematics, make and investigate mathematical conjecture, develop and evaluate mathematical arguments and evidence, as well as selecting and use various types of reasoning and methods of proof.

Thus, mathematical reasoning ability is needed by Indonesian students. The importance of reasoning is also expressed in the mathematics learning objectives contained in the Ministerial Regulation No. 22 of 2006 on SI (contents) that is capable of using the pattern and nature of reasoning, mathematical manipulation in making generalizations, compile evidence, or explain mathematical ideas and statements.

If Indonesia wants students get good results in the PISA tests, then it should provide teachers in teaching about the appropriate components in PISA. However, teachers often have difficulty in finding a reference that is used as an example in creating math problems based on the type of PISA. This does not mean, about the unavailability of PISA in Indonesia. However, in the context of PISA is not the same as what is in Indonesia, especially for the province of Bengkulu.

Therefore, in this study will be the development of a math problem for mathematical reasoning ability by context-based type PISA Bengkulu at the Junior High School.

PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT (PISA)

PISA (Programme for International Student Assessment) is a study of international student assessment program organized by the Organisation for Economic Co-operation and Development (OECD) or the organization for economic cooperation and development (Walker, 2011). The aims of PISA are to examine the ability of students regularly about the age of 15 years in reading (reading literacy), mathematics (mathematics literacy), and science (scientific literacy).

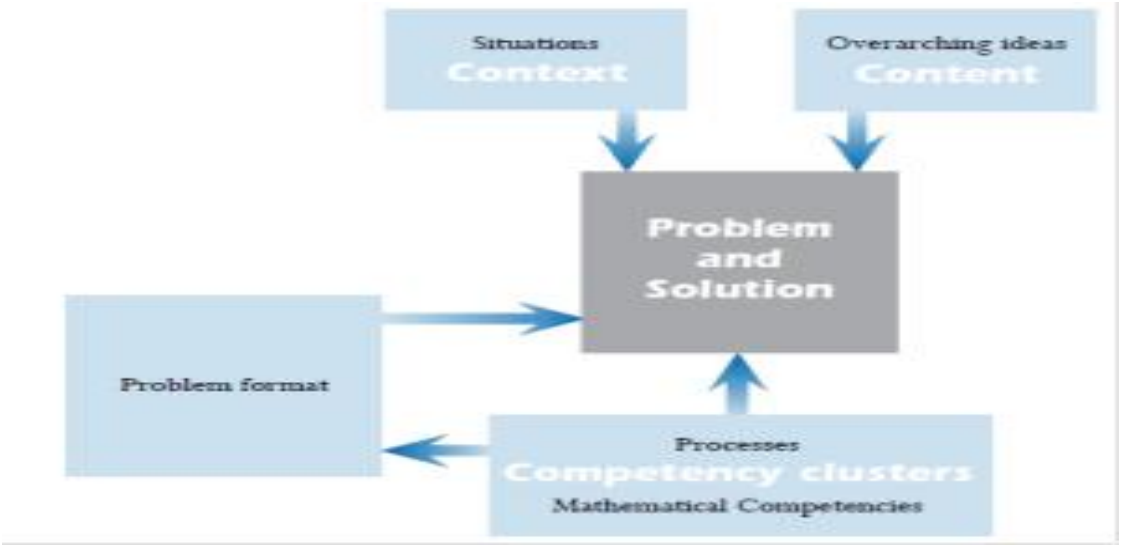
PISA is a study conducted every three years, starting in 2000, 2003, 2006, 2009, and so on. PISA survey conducted in 41 countries in the first cycle (2000), 40 countries in the

second cycle (2003), 57 countries in the third cycle (2006) and 65 countries in the fourth cycle (2009). Test given in 4500 to 10,000 students in each country (OECD, 2009).
In OECD (2009, h.13) Assessment PISA can be distinguished from other assessment, namely:

1. PISA policy oriented design and methods of assessment and reporting tailored to the needs of each participating country PISA to be easily drawn lessons on policies that have been made by the participating countries through a comparison of the data provided.
2. PISA uses an innovative approach to literacy, a concept related to the learning capacity of students to apply knowledge and skills in key subjects along with the ability to review, give a reason and communicate effectively, and solve and interpret problems in a variety of situations.
3. The concept of learning in the PISA relate to the concept of lifelong learning, the concept of learning is not limited to the 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.
4. Implementation of the PISA assessment regularly in a certain time span that allows participating countries to monitor their progress in accordance with the learning objectives that have been set.
5. Coverage of the PISA assessment is very broad, covering 30 OECD member countries and the 30 countries that joined in 2009

In OECD (2009, h.84) the definition of mathematical literacy in PISA framework, namely:

…is an individual's capacity to formulate, employ,and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena. It assists individuals to recognise the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engagedand reflective citizens.
Based on these definitions, mathematical literacy is defined as a person's ability to formulate, implement and interpret mathematics in a variety of contexts, including the ability to perform mathematical reasoning and use of concepts, procedures, and facts to describe, explain or predict phenomena or events. Mathematical literacy helps one to understand the role or usefulness of mathematics in everyday life as well uses it to make the right decisions as citizens who build, care and thought.
The mathematical knowledge and skills measured by three-dimensional with respect to (1) content or mathematics content, (2) a process that needs to be done when students observe a phenomenon, linking the symptoms with math, then solve the observed problem, and (3) situation and context used in a math problem. Three-dimensional relationships identified in PISA are described as follows:



Sumber : OECD (2009, h.90)

Gambar 1. Komponen matematika dalam PISA

In the following sections, the three components (content, process, and context) are described in more detail:

1. Content of Mathematics

Content of mathematics divided into four parts as follows:

a. Space and shape (space and shape) related to the subject of geometry. Problem about space and shape of this test the students' ability to recognize shapes, look for similarities and differences in various dimensions and shape representations, and recognize the characteristics of an object in relation to the position of the object.
b. Changes and relationships (and relationship change) related to the subject of algebra. Mathematical relationship is often expressed by equations or relationships that are common, such as addition, subtraction, and division. The relationship was also expressed in a variety of algebraic symbols, graphs, geometry forms, and tables. Because each symbol representation that has the purpose and nature of each, the process of translation is often a very important and determines in accordance with the situation and work to be done.
c. Numbers (quantity) deals with the relationship of numbers and number patterns, such as the ability to understand the size, patterns of numbers, and all things related to numbers in everyday life, such as counting and measuring certain objects. Included in the content of this number is the ability to reason quantitatively, represent something in the numbers, understand mathematical steps, counting in your head, and do an assessment.
d. Probability and uncertainty (uncertainty) associated with statistics and probability are often used in the information society.

2. Processes of Mathematics

Test of PISA examined students' ability to analyze, justify and communicate mathematical ideas effectively to propose, formulate, solve and interpret mathematical

problems in a variety of situations. In PISA, students have borne the process used to solve real-life problems referred to as mathematisation (OECD, 2009, h.105).

In PISA to describe the cognitive abilities of students includes three components: a component process of reproduction, the component connection process, and the component process of reflection. Here are the three components of the process are described in detail:

a) Components of Reproductive Processes (reproduction cluster)

In the PISA assessment, students were asked to repeat or copy the information obtained earlier. For example, students are expected to repeat the definition of a thing in mathematics. In terms of skills, students can do a simple calculation that may require settlement need not be too complicated and common. Surely this skill as we have often seen in traditional assessment.

b) Process Component connection (connection cluster)

In this connection, students are required to be able to create a link between some of the ideas in mathematics, making the relationship between the teaching materials are studied with real life in the school and community. In this same class, students can solve simple problems. Specifically, students can solve problems related to solving problems in life but still simple. Thus, students are expected to be directly involved in decision making mathematical reasoning using simple math.

c) Component Process Reflection (reflection cluster)

This reflection competence is the competence of the highest measured in the PISA ability, the ability to reason using mathematical concepts. Through this competency test, each student is expected to deal with a particular situation. They can use mathematical thinking in depth and use it to solve the problem. In this reflection, students conducted an analysis of his situation, identify and locate the 'math' behind the situation. Mathematization process includes student competence in identifying and formulating the state in math concepts, create their own model of the situation calm, analysis, critical thinking, and to reflect on the models, and solve problems, and connect it back to the original situation.

3. Context of Mathematics

In the PISA context there are four that are the focus, as follows:

a. Personal context that is directly related to the student's personal activities every day. In living daily life of the students deal with personal issues that require immediate solution. Mathematics is expected to play a role in the problem and then solve it.
b. Context of education and work related to the student's life in school and the workplace or in the environment. Students' knowledge of math concepts is expected to help to formulate, conduct classification problem, and solve the problem of education and employment in general.
c. The general context of knowledge relating to the use of mathematics in society and the wider environment in everyday life. Students can contribute their understanding of the mathematical knowledge and concepts to evaluate the relevant circumstances in the life of society.
d. Context of science that are specifically related to scientific activities that are more abstract and demanding understanding and mastery theory in mathematical problem solving.

BENGKULU PROVINCE

The total area of Bengkulu Province reached approximately 1,978,870 acres or 19,788.7 square kilometers consisting of 10 local district or city. In terms of geographical approximately 46.54% or 920 964 ha of land is forest reserves. The region is the source of nature tourism (ecotourism) is abundant with unique flora and fauna. It is located on the western side of the Bukit Barisan mountains and forests are still inhabited by a variety of wild animals such as tigers, elephants, rhinoceros, and the growth of the world's largest flower Rafflesia Arnoldy.

Bengkulu province's population reached 1.6 million people and the majority (96%) are Muslims, the rest are Christian, Buddhist and Hindu. Community originally from diverse ethnic languages and dialects of different regions such as Malay, Rejang, Enggano, Serawai, Lembak, Pasemah, Mulak Bintuhan, Pekal and Mukomuko. In terms of culture, society Bengkulu consists of two major groups, namely People and People Serawai Rejang. The Rejang people divided into two sections, namely those living in highland areas and those living on the coast called the Coastal Rejang. Serawai people living in the south of Bengkulu, they still have a relationship with Pasemah People who live in the mountainous region near Pagaralam and Mount Dempo, South Sumatra.

In addition, typical foods such as Bengkulu has Pendap, Curried Kemba'ang, Tempoyak, Lema, Juada Bay Tat, Bagar Sharks, Lapek Bint and so on. The priority commodity Bengkulu Province namely agriculture and service sectors. The agriculture sector is superior commodity crop plantation sub-sector with commodities such as palm oil, coconut, cocoa, pepper, coffee and rubber. While the fisheries sub-sector is fisheries. As for supporting the agricultural commodity sub-sectors, like fisheries, including aquaculture, aquaculture ponds and paddy cultivation. Superior commodity services sector is the field of tourism, such as nature tourism and marine tourism. While supporting other commodities contained in the mining sector in the form of coal mining.

Bengkulu has a traditional batik craft besurek, which batik cloth decorated Arabic letters bald and recognized by the government of the Republic of Indonesia, as one of the cultural heritage of the Republic of Indonesia and also enrich the cultural treasures in Indonesia. Culture Bengkulu has some different characteristics as influenced by different tribes of the South Bengkulu cultural / ethnic Serawai, Rejang culture and coastal culture. Tabot culture is a unique culture that combines local traditions with Shia Islam culturally

Traditional dances from Bengkulu, among others: Buffalo Spear Dance, Dance Princess Ivory Cempaka, Pukek Dance, Dance Andun, Kejei Dance, Welcoming Dance, Dance Angels woo Son, and Mask Dance. Meanwhile, the music is Geritan Art (with a melodious story), Serambeak (patatah-proverb form), and Andi-andi (literary art form of counsel), and Sambei (Rejang tribes distinctive vocal art, usually for weddings). Obek tourist Bengkulu province are as follows:

a. Nature tourism: Long Beach, White Sand Beach, Rat Island, Lake Revenge not already, Tread Padri and Zakat Beach, Tahura, Seblat Hunting Park, Park of Konak, Lake Test, Gedang Lake and Hill Maninjau, Lake Mas Aaron Bastari, Lake Musi, Suro, Nanua Park, Tanah Lot Lais, Lake Picung, Dio Bagite Tourism Park, and Lake Seven Colors.
b. Cultural and Heritage Tourism: Fort Marlborough, Home Sequestration Bung Karno, Parr and Hamilton Monuments, Museum of Bengkulu province, Causeway Lake, Lake Test, Swimming Pool Tabarena, Chief Curup Falls, White Water River,

Tomb Sentot Alibasyah, Training Center elephants, Mount Kaba, and Suban.

Thus, Bengkulu life style can be used in the context of the development of the PISA mathematics problem-based types such as:

a. Personal context that is directly related to the students' daily activities in accordance with the style of life of the people of Bengkulu
b. Context of education and employment as student activities at school and outside the school in accordance with the pattern of community life Bengkulu
c. The general context of knowledge relating to the use of mathematics in society and the wider environment in people's daily life Bengkulu.
d. Context of science that deals with the scientific activities in Bengkulu social life.

METHODOLOGY

Guided by the aim of this research is to produce a type of PISA math problems with contexts Bengkulu valid, then this type of research is the development (research and development). Model development of this research is the development of a model 4-D (four D), which consists of 4 stages. According to Thiagarajan (1974) (Endang, 2012) stages are: Define, Design, Develop, and Disseminate.

RESULT AND DISCUSSION

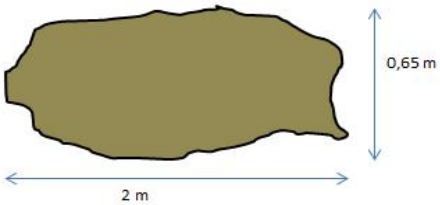
Draft I, which consists of the lattice, the card matter, and mathematics PISA problems based on Bengkulu culture is given in parallel to the experts as the process of validating the content, construct, and language.

Based on the assessment of the experts and the assessment of students made improvements or revisions to the first draft. The result of the revision of the experts and students used for the formation of a math problem drafts II.

Here are some examples of culture-based PISA Problem Bengkulu:

Tema 1. Perbaikan Alat Musik Dol pada Penutupnya

Pak Solin adalah ketua seksi perlengkapan dalam acara pembukaan dalam Festival Tabot. Sebelum dimulai, biasanya terdapat pertunjukan permainan alat musik Dol. Salah satu alat musik Dol yang akan digunakan dalam acara pembukaan Festival Tabot mengalami kerusakan pada kulit sapi nya. Sehingga akan dilakukan perbaikan dengan cara mengganti penutupnya yang memiliki luas 3.850 cm^2 dengan kulit sapi yang telah disediakan. Kulit sapi yang disediakan ini sangat berkualitas dan sangat cocok untuk membuat penutup Dol. Luas kulit sapi yang disediakan seperti pada gambar berikut ini:



Gambar a. Kulit Sapi


Gambar b. Doll

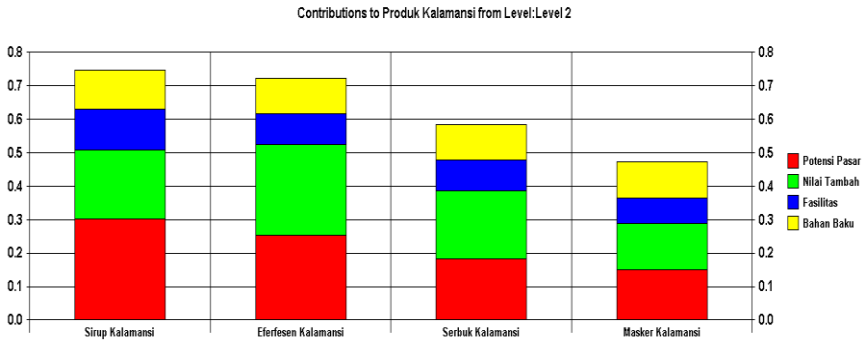
Namun, setelah diukur kulit sapi dengan Dol tersebut, ternyata kulit sapi ini tidak bisa digunakan dalam perbaikan Dol. Kenapa demikian? berikan alasan yang tepat!

Tema 2.Bunga Raflesia Arnoldy

Salah satu kebanggaan masyarakat Bengkulu yang merupakan puspa langka Indonesia yaitu bunga *Raflesia Arnoldy*. Bunga *Raflesia Arnoldy* adalah bunga terbesar di dunia. Menurut kepala Bagian Tata Usaha Balai Konservasi Sumber Daya Alam (BKSDA) bahwa bunga ini terancam punah. Untuk melestarikan bunga tersebut, kepala BKSDA berniat untuk memindahkan bunga *Raflesia Arnoldy* ke Kebun Raya Bogor. Cara memindahkanya harus menyertakan bonggol akarnya supaya tetap terjaga kelestariannya. Untuk membawanya dibutuhkan suatu tempat. Jika tempat tersebut memiliki panjang, lebar, dan tinggi berturut-turut 110 cm, 120 cm, dan 20 cm. Apakah tempat yang dibuat dapat digunakan sebagai wadah bunga *Raflesia Arnoldy* yang memiliki diameter 100 cm dan tinggi 20 cm dari permukaan tanah? Jelaskan!

Tema 3. Produk Olahan Jeruk Kalamansi

Mahasiswa Agribisnis S-2 melakukan penelitian mengenai analisis produk yang paling potensial dari olahan jeruk kalamansi di Kota Bengkulu. Produk jeruk kalamansi yang dianalisis adalah sirup kalamansi, eferfesen kalamansi, masker kalamansi, dan serbuk kalamansi. Berdasarkan analisis data dengan bantuan Criterium Decision Plus yang dilihat pada decision score maka produk olahan jeruk kalamansi dapat digambarkan dalam grafik dibawah ini.



a. Berdasarkan grafik tersebut, mahasiswa Agribisnis menyimpulkan bahwa produk olahan jeruk kalamansi yang potensial untuk dikembangkan di Kota Bengkulu adalah Sirup Kalamansi. Apakah kesimpulan mahasiswa Agribisnis tersebut benar ? Jelaskan alasanmu!

b. Berdasarkan grafik tersebut, indikator yang mempengaruhi kontribusi produk jeruk kalamansi di Kota Bengkulu adalah potensi pasar, nilai tambah, fasilitas dan bahan baku. Indikator yang mana yang mendominasi produk olahan jeruk kalamansi tersebut? Berikan penjelasan!

From the results of the first revision and revision II produced 14 items that fit mathematical reasoning abilities based on the type of the PISA mathematical context Bengkulu valid with the quality. After that, the matter will be simulated to check the allocation of time.

After the PISA math problems with context-based type of Bengkulu discussed with an expert and can be implemented revised simulation. Simulation stage is the initial stage

before the test is done. This stage aims to check the allocation of a predetermined time. In this study, the subject of simulation is the six students who have three different abilities: the ability of high, medium and low. Six students were given a math problem to mathematical reasoning ability by context-based type PISA Bengkulu totaling 14 items with the allocation of time 120 minutes.

After holding the simulation, there is no revision in the matter and the allocation of a predetermined time. At this stage of the simulation generates material mathematical matter for mathematical reasoning ability by context-based type PISA Bengkulu ready to be tested is limited

CONCLUSION

Based on the research results for the development of math problems based on the type of mathematical reasoning ability PISA with Bengkulu context, it can be concluded as follows:

Problem 1 mathematics for mathematical reasoning ability by context-based type PISA Bengkulu as many as 14 non-objective problem description form (open-response construct) have content characteristics of the three PISA: Geometry (shape and space), algebra (change and relationship), and the number (quantity); three components of the PISA (reproduction, connections and reflection); PISA four types of context (private, public, education / employment, and of science); and four indicators of mathematical reasoning (the ability to recognize reasoning and proof as fundamental aspects of mathematics, make and investigate mathematical conjecture, develop and evaluate mathematical arguments and evidence, as well as select and use various types of reasoning and methods of proof).

Problem 2 mathematics for mathematical reasoning ability by context-based type PISA developed Bengkulu categorized valid. Valid from invalid assessed qualitatively and quantitatively. Illustrated qualitatively valid assessment of the results of all validator validator which express both based on the content, construct, and language. Then based on the analysis quantitatively valid item (item validity) on the test results is limited.

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