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Analysis of Students' Ability to Master Content Components When Solve PISA Mathematics Literacy Questions at SMPN 14 Bengkulu City

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ABSTRACT

This study aims to analyse capability of students and the error process of students to solve the task of mathematics literacy PISA 2012. This research is descriptive research. The subjects of this research were students of class IX 1 and IX 2 SMP Negeri 4 Kota Bengkulu odd semester academic year 2021/2022. Instrument and data collection techniques are used in this research are test sheet and interview. The results showed that students' ability to master the content component of PISA mathematics literacy consists of four types, as follows: there are 45,67% students of class IX SMP N 4 Bengkulu city are able to master the content component shape and space, there are about 48,48% students of class IX SMP N 4 Bengkulu city are able to master the content component changes and relationships, there are about 53,25% IX students of SMP N 4 Bengkulu city are able to master the content component quantity, there are 92,8% students of class IX SMP N 4 Bengkulu city are able to master the content component probability, uncertainty, and data.

Keywords: capability, content, mathematics literacy of PISA

INTRODUCTION

Education is a process of changing a person's behavior and abilities towards progress and improvement. Education can change a person's mindset to always innovate and improve in all aspects of life towards improving one's quality. In formal education, the implementation of education cannot be separated from the educational goals to be achieved because whether or not the educational goals are achieved is a measure of the success of educational implementation. The goals of national education are adjusted to the demands of development and development of the Indonesian nation so that educational goals are dynamic [1], [2].

Elwan Stiadi states that mathematics plays an important role in human life because almost all human activities are related to mathematics[3]. Therefore, mathematics subjects need to be given to all students starting from elementary school to equip them with the ability to think logically, analytically, systematically, critically and creatively as well as the ability to work together because by studying mathematics, students will learn to reason critically and creatively, and active.

Mathematics education itself has a very important role because mathematics is a basic science that is widely used in various fields of life. Through learning mathematics, students are expected to develop critical, logical, systematic, careful, effective and efficient thinking skills in solving problems. One way of achieving the goals of mathematics education and learning can be assessed by students' success in understanding mathematics and utilizing

this understanding to solve problems in mathematics and other sciences[1], [2].

Law Number 20 of 2003 concerning National Education Standards states that national education functions to develop abilities and shape national character and a dignified national civilization in order to make the nation's life more intelligent. There are content standards and graduate standards which become references in implementing the educational process [4].

Based on this law, the government implements the National Examination (UN) as an instrument for assessing learning outcomes. The National Examination is an instrument for measuring graduate competency in terms of cognitive aspects for students nationally at the primary and secondary education levels. One of the subjects tested in the National Examination is mathematics. The mathematics learning achievements of Indonesian junior high school students at the national level show very good results, through the National Examination it can be seen that the average score for mathematics subjects in the period 2011/2012, 2012/2013, 2013/2014 respectively was 7.47 ; 6.1; 6.52 [5]. Meanwhile, at the international level, the achievements of Indonesian students are still far behind other countries. Based on the 2006 Program for International Student Assessment (PISA) ranking (mathematics literacy), Indonesia was ranked 50th out of 57 countries participating in the competition, in 2009 Indonesia was ranked 61st out of 65 participating countries, and in 2012 Indonesia was ranked 64th out of 65 countries participants in the competition[6], [7].

Looking at the results of the PISA test, namely Indonesia is always ranked in the bottom 10, it can be seen that students often make mistakes in solving PISA 2012 mathematical literacy questions which are presented in the form of story questions. The errors that occur are closely related to the level of ability possessed by students.

Spencer and Spencer define ability as a salient characteristic of an individual that is related to effective and/or superior performance in a job or situation[8], [9]. Ability/competency is the ability to behave, think and act consistently as a manifestation of the knowledge, attitudes and skills possessed. Students' ability to solve PISA 2012 Mathematics literacy questions can be seen from the students' ability to master the PISA 2012 Mathematics literacy components, namely the content and process components.

Based on the statement by the Deputy Minister of Education and Culture, Mr. Musliar Kasim, questions with PISA standards were included in the 2014 SMP National Examination questions[10]. The 2014 National Examination questions adapted to PISA are about Pythagoras and data centralization measures. A total of 77.48% of students answered correctly on the Pythagorean questions and 48.78% answered correctly on the data centralization measurement questions. Therefore, it is very important for teachers to give students the PISA model questions to improve students' abilities in working on PISA questions. Because in the following year all classes in junior high schools from class VII, VIII, IX in Indonesia will use the 2013 curriculum.

Based on this background, students' abilities in solving PISA 2012 Mathematics literacy questions will be analyzed. This research will be carried out on class IX students of SMP Negeri 14 Bengkulu City.

MATERIALS & METHODS

This research explains students' ability to master PISA Mathematics Literacy content. Therefore, the research used is descriptive research.

Research Location: SMPN 14 Bengkulu City. The subjects of this research were class IX students at SMPN 14 Bengkulu City. The data from this research are students' difficulties in solving PISA questions. The data collection methods used were tests and interviews.

This research instrument takes the form of a test and interview guide. The test takes the

form of multiple choice questions and essays. Interview guidelines are used to deepen test results.

Data analysis was carried out descriptively analytically, with the following criteria:

If students can do questions correctly according to the type of PISA 2012 mathematical literacy content component, then the student is considered capable of/mastering the PISA 2012 mathematical literacy content.

Table 1. List of Student Ability Assessments in Mastering PISA 2012 Mathematical Literacy Content

Scores	Category
7-10	Able to master content well
< 7	Not able to master content well

For description and multiple choice questions that require more detailed explanations and calculations, the student must have a score of 7-10 for each question in order to be categorized as being able to master the content components well. Meanwhile, if the student gets a score <7 then the student is categorized as unable to master the content. And for multiple choice questions that do not require an explanation, the student must answer correctly with a score of 5 in order to be categorized as being able to master the content.

RESULT

The test in this research was carried out at SMP Negeri 14 Bengkulu City with samples, namely class IX 1, totaling 32 students and class IX 2, totaling 34 students. Class IX 1 is a Bilingual/Independent class and class IX 2 is a Superior class. This sample was chosen because this class has superior abilities compared to other classes based on the teacher's perception. However, for class IX 1, when interviews were conducted with class IX 1 teachers, there were 10 students who had below average mathematical abilities. So this class is quite representative for classes with low and medium ability students. The instruments in this research consisted of 2 tools, namely test instruments and interviews to see students' abilities and students' mistakes in solving PISA mathematical literacy questions.

The test results regarding students' abilities in mastering the PISA mathematical literacy content components are presented in table 2. A summary of students' abilities in mastering the PISA 2012 mathematical literacy content components is as follows:

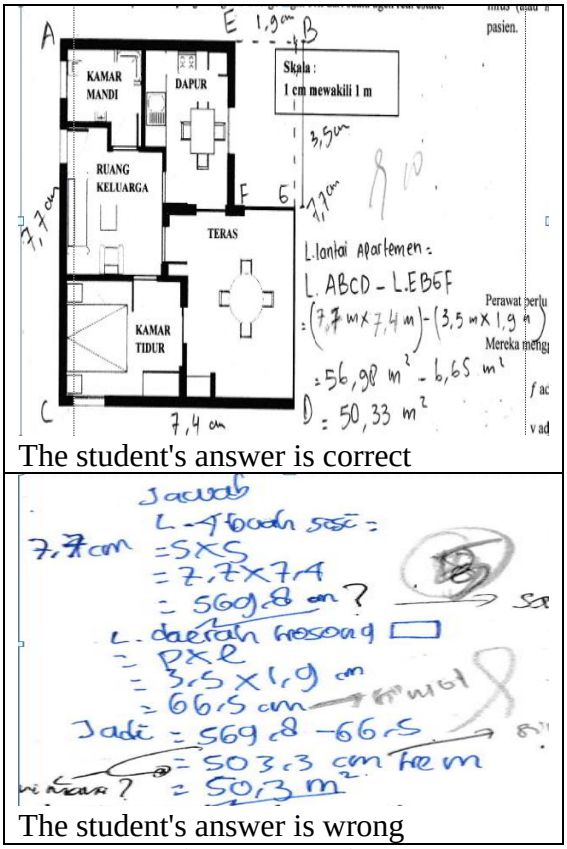
Table 2. Summary of Students' Abilities in Mastering PISA 2012 Mathematical Literacy Content Components

No	Content Component	Kelas	Percentage of Students Who Mastered the Content
1	Space and Shape	**IX 2**	45,67%
		IX 1	
2	Changes and Relationships	**IX 2**	48,48%
		IX 1	
3	Probability, Uncertainty, and Data	**IX 2**	92,8%
		IX 1	
4	Quantity	**IX 2**	53,25%
		IX 1	

DISCUSSION

Analysis of students' ability to master content components in solving PISA 2012 mathematical literacy questions based on table 2, namely, the first type of content component is space and shape. The space and shape content component consists of questions number 1, 8, 11, 12, 22, 23, and 24. Questions number 1 and 23 relate to the area of a rectangular area. Question number 8 is related to triangles and Pythagorean properties. Questions number 11, 12, and 24 relate to circles, and finally question number 22 relates to the third dimension. In the space and shape component for question number 1, only 2 students in class IX 1 were able to master the material on the area of rectangular areas. Meanwhile, in class IX 2 there are quite a lot of students who are able to master this material, namely 14 students, but this is still less than 50% of the total number of students in class IX 2. Likewise for question number 8, only 3 students in classes IX 1 and 10 students in class IX 2 who are able to answer/master material regarding the properties of triangles and Pythagoras well. This shows that in these materials class IX students at SMPN 14 Bengkulu city still need to improve their understanding. However, for question

number 22, which is related to the third dimension, all class IX 1 students were able to answer the question correctly and for class IX 2 out of 34 students, only one student answered incorrectly. This shows that in this material class IX students of SMPN 14 Bengkulu city have been able to master this material. Judging from the scores obtained by students, here are some examples of answers from students who were able and unable to master the content of space and shape:

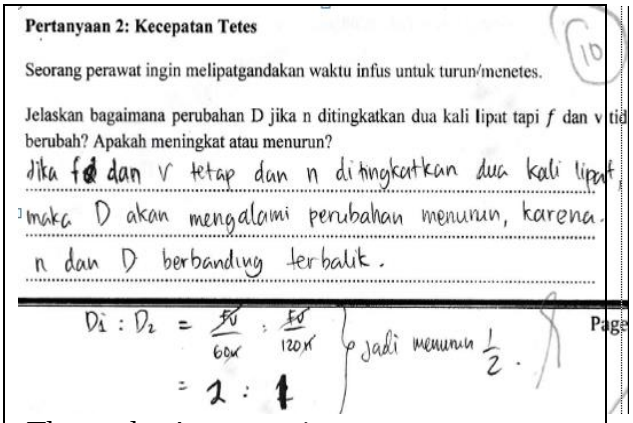


The student's answer is correct

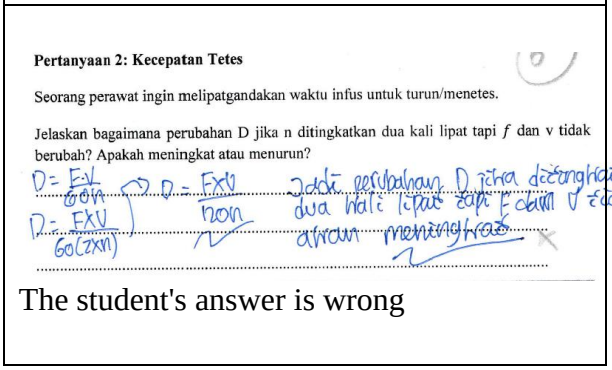
The student's answer is wrong

Figure 1. Example of student answers for space and shape content in question number 1

The second type of content component is change and connection. In the change and relationship components for questions number 2 and 9, in each question only 2 students in class IX 1 and only 8 students in class IX 2 were able to answer/master the material about explaining the effects that occur when one variable is increased twofold and the other variables remain in one formula and the material is about the length of time needed to cover the cost of purchasing a kite sail with a certain amount of diesel fuel cost savings. This shows that in these materials class IX students at SMPN 14 Bengkulu city still need to improve their understanding. However, for question number 16, which is related to changes in speed, time and distance, almost all students in both classes IX 1 and IX 2 were able to answer the question correctly, namely in class IX 1 there were 30 students and in class IX 2 there were 28 students. . This shows that in this material class IX students of SMPN 14 Bengkulu city have been able to master this material. And for other questions, on average, students were able to answer the questions correctly. The following are examples of answers from students who were able and unable to master the content of changes and relationships:



The student's answer is correct

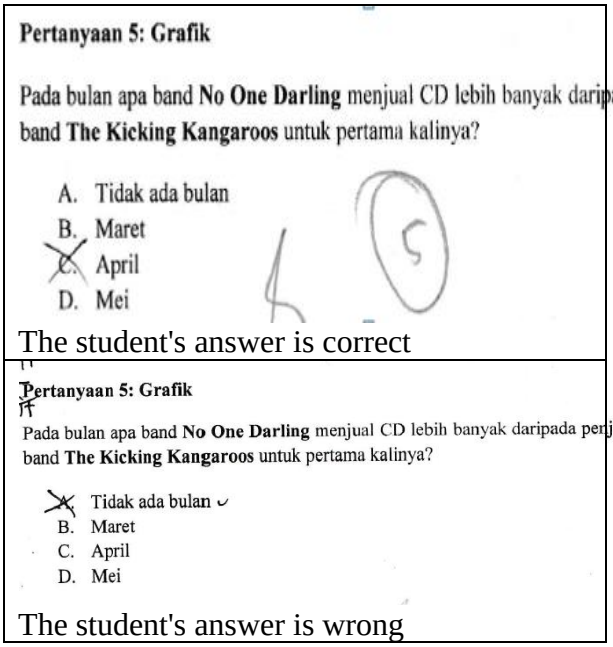


The student's answer is wrong

Figure 2. Example of student answers for content changes and relationships in question number 2

The third type of content component is probability, uncertainty, and data. The content components of probability, uncertainty, and data consist of questions number 4, 5, 6, and 19. Questions number 4,

5, 6 relate to reading graphs. Question number 19 relates to table reading. In the content of probability, uncertainty, and average data, almost all students have been able to master this content. In question number 4, all class IX 1 students were able to answer this question correctly and in class IX 2 as many as 33 students were able to answer correctly. In question number 5, all class IX 2 students were able to answer correctly and in class IX 1 28 students were able to answer correctly. The following are examples of answers from students who were able and unable to master the content of probability, uncertainty and data:



Pertanyaan 5: Grafik

Pada bulan apa band **No One Darling** menjual CD lebih banyak daripada penjualan band **The Kicking Kangaroos** untuk pertama kalinya?

A. Tidak ada bulan
B. Maret
C. April
D. Mei

The student's answer is correct

Pertanyaan 5: Grafik

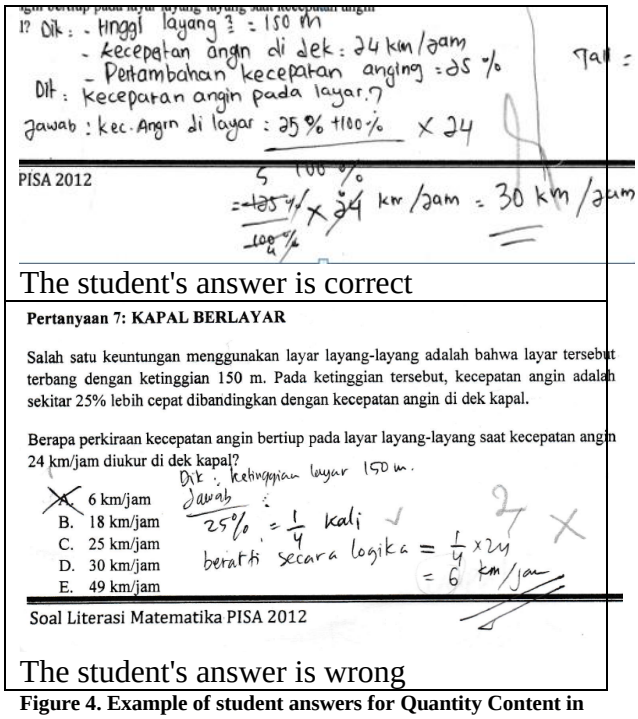
Pada bulan apa band **No One Darling** menjual CD lebih banyak daripada penjualan CD band **The Kicking Kangaroos** untuk pertama kalinya?

A. Tidak ada bulan
B. Maret
C. April
D. Mei

The student's answer is wrong

Figure 3. Example of student answers for Probability, Uncertainty and Data Content in question number 5

The last type of content component is quantity. The quantity content component consists of questions number 7, 10, 13, 15, 20, 21, and 25. Question number 7 contains the application of percentage calculations with the situation that the wind speed on the kite sail is 25% faster than the wind speed on the ship deck. Question number 10 contains comparisons of worth. Question number 13 contains the average number of climbers per day if the number of visitors is known in a certain period. Question number 15 contains the average step length in cm for a journey of 9 km with a total of 22,500 steps. Question number 20 is about choosing the smallest decimal quantity. Question number 21 is about calculating 2.5% of a value in thousands. Question number 25 contains information about identifying and constructing a quantitative model to solve problems. In this content component for numbers 7 and 13, very few students were able to answer correctly. In question number 7 for class IX 1 only 7 students were able to answer correctly and in class IX 2 only 8 students were able to answer correctly. In number 13 for class IX 1 only 8 students were able to answer correctly and in class IX 2 only 9 students were able to answer correctly. This shows that in material questions number 7 and 13, students' abilities in mastering this material still need to be improved. Meanwhile, for question number 10, almost all students were able to answer correctly, namely in class IX 1 there were 24 students and in class IX 2 there were 31 students. This shows that in question number 10 students have mastered this material well. The following are examples of answers from students who are able and unable to master quantity content:



Dik : - tinggi layang 2 = 150 m
- kecepatan angin di dek : 24 km/jam
- Pertambahan kecepatan angin = 25 %
Dit : kecepatan angin pada layar ?
Jawab : kec. Angin di layar : 25 % + 100 % × 24

PISA 2012

= 125 % × 24 km/jam = 30 km/jam

The student's answer is correct

Pertanyaan 7: KAPAL BERLAYAR

Salah satu keuntungan menggunakan layar layang-layang adalah bahwa layar tersebut terbang dengan ketinggian 150 m. Pada ketinggian tersebut, kecepatan angin adalah sekitar 25% lebih cepat dibandingkan dengan kecepatan angin di dek kapal.

Berapa perkiraan kecepatan angin bertiup pada layar layang-layang saat kecepatan angin 24 km/jam diukur di dek kapal?

A. 6 km/jam
B. 18 km/jam
C. 25 km/jam
D. 30 km/jam
E. 49 km/jam

Dik : ketinggian layar 150 m.
Jawab :
25% = 1/4 kali
berarti secara logika = 1/4 × 24 = 6 km/jam

Soal Literasi Matematika PISA 2012

The student's answer is wrong

Figure 4. Example of student answers for Quantity Content in question number 7

These results indicate that overall students' ability to master the mathematical literacy content components of PISA 2012 is still low. This is also supported by the results of research by Mulismah which states that students' ability to master the mathematical literacy content components of PISA 2012 is still low [5], [11].

CONCLUSION

Students' ability to master the PISA 2012 mathematical literacy content components consists of four types, namely as follows:

a. There are 45.67% of class IX students at SMPN 14 Bengkulu City who are able to master the content components of space and form.

b. As many as 48.48% of students IX SMPN 14 Bengkulu City were able to master the content components of change and connection.

c. There are 92.8% of IX students at SMPN 14 Bengkulu City who are able to master the content components of probability, uncertainty and data.

d. As many as 53.25% of students at SMPN 14 Bengkulu City were able to master the quantity content component.

Declaration by Authors

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