

Д

AH

< Back to results | < Previous 4 of 12 Next >

🛃 Download 🖶 Print 🖾 E-mail 🐻 Save to PDF 🥁 Save to list More... 🗲

Journal of Physics: Conference Series • Open Access • Volume 1366, Issue 1 • 7 November 2019 • Article number 012082 • 2nd International Conference on Applied and Industrial Mathematics and Statistics 2019, ICoAIMS 2019 • Kuantan, Pahang • 23 July 2019 through 25 July 2019 • Code 155273

Search

#### **Document type** Conference Paper • Bronze Open Access

Source type Conference Proceedings

**ISSN** 17426588

**DOI** 10.1088/1742-6596/1366/1/012082

#### Publisher Institute of Physics Publishing

Sponsors

Institut Teknologi Sepuluh (ITS) Nopember • Persatuan Sains Matematik Malaysia (PERSAMA) • Universiti Malaysia Pahang (UMP)

## Original language

English

Volume Editors Jaini N.I., Jamil N.M., Jonovich A.A.A., Kasim A.R.M., Zabidi S.F.A., Jusoh @ Awang R.

View less \land

# The mathematics education department students' ability in mathematical literacy for uncertainty problems on PISA adaptation test

Sanjaya F. 🖂 , Dewa Putu W.P., Julie H., Anggoro A.Y., Rudhito M.A.

🖪 Save all to author list

<sup>a</sup> Mathematics Education Department, Sanata Dharma University, Yogyakarta, Paingan, Maguwoharjo, Sleman, Indonesia

12 Views count (?) ↗ View all metrics >

🔂 View PDF 🛛 Full text options 🗸 🔂 Export

#### Abstract

Indexed keywords

Sustainable Development Goals 2021

SciVal Topics

#### Cited by 0 documents

(?)

Inform me when this document is cited in Scopus:

Set citation alert >

#### **Related documents**

The teachers' mathematics literacy ability for solving uncertainty problems on a PISA adaptation test

Sanjaya, F. , Anggoro, A.Y. , Julie, H. (2018) Journal of Physics: Conference Series

The teacher's mathematical literacy for the change and relationship problems on the PISA adaptation test

Anggoro, A.Y. , Julie, H. , Sanjaya, F. (2018) Journal of Physics:

Conference Series

The mathematics education department students' ability in mathematical literacy for the change and relationship problems on the PISA adaptation test

Anggoro, A.Y. , Julie, H. , Sanjaya, F. *(2019) Journal of Physics:* 

Conference Series

View all related documents based on references

Find more related documents in Scopus based on:

Authors > Keywords >

Metrics

Funding details

#### Abstract

The Programme for International Student Assessment (PISA) is a triennial international survey which aims to evaluate education systems worldwide by testing the skills and knowledge of 15-year-old students who are nearing the end of their compulsory education. In most of the PISA-related studies, more students as subjects than teachers. Even mathematics education students who are prospective teachers have not got a place in this PISA research. One of goals of this research was to describe mathematics education students' ability on PISA adaptation test. In this research, there were several steps to achieve the goal, that is (1) creating test questions by adapting PISA test, (2) validating test questions using expert validation, (3) asking the students to do the test, and (4) describing the students' solution test. The mathematics PISA adaptation test consist of 4 scopes, that is quantity, space and shape, change and relationship, and uncertainty. The test contained 13 questions, three quantity problems, three uncertainty problems, three change and relationship problems, and four space and shape problems. This research used 7 students of Mathematics Education Department of Sanata Dharma University as subject research. This research was a design research which developed by Cobb and Koeno. In the uncertainty area, all students answer correctly at the level 1 problem, six students answer correctly at the level 4 problem, two students answer correctly at the level 5 problem, two students answer correctly at the level 5 second problem, one student answers correctly at the level 6 problem. Therefore, the quality of mathematics education students' needs to be improved to reach the maximum level in PISA. © Published under licence by IOP Publishing Ltd.

Indexed keywords	~
Sustainable Development Goals 2021 () New	~
SciVal Topics ()	~
Metrics	~
Funding details	~

References (11)				View in search results format >	
🗆 Al	I				
CS	/ export	$\checkmark$	🖨 Print	🔀 E-mail	避 Save to PDF

Create bibliography

Campbell, P.F., Nishio, M., Smith, T.M., Clark, L.M., Conant, D.L., Rust, A.H., DePiper, J.N., (...), Choi, Y.

The relationship between teachers'mathematical content and pedagogical knowledge, teachers' perceptions, and student achievement

(2014) *Journal for Research in Mathematics Education*, 45 (4), pp. 419-459. Cited 70 times. <u>http://www.nctm.org/publications/archive.aspx?jrnl=jrme</u> doi: 10.5951/jresematheduc.45.4.0419

View at Publisher

□ 2 Julie, H.

(2017) International Journal of Science and Applied Science: Conference Series, 1, p. 55. Cited 7 times.

Julie, H., Marpaung, Y. (2012) *Widya Dharma*, p. 23. Cited 3 times.

4 Oecd

(2012) Assessment Framework. Key Competencies in Reading, Mathematics and Science. Cited 456 times.

5 Oecd

(2013) *PISA 2012 Results: What Students Know and Can Do. Student Performance in Mathematics, Reading, and Science.* Cited 1642 times.

🗌 6 Ojo

Ojose, B. (2011) *Journal of Mathematics Education*, 4, p. 89. Cited 78 times.

7 Christiansen, I.B. (2006) *Pythagoras*, 64, p. 6. Cited 20 times.

8 Stacey, K.

The PISA view of mathematical literacy in Indonesia (Open Access)

(2011) *Journal on Mathematics Education*, 2 (2), pp. 95-126. Cited 102 times. <u>https://ejournal.unsri.ac.id/index.php/jme/article/view/746/200</u> doi: 10.22342/jme.2.2.746.95-126

View at Publisher

9 Lai, Y., Smith, W.M., Wakefield, N.P., Miller, E.R., Goar, J.S., Groothuis, C.M., Wells, K.M.

Characterizing Mathematics Graduate Student Teaching Assistants' Opportunities to Learn from Teaching

(2016) Association for Women in Mathematics Series, 7, pp. 73-88. <u>springer.com/series/13764</u> doi: 10.1007/978-3-319-44950-0\_6

View at Publisher

<sup>10</sup> Julie, H., Sanjaya, F., Anggoro, A.Y.

The students' ability in the mathematical literacy for uncertainty problems on the PISA adaptation test (Open Access)

(2017) AIP Conference Proceedings, 1868, art. no. 050026. Cited 5 times. http://scitation.aip.org/content/aip/proceeding/aipcp ISBN: 978-073541548-5 doi: 10.1063/1.4995153

View at Publisher

 11 Akker Den, J.V., Gravemeijer, K., McKenney, S., Nieveen, N. (2006) *Educational Design Research*. Cited 468 times.

© Copyright 2019 Elsevier B.V., All rights reserved.

 $\triangleleft$  Back to results  $\mid$   $\triangleleft$  Previous 4 of 12 Next >

∧ Top of page

# About Scopus

- What is Scopus
- Content coverage
- Scopus blog
- Scopus API
- Privacy matters

# Language

日本語に切り替える **切換到简体中文** 切換到繁體中文

Русский язык

## **Customer Service**

Help Tutorials Contact us

## ELSEVIER

Terms and conditions  $\neg$  Privacy policy  $\neg$ 

Copyright © Elsevier B.V ↗. All rights reserved. Scopus® is a registered trademark of Elsevier B.V. We use cookies to help provide and enhance our service and tailor content. By continuing, you agree to the use of cookies.

RELX

 Simage
 Scimage Lower Lower

# Journal of Physics: Conference Series 8

COUNTRY	SUBJECT AREA AND CATEGORY	PUBLISHER	H-INDEX
United Kingdom Universities and research institutions in United Kingdom	Physics and Astronomy Physics and Astronomy (miscellaneous)	IOP Publishing Ltd.	85
PUBLICATION TYPE	ISSN	COVERAGE	INFORMATION
Conferences and	17426588, 17426596	2005-2020	Homepage
Proceedings			How to publish in this journal
			jpcs@ioppublishing.org

#### SCOPE

The open access Journal of Physics: Conference Series (JPCS) provides a fast, versatile and cost-effective proceedings publication service.

 $\bigcirc$  Join the conversation about this journal





Metrics based on Scopus® data as of April 2021



Zainab 4 weeks ago

hello, is the IOP Journal of Physics: Conference Series of this journal listested in scopus?

reply



Melanie Ortiz 4 weeks ago

SCImago Team

Dear Zainab, thank you very much for your comment. We suggest you consult the Scopus database directly. Keep in mind that the SJR is a static image (the update is made one time per year) of a database (Scopus) which is changing every day. Best Regards, SCImago Team

D Dr Girisha A 1 month ago

Dear sir,

Please inform me, whether Journal of Physics: Conference Series 1767 (2021) 012011 is rated in Q3 0r Q4.

reply

The 11th Biennial Conference on Classical and Quantum Relativistic Dynamics of Particles and Fields



#### VALUES 1209- 2019

4-T June 2019 Mérida, Yacattin, Masica

EDITOR Martia Land

The open access journal for conference proceedings

lopsolence.org/jpcs

IOP Publishing

**Proceedings of The 6<sup>th</sup> International Conference On Research, Implementation And Education Of Mathematics And Sciences (6th ICRIEMS):** Integrating Science, Technology, Engineering, & Mathematics (STEM) and Education for Disaster Risk Reduction and Mitigation

#### **Organizing Committee:**

Dr. Restu Widiatmono. (Chair) Dr. Antuni Wiyarsi (Secretary 1) Nur Fitriyana, M.Pd (Secretary 2) Dr. Kun Sri Budiasih (Treasury) Dr. Karyati (Program Coordinator)

#### Advisory Board (Steering Committee):

Prof. Dr. Wim T van Horssen (Applied Mathematics, TU Delft, Netherland)
Prof. Dr. Muammer Calik (Chemistry Education, Trabzon University, Turkey)
Prof. Fang Ying Yang Ed.D (Science Education, National Taiwan Normal University, Taiwan)
Allen Price, Ph.D (Physics Education, Emmanuel College Boston, USA)
Guillermo Dávila-Rascón (Mathematics, Universidad de Sonora, Mexico)
Osval Antonio Montesinos Lopez, Ph.D. (Statistic, Universidad de Colima, Mexico)
Dr. Azmi Mohammed (Chemistry, Universiti Pendidikan Sultan Idris, Malaysia)
Dr. Eng. Kuwat Triyana (Physcis, Universitas Gadjah Mada, Indonesia)
Dr. Hartono (Dean, Advisory Board Chair, Universitas Negeri Yogyakarta)
Dr. Slamet Suyanto (Vice Dean, Universitas Negeri Yogyakarta)

#### **Reviewers:**

Nur Aeni Ariyanti, SP., MP., M.Agr. Dr. Tien Aminatun, S.Si., M.Si. Dr. Ixora Sartika Mercuriani, M.Si. Dr. Slamet Suyanto, M.Ed. Dr. Retno Arianingrum Dr. Sri Handayani Dr. Antuni Wiyarsi Dr. Eli Rohaeti Dr. Karyati, S.Si., M.Si. Kismiantini, S.Si., M.Si., Ph.D.

#### **Editors:**

Didik Setyowarno, M.Pd. Dr. Rida Siti N Fika Fauzi, M.Sc. Marfuatun, M.Si. Annisa Filaeli, M.Si. Metridewi Primastuti, M.Pd.

#### Published by:

FMIPA Universitas Negeri Yogyakarta Karangmalang, Yogyakarta 55281 Tel. (0274)550227, Fax. (0274)548203 © September 2019 ISBN 978-602-74529-4-7 Dr. Dhoriva Urwatul Wustqa, M.S. Dr. Agus Maman Abadi, S.Si., M.Si. Dr. Ali Mahmudi, S.Pd., M.Pd. Wahyu Setyaningrum, S.Pd., M.Ed., Ph.D. Dr. Ariyadi Wijaya, S.Pd.Si., M.Sc. Dr. Drs. Sugiman, M.Si. Dr. Insih Wilujeng Dr. Restu Widiatmono, S.Si., M.Si. Dr. Rida Siti Nur'aini Mahmudah, S.Si., M.Si. Dr. Pujianto, S.Pd., M.Pd.

Rio Christy Handziko, M.Pd. Atik Kurniawati, M.Pd. Musthofa, M.Sc. Heru Sukoco, M.Pd. Anggit Reviana, M.Pd.



NOTICE: Ukraine: Click here to read IOP Publishing's statement.

# Table of contents

Volume 1397

# 2019

◆ Previous issue
 Next issue ▶

The 6th International Conference on Research, Implementation, and Education of Mathematics and Science 12–13 July 2019, Yogyakarta, Indonesia

Accepted papers received: 31 October 2019 Published online: 19 December 2019

Open all abstracts

Preface			
OPEN ACCESS			011001
Preface			
+ Open abstract	View article	PDF	
OPEN ACCESS			011002
Peer review state	ment		
	Tiew article	PDF	
Papers			
OPEN ACCESS			012001
The effects of an optical properties	nealing temperature s of barium titanate	and angular velocity variation on microstructure and (BaTiO <sub>3</sub> ) using chemical solution deposition method	
R. P. Rini, F. Nuros	yid and Y. Iriani		
	View article	PDF	
OPEN ACCESS			012002
Effect of pre-ann	ealing and annealing	g temperature on microstructural and optical properties	
of multiferroic B	$iFeO_3$ thin films pre	epared by chemical solution deposition (CSD)	
E B Agustina, Y Iri our Privacy and Co	ani and R Suryana okies policy.	se ans she you agree to our use of cookies. To find out more, see	Θ

Journal of Physics: Conference Series, Volume 1397, 2019 - IOPscience Evaluation of geographically weighted multivariate negative Binomial method using multivariate spatial infant mortality data Y S Dewi, Purhadi, Sutikno and S W Purnami + Open abstract View article 🔁 PDF **OPEN ACCESS** 012078 Valuation risk adjusted deposit insurance on heston model N Hariati, M Yunus and E R M Putri 🔁 PDF + Open abstract View article **OPEN ACCESS** 012079 What Difficulties that Students Working in Mathematical Reasoning Questions? A H Zaini and H Retnawati 🔁 PDF View article + Open abstract **OPEN ACCESS** 012080 Why are mathematics teachers advised to use blended learning in the learning process? Bulan Nuri 🔁 PDF View article + Open abstract **OPEN ACCESS** 012081 The Profile of Junior High School Students' Mathematical Creative Thinking Skills in Solving Problem through Contextual Teaching Cholis Sa'dijah, Ucik Fitri Handayani, Sisworo, Sudirman, Susiswo, Ety Tejo Dwi Cahyowati and Mukhtamilatus Sa'diyah + Open abstract View article 뿩 PDF

**OPEN ACCESS** 012082 The Effect of Problem Based Learning on Mathematical Critical Thinking Skills of Junior High School Students Fitriana Yolanda 🔁 PDF View article + Open abstract

**OPEN ACCESS** 012083 How to Create Isomorphic Example-Problem Pairs for Facilitating Analogical Thinking F M Pastoriko and E Retnowati View article 🔁 PDF + Open abstract This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see  $oldsymbol{\Theta}$ our Privacy and Cookies policy. OPEN ACCESS

1:09 PM	Jo	urnal of Physics: Conference Series, Volume 1397, 2019 - IOPscience	
The Types and Fa Word Problems:	actors of Error of E An Analysis Using	lementary School Students in Solving Mathematical the Fong's Method	01208
Hikmah Ramdhani	Putri and Djamilah Bo	ondan Widjajanti	
	View article	🔁 PDF	
OPEN ACCESS The mathematics change and relati	education departm onship problems or	ent students' ability in mathematical literacy for the 1 the PISA adaptation test	01208
Antonius Yudhi An	ggoro, Hongki Julie, I	Febi Sanjaya, M Andy Rudhito and Dewa Putu Wiadnyana	
	View article	PDF	
OPEN ACCESS Analysis of The I Reviewed from T	Difficulty of VIII <sup>th</sup> The Mathematics Co	Grade Junior High School Students in Circle Material onnection Ability	01208
Indra Kusuma Wija	yanti and Agus Mama		
	View article	PDF	
OPEN ACCESS The Lost Process Lulu Choirun Nisa	of Mathematical L and Ainal Inayah	iteracy on Excellent Students at MAN 2 Kudus	01208
	View article	🔁 PDF	
OPEN ACCESS			01208
Exploration of te material	achers' "knowledge	of students" in study-based teaching on polyhedron	
Ma'rufi, M Ilyas, R	F Pasandaran and Sal	wah	
	View article	PDF	
OPEN ACCESS Students metacog intelligence	gnitive skill in learn	ing mathematics through cooperative based emotional	01208
M Ilyas, Ma'rufi an	d F Basir		
	View article	PDF	
OPEN ACCESS	ild Their Mathews	tical Dispectitions towards Solving Contention land	01209
How Students Bu Abstract Mathem	aild Their Mathema natics Problems	tical Dispositions towards Solving Contextual and	

Mukhtamilatus Sa'diyah, Cholis Sa'dijah, Sisworo and UcikFitri Handayani

This site uses cookies. By continuing to	use this site you agree to our u	se of cookies. To find out more, see
+ Open abstract $1 \cdot  \overline{\mathbf{T}} $ View article	▶ PDF	,
our Privacy and Cookies policy.		

Θ

#### PAPER • OPEN ACCESS

# The mathematics education department students' ability in mathematical literacy for the change and relationship problems on the PISA adaptation test

To cite this article: Antonius Yudhi Anggoro et al 2019 J. Phys.: Conf. Ser. 1397 012085

View the article online for updates and enhancements.

### You may also like

- Designing PISA-like task on uncertainty and data using Covid-19 context Zulkardi, D S Nusantara and R I I Putri
- <u>Student strategy in solving PISA problem</u> through realistic mathematics education approach
- K A Fitri, R Johar, C M Zubainur et al.
- <u>Designing PISA-like mathematics problem</u> in covid-19 pandemic (PISAComat) D S Nusantara, Zulkardi and R I I Putri



This content was downloaded from IP address 202.94.83.212 on 05/04/2022 at 05:53

# The mathematics education department students' ability in mathematical literacy for the change and relationship problems on the PISA adaptation test

## Antonius Yudhi Anggoro, Hongki Julie, Febi Sanjaya, M Andy Rudhito, and Dewa Putu Wiadnyana

Sanata Dharma University, Jl. Affandi Tromol Pos 29, Sleman, Yogyakarta 55002 Indonesia

E-mail: hongkijulie@yahoo.co.id

Abstract. One of goals of this research was to describe the mathematics education department students' ability in mathematics literacy for change and relationship problem on Programme for International Students Assessment (PISA) test. The procedures of this research were (1) adapt the PISA test, (2) validate the PISA adaptation test, (3) ask seven students from mathematics education department to solve PISA adaptation test, and (4) describe bachelor students' solution profile. There were (1) three change and relationship problems, (2) four space and shape problems, (3) two uncertainty problems, and (4) four quantity problems. The type of this research is a design research. Subjects of this research were seven bachelor students of mathematics education department. The research results were as follows: (1) level four achieved by one student (14.29%) in problem number 2b.4; (2) level three achieved by (a) six students at problem number 2a, (b) five students at problem number 2b.2; and (c)three students at number 2b.3 and 3; and (3) level two achieved by three students at number 3.

#### 1. Introduction

In the 21st century, human needs 21st century skills for survive. Those skills include critical thinking and problem solving, creativity and innovation, communication and collaboration, flexibility and adaptability, initiative and self-direction, social and cross-cultural, productivity and accountability, leadership and responsibility, and information literacy [1, 2, 3, 4]. One of components that needed to build 21st century skills is mathematical literacy [5]. Mathematical literacy is an individual's ability to identify and understand mathematics role in the world, to make an accurate assessment, use and involves mathematics in various ways to fulfill the individual needs as a reflective, constructive and filial citizen [2, 6].

Unfortunately, mathematical literacy of Indonesian students was not good as expected. It could be seen from Indonesian ranking in PISA test. In 2015, Indonesia achieved ranking 63 from 70 countries and the average score for mathematics is 386. In 2012, Indonesia achieved ranking 65 from 65 countries, and the average score for mathematics is 375 [7, 8].

Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI. Published under licence by IOP Publishing Ltd 1

**IOP** Publishing

PISA test consist of four contents namely (1) the quantity, (2) space and shape, (3) change and relationship, and (4) uncertainty and data [5, 6, 9]. In the PISA test, there are six levels related to mathematical literacy of students [5, 6, 9].

According to Campbell et al., mathematical abilities of primary teachers who teach in the elementary and junior high school are related directly and positively with the students' achievement [10]. It means that a teacher who has good mathematical literacy will impact positively on improving student's mathematical literacy. This result gave idea to us how to improve our students' mathematics ability. If the schools want to improve students' mathematical literacy, they need to improve their teachers' mathematical literacy. It means universities who produced the teacher candidates has an obligation to improve the quality of prospective teachers it produced. How is our teacher's and teacher candidates' mathematical literacy? Do their mathematical literacy is good or not? Unfortunately, research in this area is still limited. So that's why this research is important to do. Because our university as one of universities producing candidate of teachers, we had obligation to know about the students' mathematics literacy and improve it. The one of research aims was to describe mathematics education department students' ability in mathematics literacy for change and relationship problem on PISA adaptation test.

#### 2. Research Methodology

The type of this research was design research. Subjects of this research were seven mathematics education department students. They were chosen randomly from mathematics education department students in one of private university. The goal of this study was achieved by using Akker's design research procedure [11]. There were three steps in the design research, i.e. (1) construct the design, in this research, the researchers constructed the PISA adaptation test, (2) try out the design, in this case, the researchers asked seven mathematics education students to do the test, and (3) do a restrospective analyze, in this case, the researchers analyze the test result base on the three qualitative data analyze steps developed by Miles and Huberman [12]. This procedures was described in the following diagram.



Figure 1. The research procedures

There were four types of the problems in the PISA adaptation test which resulted from this research, i.e. (1) three change and relationship problems, (2) four space and shape problems, (3) two uncertainty problems, and (4) four quantity problems. The language that used in the test is Indonesian, but for the benefit of scientific publications, the test was translated into English.

# 3. Result and Discussion Problem 1

This graph shows how the speed of a racing car varies along a flat 3 kilometer track during its second lap.



- a. Where was the lowest speed recorded during the second lap?
  A. at the starting line.
  B. at about 0.8 km.
  C. at about 1.3 km.
  D. halfway around the track.
- b. What can you say about the speed of the car between the 2.6 km and 2.8 km marks?
  - A. The speed of the car remains constant. C. The speed of the car is decreasing.

B. The speed of the car is increasing. D. The speed of the car cannot be determined from the graph. **Figure 2.** The problem 1 in the PISA adaptation test

In the graph, the vertical axes represent car's speed and the horizontal axes represent distance along the track. The deepest valley in the graph indicated the lowest car's speed. In this case, it happened at about 1.3 km. So, the answer of problem 1a is C. At interval (2.6, 2.8), the graph was increasing monotone. It indicated that car's speed increase at that interval. Thus, the answer of problem 1.b is B. Note that all relevant information was given in the problem, and the questions were defined clearly. All subjects could answer both problems correctly. It means, the subjects could answer questions involving familiar contexts where all relevant information is present and the questions are clearly defined. Thus, base on the PISA classification [5, 6, 9], the students' mathematics literacy were classified in the level 1.

 C. Di sokitan janak 1.3 km dani titik awal. Karena pada gnaljik sewaktu menurijukkan pada 1.3 km dani titik awal, gnaljiknya me lebih melengkung kebawah dani pada lengkungan yang lainnya. Dikotahui bahwa semakin rendah lengkungannya semakin rendah pula kecepatannya.
 B. Kocepatan mobil meningkat. Karena terlihat pada graljik yang conderung naik atau meningkat kecepatannya. Dikotahui bahwa semakin tinggi graljik semakin cepat pula kecepatannya.

Figure 3. The one example of subjects answer for problem 1

#### Problem 2

**1397** (2019) 012085 doi:10.1088/1742-6596/1397/1/012085

People living in an apartment building decide to buy the building. They will put their money together in such a way that each will pay an amount that is proportional to the size of their apartment. For example, a man living in an apartment that occupies one fifth of the floor area of all apartments will pay one fifth of the total price of the building.

- a. There were three apartments in the building. The largest, apartment 1, has a total area of 95 m<sup>2</sup>. Apartments 2 and 3 have areas of 85 m<sup>2</sup> and 70 m<sup>2</sup> respectively. The selling price for the building is 30 billion rupiah. How much should the owner of apartment 2 pay? Show your work.
- b. Circle Correct or Incorrect for each of the following statements:

Statement	<b>Correct / Incorrect</b>
A person living in the largest apartment will pay more money for each	Correct / Incorrect
square meter of his apartment than the person living in the smallest	
apartment.	
If we know the areas of two apartments and the price of one of them we	Correct / Incorrect
can calculate the price of the second.	
If we know the price of the building and how much each owner will pay,	Correct / Incorrect
then the total area of all apartments can be calculated.	
If the total price of the building were reduced by 10%, each of the owners	Correct / Incorrect
would pay 10% less.	

Figure 4. The problem 2 in the PISA adaptation test

Generally, all subjects used the same technique using ratio concept to solve this problem. First technique, they counted the total area of the apartment, that is  $95 \text{ m}^2 + 85 \text{ m}^2 + 70 \text{ m}^2 = 250 \text{ m}^2$ . After that, they used ratio to count the price of apartment 2. They used ratio because the price of the apartment is proportional to the size of the apartment according to the problem. There were five subjects who use this technique.

tlanga goclung = 30 Hilyan ruptah Yang harus di bayan pemilik apartomen I: (a) Apartomen I luasnya 95 m<sup>2</sup> I luasnya 95 m<sup>2</sup> I luasnya 96 m<sup>2</sup> I luasnya 70 m<sup>2</sup> I luasnya 70 m<sup>2</sup> I luasnya 70 m<sup>2</sup> I atau 1.02 milyar ruptah.

Figure 5. One of subject's answer for problem 2a using the first technique

Let us pay attention to the answer in figure 5. Subjects wrote  $\frac{85}{250} \times 30M = \frac{85}{250} \times 30000 \text{ juta}$ 

.The letter M represents billions in Indonesian. To simplify calculation, subject converted "30 billion" to "30000 juta" and then divided 30000 with 250. "30.000 juta" was not common way to represent 30 billion, but mathematically it is true.

The second technique to solve problem 2a is the subject simplified 95:85:70 by divided it with five. The subject got 19:17:14. After that, subject counted the sum of 19+17+14 = 50 and counted the price of the apartment by using ratio. From the subject's answer, it can say that the subject can interpret agreement between apartment buyer and seller and represent it by using ratio. Thus, six subjects using the first and the second technique were classified by PISA classification [5, 6, 9] in level 3. One another subjects could not solve it.

**Subjects answer for problem no 2b.1:** All subjects claimed that the statement is correct. This claim is false because everyone would pay the same amount of money for each meter square. This was a consequence of the rule that payment was proportional to the size of apartment. Thus, all students were classified by PISA classification [5, 6, 9] in level 1, becuse they used relevant information but not in the true way.

**Subjects answer for problem no 2b.2:** Five subjects claimed that the statement is correct. Thus 71.43% subjects were classified by PISA classification [5, 6, 9] in level three because they could communicate their interpretation of given information in the problem, the result of their thinking, and the reason of their answer. Two subjects did not answer the question.

**Subjects answer for problem no 2b.3:** Three subjects answered "incorrect" for this question. It showed that subjects could communicate their interpretation of given information in the problem, the result of their thinking, and the reason of their answer. Thus, they were classified by PISA classification [5, 6, 9] in level three. Three subjects answered "correct" for this problem. Thus, these students were classified by PISA classification [5, 6, 9] in level three used relevant information but not in the true way. One subject didn't answer the question.

**Subjects answer for problem 2b.4:** Only one student answered "correct" for this problem. This answer is true. Thus, she was classified by PISA classification [5, 6, 9] in level 4, because she could construct and communicate the reasons why they answer "correct" based on their interpretation of proportional understanding. Four subjects answered "incorrect" and they were classified by PISA classification [5, 6, 9] in level 1, becuse they used relevant information but not in the true way. Two subjects did not answer the question.

#### **Problem 3**

In 1998 the average height of both young males and young females in the Netherlands is represented in this graph. According to this graph, on average, during which period in their life are females taller than males of the same age?



Figure 6. The problem 3 in the PISA adaptation test

In above graph, the vertical axis represent high, horizontal axis represent age, the dash line represent average high of young females and straight line represent average high of young males. Three students answered that young females were taller than young males during age period 11 - 13 year. These students were able to execute clearly described procedures, including those that require sequential decisions. They also were able to interpret and use representations based on different information sources and reason directly from them. Thus, they were classified by PISA classification [5, 6, 9] in level three. One student answered that young females were taller than young males during age period 11 - 12 year. One student answered that young females were taller than young males during males during age period 12 - 13 year. One student answered that young females were taller than young males during males when they are 12 year old. These three students were able to extract relevant information from a

single source and make use of a single representational mode. Thus, they were classified by PISA classification [5, 6, 9] in level two. One student answered that young females were taller than young males during age period 11 - 14 year. This student was not able to extract relevant information from a single source and make use of a single representational mode, so this student was classified by PISA classification [5, 6, 9] in level 1.

The following table is the summary of subject's level

Problem	n Subject's Reason		The number	Percentage
	Achievement Level		of subject	
1a	Level 1	Subjects could answer questions involving familiar contexts where all relevant information is present and the questions are clearly defined.	7	100 %
1b	Level 1	Subjects could answer questions involving familiar contexts where all relevant information is present and the questions are clearly defined.	7	100 %
2a	Level 3	Subjects could interpret agreement between apartment buyer and seller and represent it by using worth comparison.	6	85,71 %
	Didn't answer the question	-	1	14.29 %
2b.1	Level 1	-	7	100 %
2b.2	Level 3	they can communicate their interpretation of given information in the problem, the result of their thinking, and the reason of their answer	5	71.43 %
	Didn't answer the question	-	2	28.57 %
2b.3	Level 3	Subjects can communicate their interpretation of given information in the problem, the result of their thinking, and the reason of their answer.	3	42.86 %
-	Level 1	-	3	42.86 %
-	Didn't answer the question	-	1	14.29 %
2b.4	Level 4	Subjects could construct and communicate the reasons why they answer "correct" based on their interpretation of proportional understanding.	1	14.29 %
	Level 1	-	4	57.14 %
	Didn't answer the question		2	28.57 %
3	Level 3	Subjects were able to execute clearly described procedures, including those that require sequential decisions. They also were able to interpret and use representations based on different information sources and reason directly from them.	3	42.86 %
	Level 2	Subjects able to extract relevant information from a single source and make use of a single representational mode	3	42.86 %
	Level 1	-	1	14.28 %

Table 1. the summary of subject's level

#### 4. Conclusion

According to above results and discussion, we can take some conclusion. Only one or 14.29% subject achieved level four in problem number 2b.4. Six or 85.71 % subjects achieved level three at problem number 2a. Five students or 71.43 % achieved level three at problem number 2b.2. Three subjects achieved level three in the problem 2b.3 and 3. Three subjects achieved level two in the problem three.

From the results of this study, researchers suggest that there needs to be concrete steps from the mathematics education department, to improve mathematical literacy skills of the students. One of steps that can be taken is to change the learning method and evaluation system in the mathematics education department. Learning methods that should be used are no lecturer-centered, but student-centered. The evaluation system with the non-test method in the lecture needs to be increased in frequency of use. If the evaluation system uses a test method, the evaluation questions in the lecture must begin to be improved in quality to be equivalent to the questions in level four, five, and six in PISA calcification.

#### Acknowledgments

We thank the Ministry of the Research, Technology and Higher Education for funding this research via "Penelitian Strategis Nasional Institusi Tahun 2018" grant distributed through the Sanata Dharma University.

#### References

- [1] Stacey K 2011 The PISA view of mathematical literacy in Indonesia *Journal Mathematics Education* **2** 95
- [2] Ariyadi W 2016 Students' information literacy: A perspective from mathematical literacy *IndoMS Journal Mathematics Education* **7** 73
- [3] Ojose B 2011 *Mathematics* literacy: Are we able. To put the *mathematics*, we learn into Everyday use? *Journal of Mathematics Education* **4** 89
- [4] Christiansen I B 2006 Mathematical literacy as a school subject: Failing the progressive vision? *Pythagoras* **64** 6
- [5] Julie H and Marpaung Y 2012 PMRI dan PISA: Suatu usaha peningkatan mutu pendidikan matematika di Indonesia *Widya Dharma* **23**
- [6] Julie H 2017 The elementary school teachers' ability in adding and subtracting fraction, and interpreting and computing *International Journal of Science and Applied Science: Conference Series* **1** 55
- [7] OECD 2013 PISA 2012 Results: What students know and can do. Student Performance in mathematics, reading, and science (Paris: OECD)
- [8] OECD 2012 Assessment Framework. Key Competencies in Reading, Mathematics, and Science (Paris: OECD)
- [9] Hongki et all. 2017 The students' ability in mathematical literacy for the quantity, and the change and relationship problems on the PISA adaptation test *IOP Conf. Series: Journal of Physics: Conf. Series* **890** 012089
- [10] Campbell, Patricia F, et. all 2014 The relationship between teachers' mathematical content and pedagogical knowledge, teachers' perceptions, and student achievement *Journal for Research in Mathematics Education* 45 419
- [11] Akker J V D, Gravemeijer K McKenney S and Nieveen N 2006 *Educational Design Research* (New York: Taylor and Francis Group).
- [12] Miles M B and Huberman A M 1994. Qualitative Data Analysis. London: Sage Publications.