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email: cakrawala.upstegal@gmail.com

Inequality Effect of Metacognition and Adaptivity Skill in Science Achievement of Indonesia Students

[1] Mobinta Kusuma ✉

[1] Pancasakti Tegal University, Indonesia

Email: mobintakusuma@upstegal.ac.id

History

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Abstract

This study aims to determine the influence of inequality in metacognition and adaptability to the achievement of science scores at the student level and school level in Indonesia. Science learning is expected to be able to develop high-level thinking skills needed in the educational process in the industrial era 4.0, including factors of metacognition ability and ability adaptation. This research is an expost facto study with a qualitative exploratory descriptive type. The data is secondary data derived from the 2018 PISA survey. Data analysis using multilevel linear models through the Jamovi 1.6.23 program. The multilevel model used consists of 3 models, namely (1) intercept model without predictor, (2) intercept model with predictor level 1 , (3) intercept model with predictor level1 & level 2. The results of the analysis show that model 2 is considered significant that the achievement of students' science scores is more influenced by student abilities, while the type of school does not have a contribution which is significant to the achievement of science scores.

Keywords: *Inequality, Science Achievement, Metacognition, Adaptivity*

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INTRODUCTION

The progress of the development of science and technology brings a transition to changes in students' thinking and behavior ability to learn actively, massively and adaptively. The ability to think at a high level is a need that needs to be developed by every student in the implementation of learning at school, including in learning science. The existence of humans as independent individuals always strives to gain knowledge with the ability to think in line with the theory of constructivism learning. The theory of constructivism learning emphasizes the learning process of each individual to be able to explore the ability to think and build learning experiences independently (Slavin, 1994). The theory of constructivism learning was born from the development of learning theory initiated by Jean Piaget (1896-1980) regarding the transformation of ideas in learning and its development, Lev Vygostsky (1896-1934) regarding the development of learning integrated with social abilities , John Dewey (1859-1952) who highlighted about the real-world learning resources learned in the classroom (Bhattacharjee, J, 2015). Through the pattern of constructivism learning theory, each individual is considered to be able to build his thinking ability which comes from real problems in life. This is the reason for several developed countries to make the achievement of scientific literacy skills as a competency standard for science education (Hanson, 2016). Students' mastery of science can have an impact on the progress of the nation from various aspects such as aspects of education, economy, culture and technology. The OECD (Organisation for Economic Co-operation and Development) which is a 78-member organisation working together for economic development purposes developed a PISA (Program for International Student Assessment) survey to measure the reading, mathematics and science skills of 15-year-olds in order to improve educational programmes organised by OECD member States to help increase impact levels economy negara. The results of the 2018 PISA survey showed that the science achievements of Indonesian students obtained an average score of 389 from the PISA average score of 489, so that Indonesia ranked 70th out of 78 countries that responded to the survey. This shows that the science achievement of Indonesian students is still at a low level (PISA, 2018).

In addition to the factors of reading grades, mathematics, and science, there are also non-cognitive faktor that affect the achievement of PISA assessments sourced from data from students, families, schools and teachers. Metacognitiveability and adaptability are some of the factors that were also measured in the PISA survey. In 2018 Indonesia was ranked 74 out of 78 PISA respondent countries, in general from mastering the ability to read, mathematics and science. Students' metacognitive abilities influence the improvement of science learning outcomes (Schraw, G., et al , 2006; Zhao, N., et al , 2014)). Adaptive abilities can help students in improving scientific literacy learning (Asrizal, A., et al , 2018). PISA explains that science literacy is the ability to use science knowledge, identify questions and draw conclusions based on evidence, in order to understand and make decisions regarding nature and its changes. Metacognitive skills and adaptability are included in the 10 abilities needed in the world of work in the 21st Century based on data from the World Economic Forum (2021). The ability of individual learning to adapt and grow from studying problems that occur in the surrounding environment and presenting solutions to the problems faced is the basis for the growth of thinking skills. Blearned independently from various science education literature to summarize and describe effective learning methods and the development of metacognitive comprehension (Thomas, 2014; Rickey & Stacy, 2000; White & Mitchell, 1994). Science learning is based on the theory of constructivism learning, where individuals are expected to grow their skills with their adaptability. Science learning trains and develops one's abilities that grow out of the complexity of thinking skills that combine critical, creative, collaborative and innovative

thinking skills. The ability to learn science as measured by adaptive assessment is able to improve higher-order thinking skills (Zulfiani, Z., Suwarna, I. P., & Sumantri, M. F. , 2020). Assessments to measure adaptive ability can add to a student's learning experience (Carney, P. A., Mejicano, G. C., Bumsted, T., & Quirk, M. , 2018).

Metacognition skills and adaptation skills that are part of efforts to achieve skill improvement in the 21st century owned by students at the school level are obtained hierarchically in PISA data. This research is a study aimed at determining the influence of metacognition skills and adaptation skills on science literacy achievements at the student level and school level. The metacognition skill indicators used consist of the ability to understand and the ability to conclude. Indicators of adaptation skills consist of adaptive abilities to instructions as well as attitudes in thinking globally.

METHODS

This research is an expost facto study with a qualitative exploratory descriptive type. This type of research was chosen because the data used is secondary data from the 2018 PISA survey conducted by the OECD. The number of respondents in the survey was 10708 students from 399 schools. The data is taken by the hierarchical cluster sampling method so that student-level data is obtained at the school level. Data analysis using multilevel linear models through the Jamovi 1.6.23 program. Variable analysis was developed based on aspects of metacognition and adaptive ability as well as science achievement scores (Table 1).

Table 1. Aspects and Variables of Analysis

Changer	Description of predictor variables
Response Variables	
RPVSCIE	Science Score
Variable PPredictor Level 1 (Student)	
UNDREM	Metacognition Understanding
METASUM	Metacognition Summing Up
ADAPTIVITY	Adaptive ability
P variable level 2predictor (School)	
SCHTYPE	Types of schools

Data analysis using multilevel linearmode 1 through the Jamovi 1.6.23 program by testing 4 models (Table 2).

Table 2. Multilevel Test Model

Model	Information
1	Intercepts without predictors
2	Intercept with level 1 predictor
3	Intercepts with level 1 and 2 predictors

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RESULTS AND DISCUSSION

Science achievement score data were obtained from the average *plausible value* (RPVSCIE) consisting of PVSCIE 1 to PVSCIE 10. *Plausible values* are student ability scores derived from the analysis of themeter of grain response theory (Willms, J. D., & Smith, T. ; 2005) . The results of the descriptive analysis of PVRSCIE data based on Table 3 showed a minimum science score of 196 and a maximum science score of 685. The mean science score is 418 with a standard deviation of 69.6.

Table 3. Science Score Analysis

	Description of RPVSCIE
N	10708
Mean	418
Median	413
Stdev	69.6
Min	196
Max	685

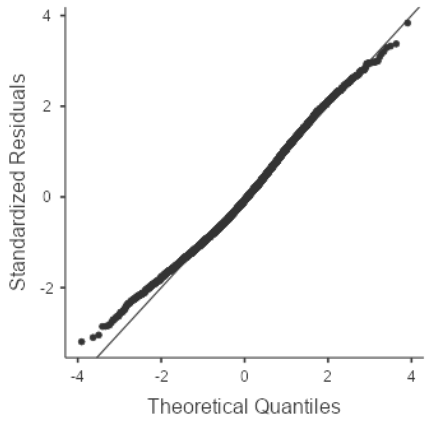

Figure 1. Science Score Plot Q-Q Diagram

Figure 1 shows the normally distributed science score data shown with the Q-Q diagram The plot looks attached to the line and slightly shows the residual data. Normal data is indicated by the attachment of data that is on the line. The multilevel model test results are shown in Table 4 which shows the overall test results of model 1, model 2 and model 3.

Table 4. Multilevel model analysis results

Levels & Variables	Model		
	1 (Intercept without predictor)	**2 (Intercept with level 1 predictor)**	**3 (Intercept with level 1 and 2 predictors)**
Level 1			
Intercept	408*	416.198*	416.201*
UNDREM		6.557*	6.561*
METASUM		9.411*	9.409*
ADAPTIVITY		-0.203*	-0.204*
Level 2			
SCHTYPE			0.568**
Component variants	2534	2151	2151
ICC	0.529	0.505	0.505
Pseudo R^2	0	0.0416	0.0416

Description: *p-value <0.01 is declared significant, **p-value >0.05 is declared less significant

Model 1 is a model with an intercept test without a predictor obtaining an intercept value of 408 with a significant p-value, variance obtained 2534 with ICC 0.529 and Pesudo R^2 0. Model 1 generally gives a score of 408 in the achievement of a student's science score. Model 2 is an intercept test with a predictor at level 1 consisting of 3 predictors with a significant p value test of intercept gain of 416,198 , metacognition ability to understand sebsar 6,557, inferred metacognition ability of 9,411 and adaptability contributes negatively with a value of -0.203. Model 3 is an intercept test with level 1 and level 2 predictors. The results of the multilevel analysis of model 3 provide significant contribution at level 1, while the contribution of level 2 is stated to be less significant with a p-value gain of 0.542, it shows that the type The school did not make a significant contribution to the achievement of science scores. The contribution of level 1 components in model 2 is stated to be more significant than in level 1 of model 3. The ability of inferred metacognition contributes the most compared to the ability of metcognition to understand. Students' metacognitive abilities influence the improvement of science learning outcomes (Schraw, G., et al , 2006; Zhao, N., et al , 2014)). Adaptive abilities can help students in improving scientific literacy learning (Asrizal, A., et al , 2018). PISA explains that science literacy is the ability to use science knowledge, identify questions and draw conclusions based on evidence, in order to understand and make decisions regarding nature and its changes.

The ability of individual learning to adapt and grow from studying problems that occur in the surrounding environment and presenting solutions to the problems faced is the basis for the growth of thinking skills. Blearned independently from various science education literature to summarize and describe effective learning methods and the development of metacognitive comprehension (Thomas, 2014; Rickey & Stacy, 2000; White & Mitchell, 1994). Metacognitive skills and adaptability are included in the 10 abilities needed in the world of work in the 21st Century based on data from the World Economic Forum (2021).

CONCLUSION

Based on the results and discussion, the factors of metacognition ability and adaptability have an influence on the achievement of students' science scores. The influence of

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metacognition ability contributes positively with dominant contribution derived from the ability of metacognition to conclude, while adaptability contributes significantly with contribution negative. The type of school type has no effect on the achievement of the science score. Based on the test of 3 multilevel models, model 2 is a model that provides the significance of obtaining the maximum science score value with an intercept acquisition contribution of 416,198, metacognition ability to understand 6,557, ability Metacognition concluded 9,411 and adaptability contributed negatively with a value of -0.203.

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