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The Capability Analysis of High Order Thinking Skills (HOTS) on Dynamic Electricity Material in Junior High School

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Abstract

The study aims to determine student's High Order Thinking Skills (HOTS) and to find out the causes of student's HOTS on dynamic electricity material. The number of samples involved 59 students consisting of 30 students from the excellence class and 29 students from the regular class. The research instrument used consisted of 8 Multiple Choice Questions (MCQs). Questions have been validated, and reliability has been tested in the medium category (Alpha Cronbachs: 0.44). The data analyzed using descriptive analysis. The average student's HOTS is 59.98% indicating the medium category. The results of the student's HOTS on the analysis provided by students from excellence classes are 71.25% indicating high category and regular class 48.71% indicating medium category. The results of the analysis show that student's HOTS is on medium category because students having difficulty in making connection one concept to another concept and using mathematics as a tool in solving physics problems. The results as a reference for improving student's HOTS. This research can be developed by increasing the sample and expanding the material being tested.

Keywords: high order thinking skills (HOTS), junior high school student, dynamic electricity

INTRODUCTION

The ability to think is one of the skills needed to face the 21st century. High order thinking skills (HOTS) are the requirements for the industrial world today (Sukla 2016). Abosalem (2016) said that the development of high order thinking skills to students considered to be the primary purpose of education stakeholders. Agustini & Fajriyah (2018), students should be able to evaluate all information received in an integrative manner. According to Saido et al. (2018), HOTS needed when students face a problem that had never existed before and needed a solution to solve it. The previous explanation shows the importance of an integrated HOTS of a person in solving a problem.

Reality shows that student's HOTS is still low. Sukla (2016), in his research, has measured how to analyze the error, the level of solving issues and the decision-making level of the graduates are still low. Thompson (2011) also examined the field of mathematics he studied from 1998 to 2007, stated that the United States still can not prepare students for higher-order thinking skills (HOTS) in solving complex problems. The results of the research that described earlier showed that in international scale, HOTS is still the focus of research.

In general, Indonesian students have problems related to high-level thinking skills. High order thinking skills of Indonesian students are still only in the school environment. Rochman & Hartoyo

(2018) research stated that the majority of Indonesian student's thinking activity occurs only in learning that takes place in school. Agustini and Fajriyah (2018) research found that high-level thinking skills of elementary school students are at levels less than the average value of 40. Another study conducted by Kurniati D et al. (2016) also found that junior high school student's high-level thinking skills to solve problems in PISA standards of 30 students obtained 18 students in the medium category and 12 students in the low category. Observation and experience of the author in teaching for five years, also found that students had difficulties when it came to matters of analysis that requires students to think critically. It shows that high levels of thinking of Indonesian students still need more attention. The previous research, concern enhance the HOTS using vary learning media. Enhancement can through the video-enrich worksheet (Bakri, Pratiwi, & Muliyati 2019), integrated augmented reality app (Bakri, Dadan, & Muliyati 2019), worksheet equipped with augmented reality app (Bakri, Ervina, & Muliyati 2019), and specific development worksheet (Fitriani, Bakri, & Sunaryo). Other research enhance the HOTS using implement the learning strategy (Nurhayati & Angraeni 2017) or based on test data (Siswoyo & Sunaryo 2017).

Based on the problems outlined, the research is still needed to focus on student's HOTS. The presence of this study help to determine how the condition student's HOTS and the difficulties experienced by students. This study answered problems that have been elaborated before; this study aimed to analyze the student's HOTS and find out the cause of student's HOTS on the dynamic electricity material.

METHODS

This research via surveys analyzed using descriptive analysis to describe the percentage of student's HOTS level. The research was conducted at the level of Junior High School. The junior high school is one of the private junior high school in Malang, with the background of middle to high economic ability. The samples taken were students of class IX, comprising 1 excellence class of 30 students and one regular class with the number of 29 students.

The instruments used in the research consisting of 8 MCQs which previously been validated and has been tested with moderate reliability (Cronbach's Alpha: 0.44). According to the previous research, Hudson (1981) found that multiple-choice can represent student's answers using essays. TABLE 1 is the distribution of HOTS questions based on cognitive level:

TABLE 1. The distribution of HOTS questions based on the cognitive level.

No	Cognitive Levels	Sub Discussion	Numbers Matter
1	C4 (Analyze)	Barriers type wire	1
		Current-voltage in series and parallel circuits	2, 3
		Electrical power	4
2	C5 (Evaluate)	Ohm's law	5
		Barriers replacement series and parallel	6, 7
		Current-voltage in series and parallel circuits	8

The data obtained and analyzed using descriptive statistics. According to Creswell (2012), Descriptive Statistics are used to indicate the general trend and the spread value. The results of the analysis will discuss the HOTS percentage of students overall and present a bar chart HOTS percentage of students in excellence classes and regular classes. The next three numbers have the lowest percentage analyzed according to HOTS cognitive level. To find out how HOTS level students, we use a range of scoring adopted from Ahmad et al. (2017) research.

TABLE 2. HOTS Score Criteria

No	HOTS Value – x (%)	Category
1	$x \geq 76$	Very high
2	$61 \leq x < 76$	High
3	$46 \leq x < 61$	moderate
4	$31 \leq x < 46$	Low
5	$x < 31$	Very low

RESULTS AND DISCUSSION

The survey results first obtained the 59.98% HOT student who shows the category of "moderate" (TABLE 2). The second level of analysis results obtained HOT on the excellence class of 71.25% category of "high" and the regular classes of 48, 71% are "moderate." The third Percentage of correct answers on each item on the excellence class and regular class obtained the results follow TABLE 3.

TABLE 3. Percentage of correct answer between excellence class and regular class.

No	Cognitive Levels	sub discussion	Number's matter	Percentage correct answer (%)	
				Excellence (E)	Regular (R)
1	C4 (Analyze)	Barriers type wire	1	60.00	34.48
		Current-voltage in series	2	66.67	79.31
		and parallel circuits	3	100.00	79.31
		Electrical power	4	86.67	79.31
2	C5 (Evaluate)	Ohm's law	5	83.33	44.83
		Barriers replacement	6	86.67	48.28
		series and parallel	7	76.67	6.90
		Current- voltage in series	8	10.00	17.24
		and parallel circuits			

Fourth, analysis to determine the cognitive level of each class that is excellence class and regular class. Table 4 shows the percentage of C4 cognitive level (analyzing) and C5 (evaluate) in the excellence class and regular class.

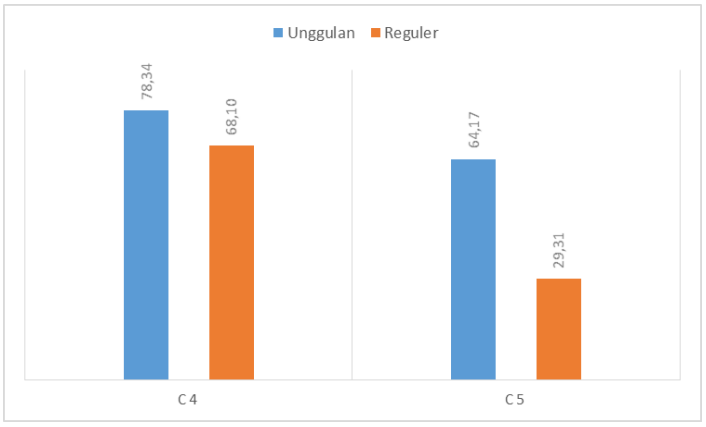


FIGURE 1. Percentage of HOTS based on the level of cognitive C4 and C5.

From the results that have been presented, then the researchers discuss in detail for each item. Researchers found three problems that have a low percentage; there is one matter at a cognitive level 2, C4 and C5 matter at a cognitive level. Students have a low percentage in sequence from question number 1, 7, and 8. Student's responses on the cognitive level C4 (question number 1), shown in FIGURE 2.

In Question 1, Excellence class students are able to analyze barriers to flow types are best, while the regular class students' response is still low. 44.83% of students still choose the number of answer options D. Based on interviews with the teacher; there was information that the student still cannot analyze the relationship between the barrier type wire with current flowing. The following are the data of student responses on the cognitive level C5 (question number 7 and 8), shown in FIGURE 3 and 4.

In question number 7, excellence class students have been able to compare the value of a replacement barrier in series and parallel circuits, while the regular class student's response is still low. 44.48% of students still choose the number of answer options D. Based on interviews with students who answered D, obtained information that the student still was able to compare the value of a replacement barrier in series and parallel circuits, but students still cannot combine with numbers.

Seorang teknisi PLN akan membuat jaringan listrik pada pabrik yang baru dibangun. Teknisi tersebut mencermati tabel hambatan jenis empat kawat sebagai berikut.

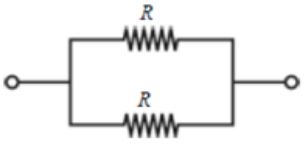
Jenis Bahan	Hambatan Jenis (Ω.m)
Perak	$5{,}9 \times 10^{-8}$
Tembaga	$1{,}68 \times 10^{-8}$
Alumunium	$2{,}65 \times 10^{-8}$
Baja	$4{,}0 \times 10^{-7}$

Teknisi akan memilih jenis kawat yang paling baik untuk menghantarkan arus listrik. Manakah jenis bahan yang akan dipilih ....

A. Perak (U= 10,00%; R= 13,79%)
B. Tembaga * (U= 60%; R= 34,48%)
C. Alumunium (U= 6,90%; R = 6,90%)
D. Baja (U= 30,00%; R= 44,83%)

FIGURE 2. The percentage of student responses to each answer choice number 1.

Seorang teknisi komputer merangkai 2 buah hambatan untuk membuat jaringan di laboratorium komputer. Perbandingan antara hambatan pengganti dari rangkaian I yang tersusun secara paralel dan rangkaian II yang tersusun seri adalah ....

I. 

II. 

A. 4 : 1 (U= 3,33%; R= 27,59%)
B. 1 : 4 * (U= 76,67%; R= 6,90%)
C. 2 : 1 (U= 6,67%; R= 20,69%)
D. 1 : 2 (U=13,33%; R= 44,48%)

FIGURE 3. The percentage of student responses to each answer choice number 7.

In question number 8 both excellence class students and regular class students are not be able to compare the lights based on the voltage and resistance are known. Most students' responses to choose an answer A. based on the class discussion conducted by teachers and students, there was information that the student answered incorrectly because of the high-level thinking skills to evaluate and connect between the concepts of physics with mathematics is low. In this matter the student should evaluate the electrical current, voltage, and power connection to the lights; as a result, the problems experienced by students are very complicated.

The findings of our study indicate that student's HOTS overall with 59.98% percentage still in the moderate category. The results showed the student's HOTS relatively higher compared to studies conducted by Rochman & Hartayo (2018), Agustini & Fajriyah (2018), Kurniati et al. (2016) show that student's HOTS is still low.

The percentage of the excellence class students 71.25% indicating as high and 48.71% of the regular class is the medium category. The results of interview teachers and students stating that the students have been able to achieve the level of cognitive analyzes (FIGURE 1) while the ability to evaluate the cognitive level in regular classes is still low because the students still can not use mathematics in solving physics.That aspects can affect the student's HOTS is the lack of student ability in mathematics. This difficulty was also found by Kereh CT et al. (2014) and Wenno (2015) that there is an influence

between basic math skills with physics. Research Quale (2011) states that the mathematics required in formulating the laws of physics and problem-solving.

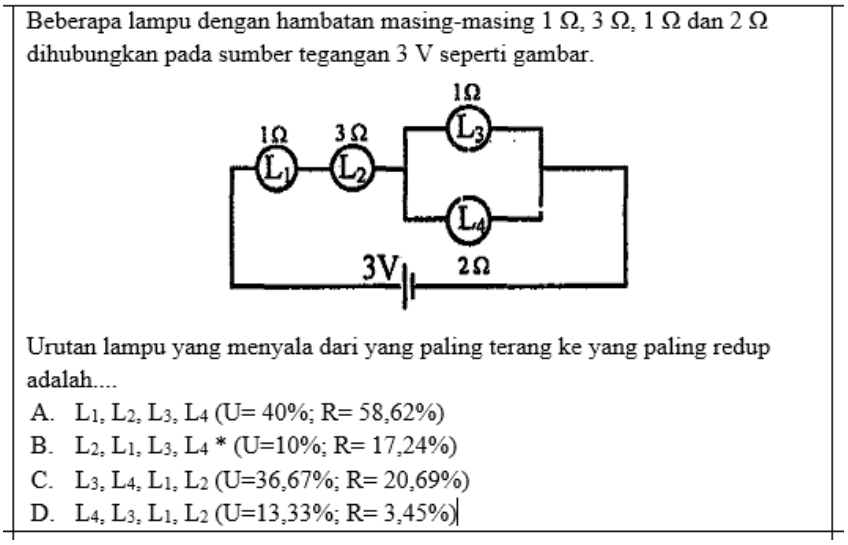


FIGURE 4. The percentage of student responses to each answer choice number 8.

The weakness of this study, the instrument consists of multiple-choice questions only. It is suggested for further researcher composed of multiple-choice questions along with the reasons in addition to the limited number of samples taken in one school with excellent class and regular class. Therefore, further research is suggested to conduct more samples that can be done at the middle and high school students from several schools.

HOTS can be improved through collaborative learning together with peers and Inquiry-Based Learning (IBL), according to research Lopes et al. (2018) and Hendryarto (2013). According to research Vijayaratnam (2009) Learning cooperative strategy can also improve student HOT.

SUMMARY

This study concludes that student's HOTS overall with 59.98% percentage still in the moderate category. Results of the analysis showed that student's HOTS was because the students are having difficulties in linking one concept to another and use mathematics as a tool in solving the problems of physics. Teachers can use these results as a reference for improving student's HOTS. This research can be developed by extending and expanding the material sample tested.

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