**Examining secondary school student’s lower order thinking skill**

**M E O Barut1, A Wijaya2**

1Graduate Program of Mathematics Education, Yogyakarta State University, 1 Colombo Street, Yogyakarta, Indonesia

2Mathematics Education Department, Yogyakarta State University, 1 Colombo Street, Yogyakarta, Indonesia

1mariaevarista.2018@student.uny.ac.id

2a.wijaya@uny.ac.id

**Abstract** Focusing in Higher Order Thinking Skill (HOTS) has been main goal in many education curriculum around the world including in Indonesia. Even though the ultimate goal is usually for students to achieve HOTS, it is also important to make sure student already mastered Lower Thinking Skill (LOTS) since it is a prerequisite in the process of using higher-order thinking. Therefore the goal of the study is to examine student’s achievement on LOTS. The paper pencil test with multiple choice format was developed and administrated to 352 students from five different secondary school in Manggarai Timur Regency. The test includes remembering, understanding and applying type of question. The data was analyzed using descriptive (mean, maximum and minumum score, and standar deviation) and inferensial statistic (Wilcoxon Signed Rank Test). Analysis of the data shows most of student’s were categorized as poor level of LOTS. Sudent’a achievement on both of LOTS Level (Remembering-Understansing and Applying) also low. Based on the statistics test, it shows that most of students has higher achievement on remember-understanding level than applying level.

**1. Introduction**

The development of knowledge, science and technology in the 21st century has cerated various new kind of needs and challenges in life. In order to deal with this changes, education field especially school must be equipped the students with various competencies to face the problems that might appear. One of the competency is thinking skill. Cotton [1] defined thinking skill as *“The set of basic and advanced skills and subskills that govern a person's mental processes”.* Thinking skill which includes critical thinking is usually employed to process data and information in the humas mind in order to understand and make conclusion on truth and falsehood.

One of the theory that has been widely used in educational field to explain about thinking skills is Bloom Taxonomy. In this taxonomy human cognitive domains classified into six hierarchical levels namely: remembering, understanding, applying, analysis, synthesis, and evaluation. The first three level usually called as Lower Order Thinking Skill (LOTS), meanwhile the last three called as Higher Order Thinking Skill (HOTS). LOTS were used in imparting the basic or factual knowledge, while HOTS requires students to interpret, analyze, or manipulate information [2][3]

Lately, HOTS become the central focus in education curicullum in many countries [4][5]. It has been promoted and integrated in classroom learning include mathematics. HOTS is consider important in the training of logical and critical thinking that are fundamental to everyday life. High level thinking skills students will produce: proficiency in problem-solving, increase confidence in learning mathematics, and increase learning achievements in non-routine problem that demands high level thinking skills. In short, it makes students more prepared for challenges and more creative in solving problems.

However the shifting towards the development of HOTS cause neglection towards LOTS [6]. Hence, experts tend to assume that HOTS is superior to LOTS by implementation and relevance [7][8]. On the other side, many study have shown that LOTS is important in providing a foundational platform for the application of HOTS [8]. Bloom and other experts [9][10][11][12][7][13] agreed that the taxonomy was designed as a step process: to perform a higher level, one must first master cognitive processes at a lower level. So that, it is believed a person cannot apply value or judgment (evaluation thinking level) without knowing the facts, understanding the facts, being capable of applying the facts, and being able to disassemble and reassemble the facts [14][5]. Study of Furthermore, LOTS is considered to be core and very important as it helps the students develop their line of thoughts, acquire knowledge on different topics and apply the knowledge effectively.

Based on the description above, it can be said that it is also important to evaluate student’s LOTS achievement in order to determine the extent of students’ LOTS in the learning process. Accordingly, the aim of the study are to examine the level of achievement for low order thinking skill as well as whether there is any difference between levels of student’s Lower Order Thinking Skill (LOTS) achievement.

**2. Method**

This study is descriptive quantitative which aims to determine student’s level achievement of LOTS through solving LOTS type of question on mathematics as well as the difference student’s achievement between LOTS level. For the purpose of the study, the total of 352 students of grade 7th and 8th from secondary school in Manggarai Timur Regency were asked to participated. The students were choosen from 5 different secondary school which consist of two high level school, one moderate level school, and two low level school. The data was collected using paper-pencil test. Multiple choices questions were designed which includes remembering, understanding, and applying type of questions.

**Table 1. Category for LOTS Achievement**

|  |  |
| --- | --- |
| Categories/Level | Interval |
| Very Well | $$85 < Score \leq 100$$ |
| Good | $$70 < Score \leq 85$$ |
| Adequate | $$55 < Score \leq 70$$ |
| Poor | $$0 \leq Score \leq 55$$ |

The data was analyzed by calculating the total scor of each student. Based on the total score, minimun and maximum score, mean, and standar deviation were calculated. Moreover, the score of each student is qualitatively classified using category on the Table 1 above in order to get better insight on student’s LOTS achievement’s Level. Meanwhile examining the difference between the LOTS Lever were done using statistical hypotesis test engan berbantuan SPSS. The wilcoxon signed rank test was used to test the hypotesis since the data was not normally distributed. To meet the second research objective, the null hypotheses and alternative of the study are:

H0 : There is no significance difference between student’s achievement in remember-understanding level and understanding level

H1 : There is significance difference between student’s achievement in remember-understanding level and understanding level

**3. Result**

First step of analysis was done by calculating student’s score for each LOTS level (Remembering-Understanding and Applying). Based on those score, the descriptive statistics was calculated for each level on each grade. The result was shown on Table 2 below.

**Table 2. Summary of Descriptive Statistic for Each LOTS’s Level**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Level of LOTS | Minimum Score | Maximum Score | Mean | Standar deviation |
| Grade7th | Remembering-Understanding | 0 | 100 | 30,53 | 19,08 |
| Applying | 0 | 55,56 | 10,77 | 13,57 |
| Grade 8th | Remembering-Understanding | 0 | 66,67 | 25,75 | 14,93 |
| Applying | 0 | 71,43 | 30,09 | 19,81 |

After that, the total score of all levels were accumulated. The descriptive analysis for student’s total score on each grade 7th and grade 8th was displaed on Table 3 below.

**Table 3. Summary of Descriptive Statistic for Overall Students**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Minimum Score | Maximum Score | Mean | Standar deviation |
| Grade 7th | 0 | 80 | 26,00 | 13,25 |
| Grade 8th | 0 | 56,25 | 27,65 | 13,30 |

Further, each student’s score were categorize based on classification on table 1. Sedangkan hasil analisa untuk masing-masing level LOTS dijabarkan sebagai berikut

**Table 4. Amount of Student on Each Category of LOTS Level**

|  |  |  |  |
| --- | --- | --- | --- |
| Interval | Categories | Grade 7th | Grade 8th |
| 85 < Score ≤ 100 | Very Good | 0 | 0 |
| 70 < Score ≤ 85 | Good | 1 | 0 |
| 55 < Score ≤ 70 | Adequate | 4 | 5 |
| 0 ≤ Score ≤ 55 | Poor | 196 | 146 |
| Total | 201 | 151 |

 Then, testing the hypotesis was done by using SPSS software. Since the data was not normally distributed then the Wilcoxon Signed Ranktest was used. Below the SPSS’s output of the data analysis.

|  |  |
| --- | --- |
|  |  |
| **Figure 1. SPSS Output for Wilcoxon Signed Rank Test On Grade 7th Data** |

Based one figure 1 above, the significance value is 0,000 which is less than 0,05. So it can be concluded that H0 is rejectedor there is difference between level of LOTS achievement for students on grade 7th. Meanwhile, it is also found most of student’s score on applying level is higher than scores in remebering-understanding level.

|  |  |
| --- | --- |
|  |  |
| Figure 2. SPSS Output for Wilcoxon Signed Rank Test On Grade 7th Data |

Similar with findings on grade 7th, it also was found that there is difference between student’s mean score on applying level and remembering-understanding level (significance value = 0,024 < 0,05). Suprisingly, most of student’s (81 students) had higher score on applying level than score on remembering-understanding level. Otherwise, 61 other students had higher score on remembering-understanding than applying level.

**4. Discussion**

Remembering, understanding and applying are some levels of Bloom’s Taxonomy that classified as lower order thinking skill. Remembering requires students to recall basic information; Understanding requires explain idea and concepts; Applying requires apply information in new way. Together, this three level form basis of student’s cognitive process [15]. On this study, both grade 7th dan grade 8th achievement on respective level of LOTS is still low. This finding parallel with result of TIMSS 2015 that revealed Indonesian student’s skill were remain in the ‘knowing’ and ‘applying’ domain [16] [17].

While overall the average score achievement of grade 7th students were at 25.00 while for grade 8 it was at 27.65. This indicates that the average LOTS achievement in both classes is still in the poor category. This is also supported by the results of categorizing each student's score (see Table 4) where most of students are categorized on poor level of achievement. Total 342 out 352 students of both grades were categorized on poor achievement. Little amount of them were categorized on adequate and good level of achievement, while none of them were categorized on very well level of achievement.

Adittionaly, the statistics test on the data shows there is difference between student’s achievement on each level of LOTS. Furthermore, it is found that grade 7th student’s achievement on remembering-understanding level is higher than applying level. This finding is in line with the hierarchical assumption of Bloom’s taxonomy of knowledge processes. It means that the lower level process usually involve simple cognitive process than the higher lever, so it is easier for student to complete the problem on lower level.

In contrast with the finding on grade 7th, most of grade 8th students (81 students) got higher achievement on applying level than remembering-understading. Even though this result differ from hierarchical assumption of Bloom’s taxonomy, the similar result also found on study of Sari et al [18]. The study discovered the average level ability of students who can answer questions for the application level is higher than the average score of students who can answer questions for the understand level. This inconsistency later needs to elaborate more on the future studies. Meanwhile findings on others 61 students analogous with other claim before.

**6. Conclusion**

HOTS are the skills that need to be mastered by the students in the 21st century in order to cope with the ongoing technological changes and advancements. But it’s also important to make sure student already mastered lower order thinking skill (LOTS) since it is one of the prerequiste to higher order thinking skill (HOTS). Findings on this study showed that most of the student for both grade 7th and grade 8th has low LOTS’s achievement. It is also shown on their achivement on respective level of LOTS which is also low.

Furthermore, it also can be concluded that there is difference between student achievement in remembering-understanding level and understanding level. Furthermore it is also found that most of student achievement on remember-understanding level are higher than applying achievement. Other than that, there is inconsistency on finding about grade 8th student’s achievement where the average of applying level score is higher than the average score on remember-understanding level. This could be caused by nature characteristic of multiple choice type of questions. In this type of question it is posible for student to randomly choose the answer without meaningful and careful consideration. Thus, there should be further study that can elaborate more on student’s answer with the utilities of another type of question for example open-ended questions.

**References**

[1] Cotton K 1991 N*orthwest Regional Educational Laboratory's School Improvement Research Series.* no. November

[2] Saido G M Siraj S Bakar A Nordin B. and Saadallah O 2015 *The Malaysian Online Journal of Educational Science* **3** pp. 13–20

[3] E. Apino and H. Retnawati, 2017 *J. Phys. Conf. Ser.* **812** 012100

[4] Seman W M W 2018 *Malaysia. Int. J. Acad. Res. Progress. Educ. Dev.* **7**, pp. 45–63

[5] Chen M H 2016 *Theory Pract. Lang. Stud.* **6**, pp. 217-226

[6] Tikhonova E 2015 *2nd Int. Multidiscip. Sci. Conf. Soc. Sci. Arts SGEM2015* **2**

[7] Jones B F and Idol L 2013 *Dimensions of Thinking and Cognitive Instruction*. Routledge,.

[8] Kamarulzaman M S Sailin S N Mahmor N A and Shaari A J 2017*Asian J. Educ. Res* **5** pp. 71–74

[9] Assaly I R and Smadi O M 2015 *English Lang. Teach.*. **8** pp. 100–110

[10] El-Khalili N H 2015 *Int. J. Emerg. Technol. Learn.* **10**, pp. 56–63

[11] Chiu T K F and Mok I A C 2017 *Comput. Educ.*. **107**, pp. 147–164.

[12] Razak F Sutrisno A B Immawan Z and Muchsin S B 2018 *J. Phys. Conf. Ser*. **1028**

[13] Agarwal P K 2019. *J. Educ. Psychol.* **111** pp. 189–209

[14] Bloom B S Engelhart M D Furst E J Hill W H and Krathwohl D R 1956 *Taxon. Educ. Object.* p. 207

[15] B. Pramesti S Sajidan and S. Dwiastuti 2018 *Advances in Social Science, Education and Humanities Researc*h **262** pp. 315–318

[16] Mullis I V S Martin M O Foy P and Hooper M 2015 TIMSS 2015 International Results in Mathematics

[17] Hadi S Retnawati H Munadi S Apino E and Wulandari N F 2018 *Probl. Educ. 21st CENTURY*, **76**

[18] Sari Y P Amilda A and Syutaridho S 2017 *J. Pendidik. Mat. RAFA* **3** pp. 146–164