Students' higher-order thinking skills through problem-based learning in Bandung

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ABSTRACT. *Higher Order Thinking Skills (HOTS) is a skill that must be possessed by students today. From the results of observations, it shows that students of SMAN 15 Bandung do not fully have HOTS in Economics, especially for Class X MIPA who choose Economics as a Cross-interest subject. One of the learning methods that can practice HOTS ability is the Problem Based Learning (PBL) method. The purpose of this study is to analyze whether the PBL method can improve students' HOTS ability compared to using the conventional method in this case the discussion method. The method used in this research is Quasi Experimental with Non Equivalent Control Group Design. The purposive sampling technique was used in the selection of samples, namely Class X MIPA 4 as an experimental class totaling 34 people and Class X MIPA 5 as a control class totaling 36 people. The results of the post test analysis showed that the HOTS value data of students was normally distributed and homogeneous so that the one way ANNOVA statistical test was used. Hypothesis test results showed that the learning method variable obtained F value = 11.101 and p = 0.002 <0.05 means that for the first hypothesis test was accepted, that there were differences in students' critical thinking skills using the problem based learning method with the discussion method. Based on N-Gain high level thinking skills, it can be concluded that there are differences in high level thinking skills of students before and after using the Problem Based Learning method in the experimental class with an increase categorized as high. It can be concluded that the PBL learning method influences students' HOTS*

Keywords *: higher-order thinking skills, problem-based learning*

1. INTRODUCTION

Recently, the ability to think at a high level (HOTS) has become a popular topic of discussion in the world of education and learning in Indonesia (Handayani, 2018). Referring to Bloom's taxonomy, HOTS is explained as a slice of the three top abilities in the cognitive dimension (analyzing, evaluating, creating), and three levels in the dimension of knowledge (conceptual, procedural, metacognitive) (Anderson & Krathwohl, 2001, Thompson, 2008). Therefore, HOTS is measured using assignments, including analyzing, evaluating, and creating conceptual and procedural knowledge, or metacognitive. This means familiarizing students with important HOTS activities assist students in solving the latest problems, adjusting students to a new atmosphere, and making decisions about a problem (Retnawati, Djidu, Kartianom, Apino, & Anazifa, 2018) With HOTS's demands, at 2018 the UN government of Indonesia has begun to submit questions that are HOTS concept. The application of the Higher Order Thinking Skills (HOTS) model questions on several high school / MA subjects that were felt to be too difficult, received a lot of responses from the examinees and became viral on social media. The policy of applying HOTS model questions is intended so that students have the ability to think at a high level and involve reasoning processes, so that they can hone critical thinking skills, logical, reflective, metacognitive, and creative. This application has become the policy of the Ministry of Education and Culture to apply questions that encourage students to make reasoning, not just understanding and application. (bsnp-indonesia.org, 2018). Questions with the HOTS type train students to think at the level of analysis, evaluation, and creation. In the 2018 National Examination, about 10% of HOTS types were given, namely 6 or 7 questions. But in reality there are many students who still find it difficult to solve HOTS questions, as stated in Antara

News on May 8, 2018 the Ministry of Education and Culture says as many as 40% of students have difficulty answering questions that require high reasoning power (HOTS) on the 2018 National Examination Whereas the Ministry of Education and Culture will plan to increase the portion of HOTS questions for the National and Middle School National Exams next year (Mahmudah, 2018). SMAN 15 Bandung is one of the schools that has implemented the 2013 curriculum and often conducts training on HOTS, but its implementation in the classroom is still limited. Economic subjects are not only taught in social science majors classes, but also become cross-interest subjects in natural science majors. Observation results indicate the ability of HOTS students majoring in Natural Sciences in economic subjects is still lacking, this could be due to teachers who have not fully used learning models that are in accordance with the 2013 curriculum, one of which is the Problem Based Learning model. Some of the results of research that have been done show that the PBL model influences students' HOTS ability. The purpose of this study is to measure whether there is a significant influence on the HOTS of students taught using the PBL model with those taught using conventional models.

2. LITERATURE REVIEW

Based on Bloom's taxonomy, higher-order thinking skills are thinking activities that involve a high level of cognitive hierarchy. In the taxonomic hierarchy Bloom consists of six levels, namely knowledge (knowledge), understanding (comprehension), application (application), analysis (analysis), synthesis (synthesis), and evaluation (evaluation). Anderson and Krathwohl (2001) argue that the thought process is dynamic, so it must be stated using verbs and need to revise the taxonomy. Another suggestion is to change the dimensions of the thought process to remember, understand, apply, analyze, evaluate and create. For the dimension of knowledge they introduce factual, conceptual, procedural, and metacognitive for each level of thought process. The dimensions of the thought process in Bloom's Taxonomy that have been refined by Anderwon & Krathwohl (2001) consist of the ability to: know (knowing-C1), understand (understanding-C2), apply (apply-C3), analyze (analyze-C4), evaluate (evaluating-C5), and creating (C).
In its development, remembering, understanding, applying are categorized in recalling and processing, while analyzing and evaluating are categorized in critical thinking and the latter creating is categorized in creative thinking. Thomas, Thorne & Small (in Aprianti, 2013) conclude that higher level thinking is a combination of critical thinking, creative thinking, and basic knowledge thinking. Limbach & Wendy (2009), identified the five steps of the process of developing higher-order thinking skills that can be implemented in almost all learning environments of active students. The five steps are: (1) determining the formulation of learning that accelerates students to a higher level, (2) asking questions. The level of student thinking is directly proportional to the level of questions asked, (3) practice before assessment. Selecting learning activities that allow students to practice will encourage them to think critically, (4) review, refine, and improve learning, and (5) provide feedback and assessment of learning.

Indicators to measure the ability to think at a high level according to Krathwohl (2002) include analysis, evaluating, and creating. Analysis includes: (1) Analysis of incoming information and then structuring information into smaller sections to identify patterns and relationships; (2) Recognize and distinguish the causes and effects of a scenario; and (3) Identifying / formulating questions. Evaluating includes; (1) Provide an assessment of solutions, ideas, and methodologies using suitable criteria or existing standards to ensure the value of their effectiveness; (2) Making a hypothesis, criticizing and testing, and (3) Accepting or rejecting a statement based on established criteria. While creating includes; (1) Generalizing an idea or way of looking at something, (2) Designing a way to solve a problem; and (3) Organizing elements or parts into new structures like never before.

The steps to compile HOTS questions include: (1) analyzing Basic Competencies (KD) that can be made about HOTS questions, (2) compiling problem grids, (3) selecting interesting and contextual stimuli, (4) writing question items on the question card in accordance with the question lattice, the question items are written to match the writing rules of the item, and (5) make a scoring guideline or answer key. (Ministry of Education and Culture, 2017).
One learning model that can develop students' thinking skills or HOTS is Problem Based Learning (PBL) (Royantoro, 2018). PBL models can train students' thinking skills in solving real problems faced

(Barber, King, & and Buchanan, 2015). Students' thinking ability in solving science problems is very necessary to train their HOTS (Saido, Siraj, Nordin, & Al-Amedy, 2015). PBL models involve students in solving real problems according to the steps of the scientific method so that students' HOTS can be developed (Kamdi, 2017). Students need to be trained on their HOTS abilities so they can be creative and innovative in solving various problems they face (Ramos, Dolipas, & Villamor, 2013). The PBL model emphasizes the problem solving process. Through problem solving in PBL, students are directed to build new knowledge, solve problems in various contexts (Simamora, Sidabutar, & Surya, 2017). The use of the PBL model was chosen because there were several studies that obtained good results. PBL is able to improve students' thinking abilities in finding and finding their own solutions to problems (Zabit, 2010).

PBL model has advantages, namely 1) the problem solving activities of students can arouse the ability to think critically, 2) increase the activity of students in the learning process and 3) students have the opportunity to apply their knowledge to the real world (Wasonowati et al., 2014) . Learning with PBL models begins with a problem that uses instructors as metacognitive training and ends with the presentation and analysis of students' work (Suliyati, Mujasam, Yusuf, Widyaningsih, 2018). Students are accustomed to solving problems, then they will practice their thinking skills.

3. RESEARCH METHODS

The method used in this study is quasi-experimental (Quasi Experimental) with pretest-posttest design using Non Equivalent Control Group. This research was conducted by applying learning using PBL in the experimental group and the discussion method in the control group. Learning activities carried out five times a meeting in each class that begins with the provision of pretest at the beginning of the first meeting and posttest at the end of the fifth meeting.

This research was conducted in Januari - februari 2020 at SMA Negeri 8 Bandung. The population in this study were students of class X IPA 4 and X IPA 5 which consisted of 70 students. The sample in this study were two classes consisting of class X IPA 4 (experimental group) and class X IPA 5 (control group), each of which amounted to 34 and 36 students. Sampling in this study was conducted using purposive sampling technique (Sugiyono, 2012: 68)

4. RESULTS AND DISCUSSION

The results of the data analysis of this study consisted of an analysis of normality and homogeneity using the SPSS version 23 computer software application with the steps for normality and homogeneity test data:

Normality Test Results

The results of the posttest data normality test of the high-level thinking skills of the experimental and control class students can be seen in the table below:

Table 1.1
Test Results for Normality in Higher Level Thinking Skills of Students Experimentation Class and Control Class

One-Sample Kolmogorov-Smirnov Test

		EKSPERIMEN	KONTROL
N		34	36
Normal Parameters[a,b]	Mean	81.3235	72.9167
	Std. Deviation	6.88750	9.51503
Most Extreme Differences	Absolute	.203	.226
	Positive	.150	.117
	Negative	-.203	-.226
Test Statistic		.203	.226
Asymp. Sig. (2-tailed)		.822	.283

a. Test distribution is Normal.

b. Calculated from data.

Source: SPSS Data Processing One Sample Kolmogorov Smirnov Test

Table 1.1 above shows the probability value of the normality test of the experimental class and the control class must be above 0.05 or> 0.05. Based on the test results of the experimental and control class posttest data, the results show that both classes have higher calculated values than the table values, ie 0.05, meaning that both classes in this study came from populations that were normally distributed.

Homogeneity Test Results

Homogeneity test results of the posttest data of the experimental and control classes on students' higher order thinking skills can be seen in the table below:

Table 1.2
Homogeneity Test Results of Experiment and Control Classes
Test of Homogeneity of Variances

KETERAMPILAN BERPIKIR TINGKAT TINGGI

Levene Statistic	df1	df2	Sig.
1.194	1	68	.290

Source: Levene SPSS Homogeneity Test Results

Table 1.2 above shows the probability value of the homogeneity of the experimental and control classes must be above 0.05. Overall research obtained from the results of the posttest homogeneity test in the experimental and control classes was above 0.05 which is equal to 0.290 meaning that the data on thinking skills at the high level of the experimental class and the control class had homogeneous variance between groups.

N Gain Results

After knowing the results of the normality test and homogeneity test, then the measurement of the effect of the use of the Problem Based Learning method is used in the experimental class. Based on the results of the calculation of the pretest and post test scores, it is obtained the average gain of understanding the concept of the experimental class tabulated in table 1.3

Table 1.3
N-Gain High Level Thinking Skills Classroom Experiments Problem Based Learning Methods

Data	Rata-rata Skor	Peningkatan	N-Gain	Indeks N-Gain	Interpretasi
Pretest	30.441	50.882	0.726	G > 0,70	Tinggi
Post test	81.323			G 0,30 < g < 0,70	Sedang
				G ≤ 0,30	Rendah

Data Source: Attachment

From Table 1.3 provides information that an increase in high-level thinking skills of students before and after using the Problem Based Learning method in the experimental class amounted to 0.726. When compared with the gain index g <0.70, the increase in concept understanding is categorized high. Based on N-Gain experimental high-level thinking skills, it can be concluded that there are differences in high-level thinking skills of students before and after using the Problem Based Learning method in the experimental class with high categorized improvement.

HYPOTHESIS TEST RESULTS

Hypothesis test results of learning method variables obtained F value = 11.101 and p = 0.002 <0.05 means that for the first hypothesis test is accepted, that there are differences in students' critical thinking skills using problem based learning and discussion methods.

CONCLUSION

This research proves the effect of problem based learning and discussion methods can improve higher order thinking skills on Cooperative material in the Indonesian Economy. Based on the results of the first hypothesis test that has been analyzed and the test obtained F = 11,101 and p = 0,002 <0.05 means that for the first hypothesis test is accepted, that there are differences in students' higher order thinking skills using the method of problem based learning with the method of discussion on subjects material economy of Cooperatives in the Indonesian Economy. From the increase in higher-order thinking skills, there was a higher increase in the experimental class compared to the control class that used the discussion method.

REFERENCES

Journal article, one author

Zabit, M. N. M. (2010). Problem-Based Learning OnStudents Critical Thinking.*A Literature Review.American Journal of Business Education (AJBE), 3*(6),19–32

Journal article, two authors

Ramirez, R. P. B., & Ganaden, M. S. (2008). Creative activities and students' higher order thinking skills. *Education Quarterly*, *66*(December), 22–33.

Arter, J. a., & Salmon, J. R. (1987). Assessing Higher Order Thinking Skills A Consumer's Guide. *Northwest Regional Educational Laboratory, Evaluation and Assessment*.

Widyaningsih, S., & Yusuf, I. (2018). Project Based Learning Model Based on Simple Teaching Tools and Critical Thinking Skills. *Kasuari: Physics Education Journal (KPEJ)*, *1*(1), 12–21.

Nurhayati, N., & L, A. (2017). Analisis Kemampuan Berpikir Tingkat Tinggi Mahasiswa (Higher Order Thinking) dalam Menyelesaikan Soal Konsep Optika melalui Model Problem Based Learning. *Jurnal Penelitian Dan Pengembangan Pendidikan Fisika*, *3*(2), 119–125

Mayasari,R.,&Adawiyah.(2015). Pengaruh Model Pembelajaran Berdasarkan Masalah pada Pembelajaran Biologi terhadap Hasil Belajar dan Keterampilan Berpikir Tingkat Tinggi di SMA. *Jurnal Penelitian Pendidikan Biologi Indonesia*, *1*(3), 255–262

Journal article, three or more authors, accessed online

Prasetyani, E. Y., Hartono, H., & Susanti, E. (2016). Kemampuan Berpikir Tingkat Tinggi Siswa Kelas XI dalam Pembelajaran Trigonometri Berbasis Masalah di SMA Negeri 18 Palembang. *Jurnal Gantang Pendidikan Matematika FKIP-UMRAH*, *1*(1), 31–40

Kustyorini, Y., Hasibuan, S., Fitriani, F.,Tarigan, R. (2016). Pengaruh Model Pembelajaran Berdasarkan Masalah terhadap Hasil Belajar Siswa pada Materi Pokok Suhu dan Kalor Kelas X Semester. *Jurnal Inpafi*, *4*(1), 154–16.

Books, in print

Anderson, L. W. & Krathwohl, D. R. 2001. A *Taxonomy for Learning, TEahing, and Assessing.* New York: Addison Wesley Longman Inc.

Sugiyono, S. (2016). *Metode Peneltitan Kuantitatif, Kualitatif, dan R&D.*Bandung: Alfabeta

Journal article from a subscription database (no DOI)

Pendidikan, P., & Jember, F. U. (2018). Employing Critical Reading Strategy To Promote Students' High Order Thinking Skills, *07*(2), 51–56. https://doi.org/10.25037/pancaran.v7i2.174

Retnawati, H., Djidu, H., Kartianom, K., Apino, E., & Anazifa, R. D. (2018). Teachers' knowledge about higher-order thinking skills and its learning strategy. *Problem of Education in the 21st Century*, *76*(2), 215–230.

Ennis, R. H. (1993). Critical thinking assessment. *Theory Into Practice*, *32*(3), 179–186. https://doi.org/10.1080/00405849309543594

Dumas, D., & Alexander, P. (2018). Assessing Differential Item Functioning on the Test of Relational Reasoning. *Frontiers in Education*, *3*(March), 1–11. https://doi.org/10.3389/feduc.2018.00014

Hidayat, W., Wahyudin, & Prabawanto, S. (2018). Improving students' creative mathematical reasoning ability students through adversity quotient and argument driven inquiry learning. *Journal of Physics: Conference Series*, *948*(1). https://doi.org/10.1088/1742-6596/948/1/012005

Lewis, A., & Smith, D. (1993). Defining Higher Order Thinking. *Theory Into Practice*, *32*(3), 131–137. https://doi.org/10.1080/00405849309543588

Kemendikbud, 2017. Modul *Penyusunan Higher Order Thinking Skill (HOTS*). Jakarta: Direktort Jenderal Pendidikan Dasar dan Menengah Departeman Pendidikan dan Kebudayaan.