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HOTS of VIII class students reviewed from creative thinking process of the Osborn model in PjBL

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Abstract

The aim of this study was to find out how the effectiveness of PjBL towards students' HOTS and to find out how the HOTS process of students in terms of the Osborn Model thinking process. This study uses mixed methods using a pre-experimental research design that is used is the one-shot case study using a sequential explanatory strategy. The population used in this study were all 8th-grade students at one junior high school in Semarang in the odd semester of the 2019/2020 school year. The research subjects were students of class 8A in a Junior High School in Semarang. Methods of data collection were carried out using tests, interviews, and observations. The results of the quantitative research showed that the ability of students in the HOTS aspect who received PjBL learning did not achieve actual passing grade. It can be concluded that the project-based learning model is not effective against students' HOTS. The results of the qualitative research indicate that there are descriptions of the HOTS process at various levels of analysis and evaluation. The diversity of HOTS process descriptions is shown in the fact-finding idea-making stage, some subjects who can achieve the evaluation level and get high scores to choose then write down information to solve the problem. In the idea-generating stage, subjects who have reached the evaluation level in HOTS tend to do one thing to find ideas, read repeatedly to find ideas and do not move to other problems if they don't find ideas. In the idea evaluation stage, the subject with the level of analysis does not check the complete results. the subject with the level of evaluation checks all the results of completion or some of the results of completion, some students pay attention to writing the results of the completion so that it is easy to understand.

1. Introduction

The 2013 curriculum was formed so that these abundant productive age human resources can be transformed into human resources who have competence and skills and can compete in the international world (Permendikbud, 2018). High-order thinking skills, being creative, having skills, understanding various cultures, and being communicative and having lifelong learning are things that humans need to learn to become high-quality human resources and skills and can work together to face global competition (Nuha, Waluya, & Junaedi, 2008). Mathematics lessons are very important for students because they can equip the ability to think logically, analytically, systematically, critically, and creatively as well as the ability to work together (Purnomo, Asikin, & Junaedi, 2015). In practice, mathematics learning in schools has not yet reached the target set by the Ministry of Education and Culture. This is shown in the results of the 2015 PISA showing that Indonesia's mathematical ability obtained an average score of 384 from the OECD average score worldwide of 490 (OECD, 2016). Then the TIMSS survey data shows that in mathematics, the Indonesian state gets a score of 26 out of an average international score of 50.

Based on the results of the PISA and TIMSS survey it can be concluded that the HOTS ability of students in Indonesia is still low. (Setiawan, Dafik, & Lestari, 2014), stated that the PISA questions were

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classified as HOTS and LOTS questions. TIMSS is about the cognitive domain of knowing, applying, and reasoning (Sari, 2015). In the domain of reasoning, it consists of analyzing, synthesizing, evaluating, making conclusions, making statements, and making arguments (Sari, 2015). Pohl stated that the ability to involve analysis, evaluation and creation is considered a higher-order thinking ability (Lewy et al., 2013).

In learning mathematics, creativity is needed in solving problems which are expected to bring up new creative ideas in analyzing and solving problems (Kemendikbud, 2013). According to Rajendra and Thompson in Ardiansyah, Junaedi, & Asikin (2018), creativity is very important in higher-order thinking skills because creating is the highest level in Bloom's Taxonomy and its development, creative thinking, critical thinking, problem-solving, and mathematical reasoning can develop higher-order thinking skills. So, creativity has an important role in the high order thinking skills of students and is very important for students in creating new ideas.

According to King et al., as quoted by Wibawa & Agustina (2019), HOTS is the ability to think which includes critical, logical, reflective, metacognitive, and creative thinking. Rofiah et al., added as quoted by Setiawan et al. (2014), high-order thinking skills have a role in the ability to connect, manipulate, and transform existing knowledge and experiences to think critically and creatively to make decisions and solve problems in a new situation. Krathwohl (2002) revised the taxonomy by classifying 6 cognitive processes: remembering, understanding, applying, analyzing, evaluating, creating. According to Anderson et al., in Arlianty et al. (2019), indicators for measuring HOTS include analyzing, evaluating and creating. Bloom classifies thinking skills into two categories, namely Low Order Thinking Skills (LOTS) which consists of remembering, understanding, and applying, then High Order Thinking Skills (HOTS) which consists of analyzing, evaluating and creating. In Bloom's taxonomy there is only a cognitive domain, but Anderson and Krathwohl add operational word grouping as a new dimension in the taxonomy. Table 1 below is the structure of the cognitive process revision of Bloom's taxonomy, operational verbs and division of thinking levels (Krathwohl, 2002; Arlianty et al., 2019).

Table 1. Cognitive Process Structure, Operational Verbs, and Thinking Level

Category	Keyword	Thinking Level
Remembering is taking relevant knowledge from long-term memory.	State the definition, repeat the statement.	*Low Order Thinking Skills*
Understanding is determining the meaning of instructional messages, including oral, written, and graphic communications.	Grouping, describing, identifying, mapping, reporting, explaining,	
Implementing are doing or using procedures in certain situations.	Choose, demonstrate, illustrate, interpret.	
Analyzing is breaking down the material into its constituent parts and detecting how the parts relate to each other and with the overall structure or purpose.	Check, compare, separate.	
Evaluating is making judgments based on criteria and standards.	Give opinion, vote.	*High Order Thinking Skills*
Creating is putting elements together to form a coherent whole or create an original product.	Change, build, create, design, build, formulate.	

HOT is able to make students learn more deeply, knowledge is thick, and deepen the concept well (Widodo & Kadarwati, 2013). Thinking well is obtained by regularly and routinely challenged to think (Brookhart, 2010). Thomas and Thorne stated in Widodo & Kadarwati (2013), that HOT is an ability that can be learned and taught to students, HOT can improve the skills and character of students.

Creativity has an important role in HOTS. However, Adibah in (Sunaringtyas, 2017), states that basically everyone has the potential to be creative, but the level of creativity of each individual is different. According to the Creative Education Foundation (CEF), the secret to creating new ideas is to separate divergent thinking from convergent thinking. Divergent thinking is generating lots of ideas and choices. Convergent thinking is evaluating ideas and choices, and making decisions.. Warr & O'Neill (2005),

explain that the creative thinking process is a process that is basically internal to an individual with which ideas are generated. Osborn in (Warr & O'Neill, 2005), explains that the thinking process of students uses the Osborn Model which includes 2 stages, namely Idea Generation and Idea Evaluation. Idea Generation has 2 stages, namely (1) fact-finding is a process of problem definition and preparation, (2) idea-finding is a process of generating new ideas through a combination of existing old ideas. At the and Idea Evaluation stage, new ideas or creative solutions are examined by students themselves.

HOTS includes critical thinking and creative thinking (Conklin, 2011). PjBL is one of the appropriate learning models in the development of HOTS of students because according to Bell (2010), project-based learning makes students learn through collaboration and use critical thinking skills and foster creativity when they are involved in projects. The project that will be done by students requires them to be able to explore their work (Siew & Chong, 2014). This makes PjBL a learner-centred learning that supports the active role of students. Following the demands of the 2013 curriculum that students play an active role in learning and teachers as guides and facilitators who provide opportunities for students to learn actively, creatively, and fun.

Based on these descriptions, the aim of research was conducted to (1) to find out how the effectiveness of PjBL towards students' HOTS; (2) to find out how the HOTS process of students in terms of the Osborn Model thinking process.

2. Methods

This study uses mixed methods using a research design pre-experimental that is used is the one-shot case study using a sequential explanatory strategy. The quantitative approach in this study was to determine the effectiveness of PjBL on the HOTS of 8th-grade students by knowing the ability of students in the HOTS aspect who received PjBL learning to achieve classical completeness and knowing the ability of students in the HOTS aspect who received PjBL learning reached actual passing grade. The qualitative approach in this study was to obtain descriptive data about the HOTS process of students in terms of the creative thinking process of the Osborn Model.

This research was conducted at junior high school in Semarang in 2019/2020 school year with 8th-grade students as the research population. The research was conducted from March 2019 to July 2020. Of the 8 classes, 1 class was selected, namely class 8A as the experimental class to be subjected to the PjBL model.

Research subjects were selected based on their level of creativity and HOTS test results. Torrance Figural-A and Figural-B revisions in 1974 are instruments to determine the level of creativity of students. Four research subjects were obtained by reducing the data based on the uniqueness of the results of the level of creativity using the HOTS test which can be seen in the following Table 2.

Table 2. Samples Data

Sample	Criteria of Creativity	HOTS Score
H-04	High	38,9
H-07	High	36,1
H-08	Low	55,6
H-26	High	41,7

Data collection techniques in this study used tests and interviews. Quantitative data analysis by testing the hypothesis that has been made. Qualitative data analysis with data reduction, data presentation, concluding, and data validity. The effectiveness of the PjBL model is obtained by analyzing the hypothesis using the right side proportion test and the right side average test. HOTS descriptions of students in the thinking process of the Osborn model were analyzed using triangulation on HOTS test results with interview results.

3. Results & Discussions

3.1. Ineffectiveness of PjBL on HOTS of Students

In this study, the effectiveness of PjBL on HOTS of students is how to achieve completeness of learning which is reviewed quantitatively with the following indicators, (1) the ability of students in the HOTS aspects who get PjBL learning does not achieve classical completeness of 75 % with actual passing grade of 47; (2) the ability of students in the HOTS aspect who received PjBL learning did not achieve completeness individually with an actual passing grade of 47.

The results of the research on the effectiveness of the PjBL model that had been implemented in grade 8^{th} did not achieve classical completeness by 75% with actual passing grade of 47 and did not achieve completeness individually with an actual passing grade of 47. It can be concluded that the PjBL model is not effective against the HOTS of students.

Bell (2010) explains in his research that in project-based learning, students learn through collaboration and use critical thinking skills when they are involved in projects. In this study, it is not in accordance with the results of this study. In implementing project tasks, there are several groups who do not collaborate to solve problems together and are more likely to work individually on project tasks. Another thing was found that students were less confident in doing project assignments and tended to ask the teacher in evaluating the projects they made. In addition, the lack of knowledge exploration can be one of the factors that cause PjBL to be ineffective. This is indicated by the fact that many students still ask about mathematical calculations that they should have learned at the previous level. Then in project work, many groups use sample questions in books in developing projects and it is unrealistic what they experience in their daily lives. In the research by Rietzschel, Nijstad, & Stroebe (2007), it is clear that deep exploration shows that the originality of the ideas generated depends on the extent to which people are involved in deep exploration of their knowledge. This lack of diversity of practice questions makes it difficult for students if there are different questions. In addition, the teacher giving various questions related to the field of work makes students choose questions that are in accordance with their ideas and some students do not care about questions from other fields of work. With teachers who do not use media in learning to make students bored and learning less effective because some practice questions are not discussed because the time is over.

3.2. HOTS of Students Reviewed from The Thinking Process of The Osborn Model

The description of HOTS of students in terms of the creative thinking process of the Osborn model is obtained through interviews with subjects who have completed the creativity test and HOTS test. After the HOTS test and interviews with the subject were carried out, data triangulation was carried out.

At the stage of making ideas, it is divided into two stages, namely finding facts and finding ideas. At the fact-finding stage, there is no significant difference, all subjects can state the core of the problem correctly but some subjects who can achieve the level of evaluation and get high scores, write down information to solve the problem. In the idea search stage, subjects who have reached the evaluation level in HOTS tend to do one thing to find ideas, then read over and over again to find ideas, and do not move to other problems if they do not find ideas.

Subjects who only reach the level of analysis move on to other problems when experiencing difficulty. Another thing that was found was that all students scribbled on other papers in solving problems because they had been used by the teacher, some students wrote down problems and consideredother more efficient solutions.

In the idea evaluation stage, the subject with the level of analysis does not check the completion results. Students with the level of evaluating conduct an examination of all the results of completion or some of the results of completion. Also, some students pay attention to writing the completion results so that they are easy to understand.

4. Conclusion

Based on the results and discussion obtained the PjBL model not effective against student HOTS. At the fact-finding stage, all subjects can state the core of the problem correctly, then some subjects who can achieve the evaluation level and get high scores, choose then write down information to solve the problem. At the idea-seeking stage, all subjects scribbled on another paper because it had become a habit of the teacher. Also, subjects who have reached the evaluation level in HOTS tend to do one thing to find ideas, then read over and over again to find ideas, and do not move to other problems if they do not find ideas. At

the idea evaluation stage, the subject with the analyzing level does not check the results of completion. Students with the level of evaluating conduct an examination of all the results of completion or some of the results of completion. Also, some students pay attention to writing the completion results so that they are easy to understand.

Based on the results, the researcher gave suggestions, in working on the project, the teacher should pay more attention to students and direct them well because many students do not collaborate with other group members. In the HOTS test process that involves the Osborn Model thinking process, the teacher conditions students which in the process can interfere with other students in processing test questions. In the student worksheet, give as many questions as possible covering various fields of work. Giving little questions makes students less explore other fields of work which include two variable linear equation system material. Give students a question discussion document in the form of a file so that students are more focused when the teacher explains and more time-efficient because the discussion of questions that cover the field of work is more time-consuming.

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