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Project-Based *Learning Based on Multiple Intelligences* Theory: Its Effectiveness Reviewed from Student Learning Achievement, Creative Thinking, and Curiosity

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Abstract

This study aims to test the effectiveness of Project-Based Learning based on the theory of multiple intelligences in terms of learning achievement, creative thinking, and curiosity. This study is a type of quasi-experimental research conducted in one class. The population in this study was grade VII junior high school students in Sleman Regency, Special Region of Yogyakarta, Indonesia. One class in the population was randomly selected as a sample. Data was collected using learning achievement test instruments, creative thinking skills, and student curiosity questionnaires. Project-based learning based on the theory of multiple intelligences is said to be effective if: (1) the average result of the student's mathematics learning achievement test reaches the Learning Objective Achievement Criteria (KKTP) set by the school, namely 75; (2) the average score of the student's creative thinking ability test is at least 70 (from a score range of 0-100); (3) the average score of the student's curiosity questionnaire after learning is higher than the average result before learning. Data analysis of learning achievement and creative thinking tests was conducted using the Wilcoxon Signed Rank Test, while the student curiosity questionnaire was conducted using the paired t-test. The results of the study α=5% showed that (1) project-based learning based on multiple intelligences theory is effective in terms of learning achievement; (2) project-based learning based on multiple intelligences theory is effective in terms of creative thinking; (3) project-based learning based on multiple intelligences theory is effective in terms of student curiosity. Data from the sample showed an average learning achievement test result of 81 (from a score range of 0-100), then creative thinking as indicated by the average creative thinking ability test result of 76 (from a score range of 0-100) and an average student curiosity score at the end of learning of 85.26 (from a score range of 0-100) higher than the average student curiosity score at the beginning of learning of 56.93 (from a score range of 0-100).

Keywords: *Project-Based Learning; Multiple Intelligences; Learning Achievement; Creative Thinking; Curiosity*

Introduction

The independent curriculum in Indonesia is implemented in educational units so that teachers can be learning leaders who can utilize the independent teaching platform and prioritize project-based learning (Cholilah *et al*, 2023). One of the learning methods that uses projects is ***Project-Based Learning***

(PjBL). PjBL is a learning that encourages students to be active in investigating and completing tasks, both individually and in groups, to pro-duce products as learning outcomes (Rangkuti, 2019; Dinda , 2021 ; Al Awab *et al* , 2021) . Learning with PjBL students learn in a meaningful way through exploration, assessment, understanding, and combining various information from different sources (Educational Technology Division, 2006; NYC Department of Education, 2009) in addition to the PjBL learning experience can also increasing student enthusiasm, training thinking skills through problem solving, and honing the courage to appear and express opinions (Romli & Ixfina, 2023; Thomas, 2000). In addition to improving the learning experience and solving problems, PjBL also provides students with the opportunity to create projects according to their characteristics (Avivi *et al*, 2023). To support the utilization of student characteristics in learning, an approach is needed that can facilitate the diversity of student potential. One of the utilizations of student characteristics is the theory of *multiple intelligences.*

Multiple intelligence itself can facilitate learning according to the characteristics of students (Maharani, 2015). *Multiple intelligence* is not just one intelligence, but consists of various types of intelligence possessed by a person with different levels (Gardner, 2008; Arikan and Unal, 2018). Learning with *multiple intelligences* provides a learning experience that is designed in line with the intelligence possessed by each student (Legowo, 2017). *Multiple intelligences,* it allows a more personal and effective learning process because it is adjusted to the variety of intelligence possessed by each student, so that their learning potential can develop optimally.

To implement learning that is under the various intelligences of students, the application of PjBL learning combined with the theory *of multiple intelligences* is an effective strategy (Romli & Ixfina, 2023). The suitability of PjBL learning to student characteristics has a positive impact on improving learning achievement.

Learning achievement itself is an achievement obtained by students in learning activities, which is obtained through studying, doing assignments, tests, or exams at a certain level of education in the form of grades or numbers obtained from evaluations carried out by teachers (Lomu & Widodo, 2018). Permendikbudristek Number 032 of 2024 Concerning Learning Achievements, such as conceptual understanding, reasoning, problem solving, mathematical communication, mathematical connections, and mathematical dispositions contained in the objectives of mathematics learning. This means that if student learning achievement is high, then the objectives of mathematics learning referred to in the Permendikbudristek have been successfully achieved, while if learning achievement is low, it means that the objectives of mathematics learning can be said to have not been achieved optimally.

In addition to academic achievement, creative thinking is also important to pay attention to in the 21st century. Creative thinking skills are needed to solve a problem or find alternative solutions to a problem (Adiastuty *et al,* 2020; Romaito *et al* , 2020; Suryandri *et al* , 2021) . Creative thinking skills are the ability to produce many ideas and answers in solving problems (*fluency*), flexibility, originality *and* elaboration *(*Medyasari *et al,* 2022). Therefore, creative thinking skills are an important aspect that must be developed in the learning process.

But in the field, creative thinking is still relatively low and has not received more attention. According to Marliani (2015), the ability to think creatively is still low in many schools. Almost the same opinion was also expressed by Anggoro (2015), he said that creative thinking and student learning outcomes are still less than optimal because many teachers still apply conventional learning and also the weak use of language in math books and illustrations that are not interactive so that they fail to convey the core message of the book. Therefore, it is necessary to increase creative thinking so that students can solve problems in everyday life.

Affective abilities are also very important to note, one of the affective abilities is curiosity. Curiosity is the desire to gain new knowledge shown through exploration activities and asking many

questions in learning so that they can solve problems (Litman & Spielberger, 2003; Renner, 2006; Jirout & Klahr, 2012; Baxter & Switzky, 2017).

Curiosity plays an important role in learning. Through curiosity, learning is not just knowing but exploring to find out more so as to give meaning to what is obtained in the learning process (Mardhiyana & Sejati, 2016). The existence of an attitude of curiosity will certainly encourage students to try to find, find, and conclude the results of their findings related to everyday life.

According to Setiyadi, (2018) the low level of students' curiosity in the learning process is due to the lack of learning activities that emphasize students' activities to explore their knowledge of the material being studied. The same thing was also conveyed by Hariyanti & Lestari (2023), that curiosity is still in the very low category, due to monotonous learning activities and not giving students time to ask questions and obtain information independently. Similar to the two opinions above, according to Nurahman *et al.* (2023), during the learning process, student involvement in learning is still low due to the lack of students' curiosity about the learning material being delivered.

From the several explanations above, the low curiosity is caused by monotonous learning and lack of opportunities for students to ask questions or explore information independently, so that student involvement in learning is also low, so there needs to be an increase in students' curiosity in more active learning.

Based on the background described above, there is a need for *project-based learning* based on *multiple intelligences* reviewed from the learning achievement, creative thinking ability, and curiosity of students. *Project-based learning hypothesis* based on *multiple intelligences* said to be effective if:

1. The average score for students' mathematics learning achievement test reached 75.
2. The average creative thinking ability test for students reached 70.
3. The average score of the students' curiosity questionnaire stated that the results after were higher than the average score before.

Method

This study is an experimental study with one class. The population in this study was students in grade VII of SMP Negeri in Sleman. The sample of this study consisted of one class. The material applied was students studying geometry in the sub-material of lines and angles.

Data collection was conducted using learning achievement test instruments in the form of objective questions, creative thinking questions in the form of descriptions and student curiosity questionnaires that had met the reliability test (Cronbach's Alpha coefficient on learning achievement of 0.763, creative thinking of 0.677, and curiosity questionnaire of 0.832). ***Project-based learning*** based on the theory of *multiple intelligences* is said to be effective if: (1) the average of students' mathematics learning achievement tests reaches 75; (2) the average of students' creative thinking ability tests reaches 70; (3) the average of students' curiosity questionnaire results states that the results after are higher than the average results before. Data analysis used in this study, for learning achievement tests and creative thinking ability tests using the *Wilcoxon Signed Rank Test*, while the student curiosity questionnaire uses the *paired t-test.*

Results and Discussion

Results

1. The Effectiveness of *Project-Based Learning Based on Multiple Intelligences* Theory Reviewed from the Learning Achievement Perspective

Based on the results of the mathematics learning achievement test on the material of lines and angles obtained from 30 students who took the test, there were 25 students who achieved a score of 75 and 5 students had not achieved 75. The range of scores obtained by students was 0 to 100, the highest score obtained was 93 and the lowest score obtained was 67 with an average class score of 81 with 25 students who completed and 5 students who did not complete. This shows that in general the learning achievement of students has reached 75. The results of the student achievement test can be seen in the following table.

Table 1. Learning Achievement Test Results

No	Description	Mark
1	Many students	30
2	Maximum value	100
3	Minimum value	0
4	The highest score	93
5	Lowest value	67
6	Class average grade	81
7	Number of students who completed	25
8	Number of students who have not completed	5

Next, hypothesis testing will be carried out. using the *Wilcoxon Signed Rank Test*.

The hypothesis on the first effectiveness criteria is reviewed from the learning achievement perspective.

$H_0 : \mu_p \leq 74.9$ The average score of the student learning achievement test is less than or equal to 74.9.

$H_1 : \mu_p > 74.9$ The average score of the student learning achievement test is more than 74.9.

The output result of *the Wilcoxon Signed Rank Test* obtained the *Asymptotic Significance* or *Asymp.Sig value* is $0{,}001$, the value is smaller than the value $\alpha$of 0.05. $Asymp.Sig = 0{,}000 < \alpha = 0{,}05$then H_0it is rejected. It can be concluded, with a significance level of 5%, the average value of the student achievement test is greater than 74.9. Based on the specified criteria, *project-based learning* is based on *multiple intelligences* theory **effective in terms of student learning achievement** .

2. The Effectiveness of *Project-Based Learning Based on Multiple Intelligences* Theory Reviewed from the Perspective of Creative Thinking Ability

Based on the results of the creative thinking ability test on the material of lines and angles obtained from 30 students who took the test. There were 26 students who completed it and 4 students who had not completed it. It is known that of the 30 students who took the test, the highest score achieved was 85, while the lowest score was 63. The average class score was 76, with a theoretical maximum score of 100 and a theoretical minimum score of 0. The minimum completion limit was set at 70. From these results, 26 students succeeded in achieving learning completion, while 4 students had not completed it. The results of the creative thinking ability test can be seen in the following table.

Table 3. Results of Creative Thinking Ability Test

No	Description	Mark
1	Many students	30
2	Theoretical maximum value	100
3	Theoretical minimum value	0
4	Completion Limit	70
5	The highest score	85
6	Lowest value	63
7	Class average grade	76
8	Number of students who completed	26
9	Number of students who have not completed	4

Next, hypothesis testing will be carried out. using the *Wilcoxon Signed Rank Test*.

The hypothesis on the first effectiveness criterion is reviewed from the perspective of creative thinking ability.

$H_0 : \mu_p \leq 69.9$ The average score of the students' creative thinking ability test is less than or equal to 69.9 .

$H_1 : \mu_p > 69.9$ The average creative thinking ability test score is more than 69.9.

The output results of *the Wilcoxon Signed Rank Test* obtained the *Asymptotic Significance* or *Asymp.Sig value* , $0{,}000$which is less than $\alpha\, 0.05$.$Asymp.Sig = 0{,}000 < \alpha = 0{,}05$ then H_0rejected. It can be concluded with a significance level of 5%, the average values of the creative thinking ability test are greater than 69.9. Based on the specified criteria, *project-based learning* is based on *multiple intelligences* theory **effective in terms of creative thinking skills.**

3. The Effectiveness of *Project-Based Learning Based on Multiple Intelligences* Theory Reviewed from the Perspective of Student Curiosity

To see the effectiveness of *project-based* learning *multiple intelligences* theory , a hypothesis test was conducted to determine whether the average score of students' curiosity at the end of learning was significantly greater than the average score of students' curiosity at the beginning of learning. There was a significant increase in the results of the student curiosity questionnaire between the beginning and the end of learning. The average score increased from **56.93** in the initial questionnaire to **85.26** in the final questionnaire, with an increase of **28.33**. These results indicate a significant increase in students' curiosity after learning with *project-based learning* based on *multiple intelligences* theory. A brief description of the student curiosity questionnaire data can be seen in the following table.

Table 5. Brief description of students' curiosity questionnaire data

Description	Curiosity Questionnaire	
	Beginning	End
Number of Students	30	30
Average	56.93	85.26
Std. Deviation	7.14	11.05
Theoretical maximum value	125	125
Theoretical minimum value	25	25
The highest score	51	108
Lowest value	49	70

Next, hypothesis testing will be carried out. using the *paired t-test.*

The hypothesis on the first effectiveness criterion is reviewed from the perspective of student curiosity.

$H_0 : \mu_{posttest} \leq \mu_{pretest}$ The average result of students' curiosity scores after was not higher than the average result of students' curiosity scores before.

$H_1 : \mu_{posttest} > \mu_{pretest}$ The average result of students' curiosity scores after was higher than the average result of students' curiosity scores before.

From the *paired t-test, the sig.(2-tailed)* value = 0.003 was obtained $< 0{,}05$, so H_0it was rejected, which means that there was a significant difference in the average results of students' curiosity scores between the pretest and posttest.

Based on the results of the analysis of the student curiosity questionnaire, it can be concluded that *project-based learning* is based on The theory of *multiple intelligences* **is effective when viewed from the average score of the student curiosity questionnaire** and there is a significant difference in the average score of student curiosity between the pretest and posttest.

Discussion

Project-based learning and *multiple intelligences* theory **effective in terms of student learning achievement** . This is because learning achievement can develop well through activities in *project-based learning.* The results of this study are in accordance with the research of Sumarni & Manurung (2023) which states that learning by implementing the PJBL (*Project-Based Learning)* model has a significant increase in the learning process. The results of the study by Farhin *et al* (2023) stated that implementing *project-based learning* in the learning process has been proven to be effective in increasing academic achievement, student involvement, and in-depth understanding of the subject matter.

Project-based learning *multiple intelligences* theory **effective in terms of creative thinking skills**. This is because creative thinking can develop well through activities in *project-based learning.* Because during the learning process it can develop well with the questions used to facilitate creative thinking skills. The results of this study are in line with Noviyana's research (2017) which states that the results of the research that has been carried out concluded that there is a significant influence of the *project-based learning model* on the creative thinking skills of class VIII students in the even semester of SMP Negeri 3 Bandar Lampung. The average creative thinking skills of students using the *project-based learning model* were 86.39, higher than the average creative thinking skills of students using conventional learning, which was 53.77. Strengthened by the results of research by Octariani & Rambe (2020) showing that using *project-based learning* has a positive influence, namely being able to improve the creative thinking skills of class XI students compared to direct learning.

Project-based learning The theory of *multiple intelligences is effective when viewed from the students'* high **level of curiosity at the end of the learning process.** This shows that *project-based learning* is effective in increasing students' curiosity. This study is in accordance with the research of Piani & Hadiyanti (2024) who said that the results of the study concluded that the application of the PjBL model in classroom learning activities can help teachers to increase curiosity and improve student learning outcomes. Similarly, the research of Setiono *et al* (2021) said that the application of the *Project Based Learning* (PjBL) learning model can increase the attitude of curiosity.

Conclusion

By using $\alpha = 0{,}05$it is concluded that PjBL based learning The theory *of multiple intelligences* meets the criteria for effective learning achievement as indicated by the average result of the learning achievement test of 81, then creative thinking as indicated by the average result of the creative thinking ability test of 76 and the average score of students' curiosity at the end of learning of 85.26, which is higher than the average score of students' curiosity at the beginning of learning of 56.93.

The results are effective because PjBL learning is combined with *multiple intelligences* theory. In the learning process, students do not only receive information, but are directly involved in designing and completing projects that are in accordance with the type of intelligence they have. This involvement encourages students to explore ideas independently, foster a high sense of curiosity, and develop creative thinking skills in solving problems faced during project work. Thus, the combination of PjBL and *multiple intelligences theory* not only creates a fun and meaningful learning atmosphere, but also has a positive impact on improving student learning achievement as a whole.

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