

**THE EFFECT OF PjBL-STEM LEARNING MODEL ON STUDENTS' COGNITIVE SKILL IN MATTER SUBSTANCES AND THEIR CHANGES SUBJECT****Mufidah,G^{1,*}, Rahmah Evita Putri², Rani Oktavia³, and Firda Azzahra⁴**

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Accepted: April 23th, 2024. Published: July 31th, 2024**Abstract**

The background of this research was the results of the researcher's observations on 8th grade students of SMPN 14 Padang. Based on the results of observations, information was obtained that teachers had previously implemented the PjBL learning model but never had implemented the STEM approach, and teachers had never combined the learning model with the STEM approach. The purpose this research was to examine the effect of the PjBL-STEM learning model on students' cognitive skill regarding substances and their changes subject. The type of research used was Quasi Experimental, design, using a Posttest Control Group Design. This research used two classes, there were experimental and the control class. The experimental class uses the PjBL-STEM learning model, while the control class used a conventional approach learning model. Sampling in this study was carried out using a purposive sampling technique, based on almost the similliary average daily test scores. The instrument of this research were multiple choice test with 20 questions. The results of data analysis show that the cognitive skill of students in the experimental class are higher than those in the control class. The used of the PjBL-STEM learning model makes a good difference in students' cognitive abilities. The results of hypothesis testing based on posttest data obtained from the two sample classes showed that, H₀ was rejected and H₁ was accepted, so it can be interpreted that there is a difference in the average cognitive abilities of students in the experimental class and the control class. There is an effect of the application of the PjBL-STEM learning model on the students' cognitive skill on substance material and its changes subject.

Keywords: Cognitive Abilities, Learning Models, PjBL-STEM

Introduction

The curriculum is a collection of plans and arrangements regarding the objectives, content and learning materials along with the methods used as a reference in organizing learning activities to achieve certain educational goals (Ministry of National Education, 2003). The independent curriculum is a curriculum with diverse intracurricular learning where the content will be maximized so that students have enough time to understand concepts and strengthen their competencies (Ujang et al., 2022).

Science learning in the independent curriculum demands knowledge and skills. Where, science learning has an emphasis on implementing project activities. Project Based Learning (PjBL) model is a learning model that uses projects as the core of learning (Hanim & Kurniawan, 2022). The learning model by implementing PjBL is a model that is recommended for use in the independent curriculum.

The PjBL learning model will be more optimal in its application if combined with a harmonious approach, one of which is the approach recommended in the independent curriculum, namely the STEM approach. The PjBL-STEM model encourages students to understand concepts through problem identification and product creation as solutions to these problems (Laboy-Rush, 2010). The PjBL model with the STEM approach is a good solution to increase students' knowledge in science learning. STEM is a combination of science, technology, engineering and mathematics that is popularized in a number of developed and developing countries (Elva & Irawati, 2021). STEM (Science, Technology, Engineering and Mathematics) is an interdisciplinary approach that requires students to actively participate in implementing discussions in class. Students are required to actively use technological products in learning that applies the STEM approach (Hanim et al., 2022). The PjBL-STEM learning model in the learning process, all activities that take place tend to emphasize the active participation of students so that they can maximize learning

activities that support achieving learning success in mastering concepts and improving cognitive, communication, creative and good character abilities (Kurniawati et al., 2022).

Based on the results of interviews conducted in four schools, it was found that all schools have used the independent curriculum, one in three schools is a driving school and is a driving teacher. The four schools have used the PjBL learning model in almost all science materials. Two of the four schools said that teachers have used STEM in their learning but in its implementation, there were no engineering steps. One school said that it had used STEM by making a Gerobak Sodor product which would later be used in the form of a game. However, this Gerobak Sodor is not an application of STEM because it does not create products that are in accordance with the principles of STEM, namely (Science, Technology, Engineering, and Mathematics).

The purpose of this study is to test the effect of implementing the PjBL-STEM learning model on the cognitive abilities of phase D students on the material of substances and their changes.

Research Method

This study used the Quasi-Experiment method. The data studied were students classified into 2 classes consisting of experimental and control classes. This study was conducted with the Posttest Control Group Design design, meaning that the experimental and control classes were given different treatments (Sugiyono, 2012).

Table 1. Post-test control group design

Class	Treatment	Post-Test
Experiment	X	O ₁
Control	-	O ₂

(Sugiyono, 2021)

The population involved were 62 students of class VII at SMPN 14 Padang. In taking the sample, the purposive sampling technique was used, which is a technique in determining samples using special criteria (Sugiyono, 2011).

The samples studied were experimental groups with treatment receiving PjBL-STEM learning and control groups implementing conventional learning. Both sample classes had 31 students each. The instrument in this study was a posttest with 20 objective questions. These posttest questions had passed a validation test with 3 expert validators and a test of question items before the study to see whether the questions were feasible or not.

Statistical analysis was performed using formulas in Microsoft Excel. The data analysis was carried out by applying inferential statistics. This is a statistical technique used to analyze sample data and obtain results that apply to the population (Sugiyono, 2011). This study applies quantitative analysis techniques. In conducting quantitative data analysis, it involves statistical analysis obtained from test results taken after learning and paying attention to learning objectives. The use of inferential statistics depends on the results of the prerequisite tests to be carried out (normality and homogeneity tests).

Result and Discussion

The research was conducted from November 16, 2023 to December 8, 2023, with 8 meetings each in both the experimental and control classes studying the same material. The research location was at SMPN 14 Padang in the 2023/2024 academic year.

Based on the observation results, the implementation of the ongoing learning is in line with the procedures in the PjBL-STEM model, as can be seen from the results of the observation sheet, 100% of which was implemented, meaning that in 8 meetings, 2 PjBL-STEM cycles have been carried out.

The next step is to conduct a prerequisite test data analysis which includes a normality test and a homogeneity test.

Table 2. Normality Test

Class	L_{hitung}	L_{tabel}	Description
Experiment	0,223	0,886	Normal
Control	0,115	0,886	Normal

From the results of the posttest data normality test in the experimental and control classes, it shows that the distribution is normal. Data that has been normally distributed is then tested for data homogeneity.

Table 3. Homogeneity Test

Class	N	α	F_{hitung}	F_{tabel}
Experiment	31	0,05	0,597	1,840
Control	31	0,05		

Based on table 3, it shows the experimental and control classes with homogeneously distributed data.

Table 4. Hypothesis testing

Class	t_{count}	t_{table}	
Experiment	23.75	2.96	Accepted
Control			

Referring to the results of the analysis carried out, it was obtained that $t_{count} = 23.75$ and $t_{table} = 2.96$. So, it can be concluded that $t_{count} > t_{table}$, H_0 is rejected and H_1 is accepted.

So it can be concluded that there is a meaningful influence of the use of the PjBL-STEM model on the cognitive abilities of phase D students on the material of substances and their changes.

Conclusion

Referring to the results of the research conducted, the conclusion obtained is that there is an influence on students' cognitive abilities by applying the PjBL-STEM model to the material of substances and their changes, as seen from the data that has been analyzed showing the t-test value which is located in the H_0 rejection area so that accepting H_1 means there is a significant influence.

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