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The Effectiveness of PjBL Models and TPACK Approach on the Science Learning Outcomes of Student at Gugus Elang Elementary School, Mlonggo District

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Abstract: The purpose of this research is to analyze the effectiveness of Project Based Learning (PjBL) model and the Technological Pedagogical Content Knowledge (TPACK) approach on science learning outcomes for fifth grade elementary school student in Gugus Elang, Mlonggo District, Jepara Regency. The research method uses quantitative methods. This research uses data collection techniques in the form of tests, namely pretest and posttest which are carried out in control classes and experimental classes. The sampling technique uses simple random sampling. The test result data was analyzed quantitatively using SPSS 26 and Microsoft Exel 2021 software. The result of this reseach are: 1) Based on the t test carried out, there is a significant difference between the average learning outcome scores of experimental class students and the control class, in order words the Project Based Learning (PjBL) learning model is effective in improving science learning outcomes for Class 5 Elementary School student in Mlonggo Distric, Jepara Regency. 2) The average learning outcome of experimental class student better than the control class, based on the t test there is a significant difference between thevaverage learning outcome scores of student in the experimental class and the control class. Thus, the Technological Pedagogical Content Knowledge (TPACK) approach is effective in improving science learning outcomes for fifth grade elementary school students in Gugus Elang, Mlonggo Distric, Jepara Regency. 3) The average learning outcomes of student in the experimental class are better than the average in the control class. There is a significant difference between the average learning outcome scores of students in the experimental class and the control class. Thus, the Project Based Learning (PjBL) learning model and the Technological Pedagogical Content Knowledge (TPACK) approach are effective in improving science and science learning outcomes for fifth grade elementary school student. So that conclusions can be drawn from the Project Based Learning (PjBL) learning model and the Technological Pedagogical Content Knowledge (TPACK) approach.

Keywords: Project Based Learning models, TPACK, learning outcomes in natural and social sciences, Elementary School.

1. Introductions

In the learning process in the classroom, we often find that students in learning still seem unprepared to receive the material given by the teacher so that they seem stressed ang less enthusiastic about following the lesson. One of them is when they study social studies subject, although social studies lessons are classified as fairly easy lessons, in reality, students' learning outcomes are canges in a person's behavior as awhole, not just one aspect of human potential. According to Soedijarto in Purwanto (2011:46) states that learning outcomes are alevel of mastery achieved by students in following the teaching and learning process according to the set educational goals. Students have different abilities after receiving their learning experiences (Mukhlisin et al., 2022).

This also happened to fifth grade students of Public Elementary School in Gugus Elang, Mlonggo District. This fact can be seen from the low learning outcomes of students because learning is still conventional, teacher-centered, ang students feel bored with the learning model applied by the teacher. Theachers only give written assignments and use makeshift teaching materials and even only use LKS in conducting evaluations in class.

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In the initial observation activity, the Mid-semester Assessment data for the 2023/2024 Academic Year showed that the results of the social studies learning of grade V students of SDN 3 Jambu on the Ecosystem material for the 2023/2024 academic year showed that out of 28 students, only 9 students or 32% obtained scores above the KKM and 68% or 19 students obtained scores below the KKM. For the social studies subject at SDN 3 Jambu, the Minimum Completion Criteria (KKM) score must reach 75.

Sani said that a long-term activity that involves students in designing, as well as making angd displaying a product in order to solve problems in the real world. Thus the Project Based Learning (PjBL) learning model based on Technologigal Pedagogical Content Knowledge (TPACK) can be used as a learning model to develop students' ability to plan, communicate, solve problems and be able to make decisions and various problems faced (Rahman et al.,2019).

The result of previous research using the Project Mased Learning model (PjBL) in learning activities have been proven to increase student learning motivation so that learning outcomes increase, this is evidenced by previous reseach conducted by (Kasanah, 2022). This learning model can be combined with Technological Pedagogical Content Knowledge (TPACK). TPACK is a teacher's knowledge of how a teacher can facilitate student learning of certain content through pedagogical approaches (Cox & Graham, 2009: 63). In his research, 90% of students in the class studied wewe motivated to follow the learning by applying the Project Based Learning (PjBL) learning model. The Technological Pedagogical Content Knowledge (TPACK) Learning model is able to improve students' critical thinking and metacognitive skills. (Ichsan, et al., 2022).

1.1 Conceptual framework

Learning activities will be more optimal if lerning resources used by students and learning strategies carried out by teachers can create a pleasant learning atmosphere in the classroom. So that learning in the classroom is not booring for students, an interesting learning model can be applied so that IPAS learning outcomes in the classroom increase.

The utilization of current technology can be combined with applying learning models to improve student learning outcomes in the classroom. Through the use of Project Based Learning models, students will be more interested in participating in lessons so that their learning outcomes increase. Integrating the Project Based Learning (PjBL) learning model with Technological Pedagogical Content Knowledge (TPACK) will make learning in the classroom more meaningful, because there is a connection between the material taught and daily activities in the environment where students live.

1.2 Research objectives

This study was conducted to analyze the effectiveness of the Project Basad Learning (PjBL) learning model integrated with the Technological Pedagogical Content Knowledge (TPACK) approach to the learning outcomes of Natural and Social Sciences in fifth grade students.

2. Methodology

2.1 Research design

This study uses a quantitative reseach design using a pretest-posttest control group design. This reseach desidn has the characteristic that there is a group devided into experimental and control classes, both groups were given a pretest to determine the initial ability of students, this was done todetermine whether the are differences between the experimental class and the control class. After that, all of them were given a post test.

2.2 Respondents of the study

Population is the whole subject ot object that is used as research. The population in this study were all fifth grade students in Gugus Elang with a total of 243 students. In this study, reseachers took 3 public elementary schools in the Elang Cluster, Mlonggo District, Jepara Regency, which included experimental class 1, namely SD Negeri 6 Jambu, experimental class 2, SD Negeri 3 Srobyong, ang control class at SD Negeri 3 Jambu. The sample selection from this population is simple random sampling, namely sampling by simple random sampling.

3. Findings and Discussion

The data used in this study were obtained from pretest and posttest data, in experimental and control classes. The pretest result are used to know or measure the initial ability of students, while the posttest is used to measure the final ability level of students. The following are the results of the data description analysis.

Table 1. Pretest Data Analysis

	Pretest kontrol	Pretest PjBL	Pretest TPACK	Pretest PjBL and TPACK
N	28	27	16	43
Mean	43,75	47,41	44,69	47,56
Median	45	50	42,5	50
Modus	40	50	40	50
Std. Deviation	8,12	11,21	10,08	10,60
Varian	65,97	125,71	101,56	112,35
Minimum	30	30	30	30
Maximum	55	65	60	70
Amount	1225	1280	715	2045

Based on the pretest value table, it shows that the average value of control class is 43.75. The average of the PjBL class is 47.41, the average of the TPACK class is 44.69, and the average of the PjBL and TPACK classes is 47,56. The acquisition of the maximum value or the highest value in the control class was 55, the PjBL clas was 65, the TPACK class was 60, and the PjBL dan TPACK class was 70.

Table 2. Posttest Data Analysis

	Posttest kontrol	Posttest PjBL	Posttest TPACK	Posttest PjBL and TPACK
N	28	27	16	43
Mean	70,14	76,85	78,44	79,19
Median	67,5	75	80	80
Modus	65	70	80	70
Std. Deviation	12,86	9,72	11,79	9,82
Variance	165,39	94,52	139,06	96,35
Maximum	95	95	95	95
Minimum	50	60	55	60
Amaout	1964	2075	1255	3405

Based on the Posttest value table, it shows that the average value of the control class is 70.14. The average of the PjBL class is 76.85, the average of the TPACK class is 78.44, and the average of the PjBL and TPACK classes is 79.19. The maximum value or the highest value in the control class, PjBL, TPACK and PjBL and TPACK class was 95. The pretest and posttest result can be clarified by using a bar chart, which can be seen in Figure 4.1

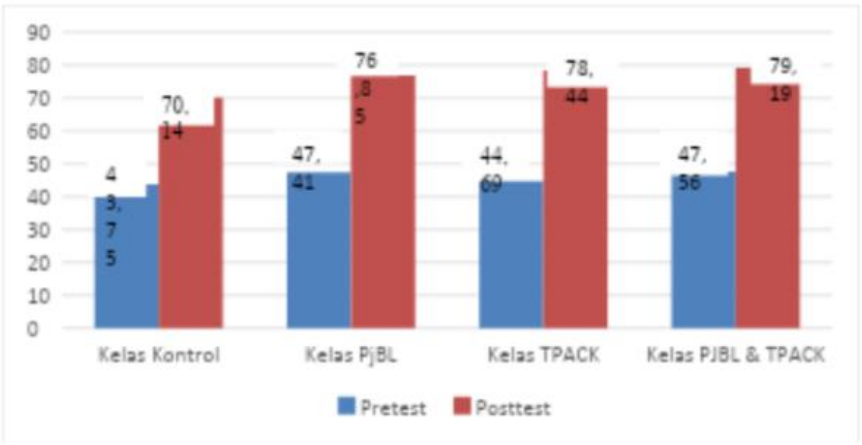

Figure 1. Diagram of pretest and posttest result

From Figure 1, it can be seen that the average pretest and posttest scores of the control class are lower that those of the other classes.

3.1 Knowledge

Based on Table 2, the 75.83% overall scores of the respondents using the level of proficiency scale from the K to 12 curricula is "Developing Level". Specifically, the respondents are in the "Developing Level" on general topics on particle nature of matter and periodic table of elements while "Beginning Level" for topics on atomic structure. Table 3. Mean, standard deviation and qualitative description of the respondents' scientific knowledge.

Table 3. Descriptive analysis

General Topics	SD*	%	QD*
Particle Nature of Matter	1.03	78.75%	Developing Level
Atomic Structure	1.00	70.38%	Beginning Level
Periodic Table of Elements	1.00	79.125%	Developing Level
Total Knowledge	1.86	75.83%	Developing Level

It denotes that the knowledge competency of the respondents in these particular areas in chemistry is low. Demir, Kilinc and Dogan (2012) found out that there is a gap between the learning targets of the spiral science curriculum and students' level cognitive abilities and this made teachers to face difficulty in teaching the wide range of knowledge and number of concepts that grow in complex with the change of grade levels. Consequently, the students were required to study by rote learning and leads to a low level of understanding the practical and theoretical competency of the subject.

3.2 Sample of a figure is as below

Tabulation is a way to present both quantitative and qualitative data visually. Findings from all studies were collated under the three revised questions used in data extraction. Figure 1 diagrammatically depicts the themes.

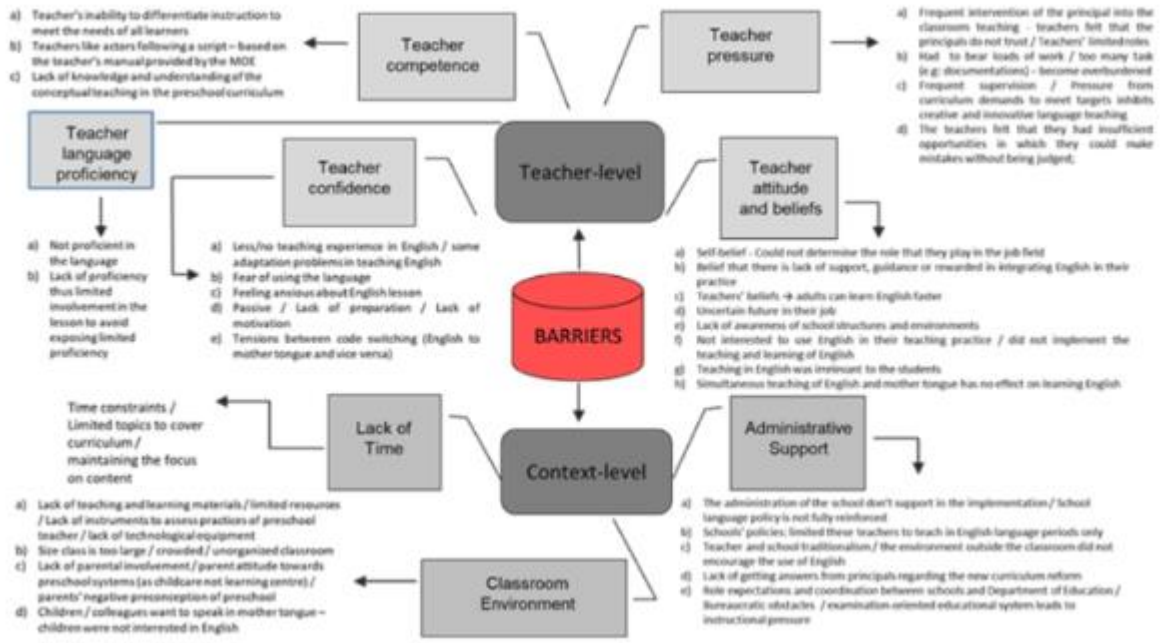

Figure 2. Descriptive themes

4. Conclusions and Recommendations

As revealed in the study, the knowledge and process skills of the respondents are at par in the ideal target level of proficiency, and they are not comprehensively exposed to the scientific inquiry processes. Moreover, there are areas in chemistry that should be improved. With this, the proposed strategic intervention materials (SIM) are based on the areas in chemistry that are least mastered by the respondents. The proposed intervention material will be subjected to validation and improvement and can be used to another similar study for the enhancement of teaching chemistry- grade 8.

Moreover, students are encouraged to participate in different chemistry activities such as joining science fairs, seminars, and science organizations to practice their process skills and improve their knowledge level. Teachers should elevate their teaching styles in teaching chemistry concepts and emphasized the application of process skills that are related to their daily life activities. Therefore, the results of studies in teaching sciences are significant as platform in reviewing and assessing science curriculum for further improvements.

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Conflict of Interest
The authors declare there is no conflict of interest.

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