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# The Project-Based Learning Model Improves Science Knowledge Competencies of Class V Elementary School Students

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***ABSTRAK***

*Lemahnya proses pembelajaran yang berlangsung dan tidak sesuai dengan tujuan pelajaran IPA. Guru hanya menyampaikan konsep kepada siswa yang harus dihafalkan tanpa menggunakan media pembelajaran. Penelitian ini bertujuan untuk menganalisis pengaruh model Project Based Learning terhadap kompetensi pengetahuan IPA siswa kelas V pada SD. Jenis penelitian ini ialah quasi experiment dengan rancangan penelitian non-equivalent control group design. Populasi penelitian ini berjumlah berjumlah 190 siswa kelas V SD. Sampel pada kelompok eksperimen berjumlah 31 orang dan kelompok kontrol berjumlah 36 siswa kelas V SD. Metode pengumpulan data yang digunakan yaitu metode tes objektif. Data hasil penelitian dianalisis menggunakan teknik analisis statistik deskriptif dan teknik analisis statistik inferensial (uji-t). Hasil analisis data diperoleh rata-rata skor pre-test kelompok eksperimen 14 dengan kategori rendah, dan rata-rata pre-test pada kelompok kontrol 12,41 dengan kategori rendah. Rata-rata post-test kelompok eksperimen 18,80 dengan kategori sedang, sedangkan rata-rata post-test kelompok kontrol 15,33 dengan kategori rendah. Berdasarkan hasil analisis uji-t, diperoleh terdapat pengaruh yang signifikan model Project Based Learning terhadap kompetensi pengetahuan IPA siswa kelas V SD. Disimpulkan bahwa model Project Based Learning dapat meningkatkan pengetahuan IPA siswa kelas V sekolah dasar.*

**ABSTRACT**

The weak learning process is different from the objectives of science lessons. The teacher only conveys concepts to students that must be memorized without using learning media. This study aims to analyze the effect of the Project Based Learning model on the science knowledge competence of fifth-grade students in elementary school. This type of research is quasi-experimental with a non-equivalent control group design. The population of this study amounted to 190 students of fifth-grade elementary school. The sample in the experimental group was 31 people, and the control group was 36 fifth-grade elementary school students. The data collection method used is the objective test method. Research data were analyzed using descriptive and inferential statistical techniques (t-test). The results of data analysis obtained the average pre-test score of the experimental group 14 in the low category, and the average pre-test in the control group was 12.41 in the low category. The average post-test of the experimental group was 18.80 in the medium category, while the average post-test in the control group was 15.33 in the low category. Based on the results of the t-test analysis, it was found that the Project Based Learning model significantly influenced the science knowledge competence of fifth-grade elementary school students. It was concluded that the Project Based Learning model could improve the science knowledge of fifth-grade elementary school students.

## 1. INTRODUCTION

Education is learning, skills, and habits of a group of people passed down from generation to generation. Education is also a complete and continuous learning process. Education is one of the national development targets that aims to make the nation's life more intelligent and improve the quality of Indonesia's human resources (Anjelina Putri et al., 2018; Mabruroh, 2019). Development is increasingly

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rapid, and we must be ready for all kinds of challenges, one of which is familiar to the world of education: curriculum issues. Over time, the government continues to make various efforts to improve the quality of education, one of which is changing the curriculum (Hidayati & Astuti, 2020; Rusdarti et al., 2019; Sugiarto, 2018). The 2013 curriculum is an integrated thematic-based curriculum that integrates various competencies from various subjects into various themes so that learning can provide students with meaningful experiences (Anggara, 2018; Marfilinda, 2019). The 2013 curriculum emphasizes a scientific approach to the learning process. Students actively construct knowledge by observing, asking, communicating, identifying, and collecting data (Mega et al., 2015b; Sanjiwana et al., 2015). The scientific approach is intended to provide understanding to students in terms of knowing and then being able to understand various materials to get information (Putri et al., 2019; Safitri & Ardana, 2020). The learning process in the 2013 curriculum emphasizes memorizing skills and the 4C skills (Communication, Collaboration, Critical Thinking, and Creativity). Learning in the 2013 curriculum aims to develop students' potential so that they can live as individuals and citizens who are faithful, productive, creative, innovative, and affective and able to contribute to the life of society, nation, and state. Learning in the 2013 Curriculum can provide opportunities for students to develop their potential or abilities both in attitudes, knowledge, and skills needed for their lives so that they can be used in society, nation, and state (Mega et al., 2015a; Susanti et al., 2015).

Science lessons have a very important role in the educational process. Natural Science is a science that studies the natural environment and its contents (Ginanjar et al., 2015; Hasanah et al., 2023; Sugiyanto et al., 2018). Natural Sciences (Science) is a material content included in thematic learning in the 2013 Curriculum. In the 2013 Curriculum (K13), science lessons at the elementary school level emphasize aspects of process skills, both basic and integrated skills processes. Science lessons aim to make students think scientifically, reason, and critically (Kumala Dewi et al., 2018; Kusumayani et al., 2019). In addition, science lessons aim to equip students to be able to develop curiosity, improve skills, and awareness to be able to appreciate the natural surroundings, which can be used as a basis for continuing to a higher level of education (Arfinanti, 2018; Jayadiningrat & Ati, 2018; Riswanto & Dasmo, 2015). The reality in the field shows that this is difficult to realize. One of the problems faced by the world of education is the problem of the ongoing learning process needing to be stronger and by the objectives of science lessons. Many factors can influence the continuity of the learning process, including teacher, student, environment, and facilities and infrastructure factors used in the school (Diawati et al., 2018; Suryantari et al., 2019). Teachers only convey concepts or information to students where the information must be memorized without applying models or media as aids in the learning process. It causes learning not to be able to develop students' thinking abilities but is only directed at the ability to memorize and remember. As a result, science lessons become less interesting subjects for students.

The observations and interviews with fifth-grade teachers at SDN Gugus III, Sukawati District, which consists of 6 schools, show that learning activities still use conventional learning, the lecture, question and answer, and assignment methods. Many learning models can be used in science learning. The density of material or teaching materials must be delivered, which means that conventional learning is chosen to save time. Conventional learning is a learning process carried out in one direction, from teacher to student, where the teacher explains, and the students act as listeners (Mega Lestari et al., 2018; Widiasih, 2018). The teacher delivers material only from simple illustrations in students' thematic books because they need help determining a suitable learning model to apply to science lessons. This results in a lack of student enthusiasm in the learning process, impacting students' science knowledge competency. Conventional learning implemented by teachers is less enjoyable, so students become bored more quickly and less comfortable participating in learning. Choosing this method also causes students to be less active in the learning process. It can trigger various poor understanding of the learning material. In addition, choosing this conventional method can cause students to be given less freedom to express their activity.

From the previous description, there is a gap between the expected conditions and the real conditions in the field. Thus, the goals of science education cannot be realized. One learning model considered effective in teaching students science lesson content is the Project Based Learning (PjBl) model. The Project Based Learning model is estimated to effectively increase students' motivation, creativity, and knowledge competency (Kumala Dewi et al., 2018; Widyaningrum, 2023). Applying the Project Based Learning Model will give students a pleasant learning atmosphere and meaningful learning experiences (Handayani et al., 2021; Yusti et al., 2021). The Project Based Learning model is a learning model that focuses students on carrying out in-depth investigations of a problem. This model also allows students to complete a project from a problem given by the teacher so that students' critical thinking skills and creativity emerge (Apsari & Wiarta, 2020; Unaenah & Rahmah, 2019). The application of the Project Based Learning Model is not only seen as capable of achieving direct learning objectives (instructional effect), such as achieving Competency Standards, Basic competencies, and Indicators but is also seen as

capable of providing a direct effect (nurturant effect) (Guo et al., 2020; Lu, 2023). Activities are still needed to stimulate students' curiosity, creativity, and active role to support the implementation of the Project Based Learning model. A diorama media creation project is implemented in the learning process, which will later produce a product as a diorama. Through diorama-making projects, the Project Based Learning model can involve students in meaningful learning. Meaningful learning is a learning process in which students not only memorize learning concepts but also how students can apply these concepts in everyday life. The success or failure of the learning process will be reflected in the increase in students' knowledge competence (Edy et al., 2019; Ruslan et al., 2021).

The Project Based Learning model is an innovative learning model that actively involves students constructing their knowledge independently with groups to complete projects designed by the teacher (Handayani & Abadi, 2020; Prabowo et al., 2020). At the end of learning, students are expected to be able to solve these problems and questions through activities and project results in the form of dioramas. A diorama is one of the three-dimensional media or artificial media that aims to give a picture of the actual atmosphere or state of the object. Diorama media can give a real impression of a certain object. In a diorama, you can display a scene that describes an event that happened regarding history, characters, natural conditions, and city conditions that support the learning process. In applying the Project Based Learning Model, participants will seek their knowledge through diorama media creation projects with group members. Thus, students can put the knowledge gained as a product as a Diorama, which will be presented in front of the class at the end of the learning activity. Based on this, this study aimed to analyze the effect of the Project Based Learning model on the science knowledge competence of fifth-grade students in elementary school.

## 2. METHOD

In this design, two classes are used: the class that receives special treatment by applying the Project Based Learning learning model as the experimental class, and the class that applies conventional learning becomes the control class. In the Non-equivalent Control Group quasi-experimental design, the design was taught using the Project Based Learning model. The experimental design used was a "Non-equivalent control group design." The population of this study was fifth-grade students at SDN Gugus III, Sukawati District, which consisted of six public elementary schools. The total population for this study is 190 students, which is presented in Table 1.

**Table 1.** Population composition of fifth-grade students at SDN Gugus III, Sukawati District, Academic Year 2022/2023

| School | The number of students |
|---|---|
| SD Negeri 1 Batuan | 24 |
| SD Negeri 2 Batuan | 37 |
| SD Negeri 3 Batuan | 38 |
| SD Negeri Hindu 4 Batuan | 36 |
| SD Negeri 1 Batuan Kaler | 31 |
| SD Negeri 2 Batuan Kaler | 24 |
| **Total** | **190** |

In research, research instruments are certainly needed. Instruments are tools used by researchers to carry out the data collection process. The natural science material used in this research is the water cycle material in Theme 8, one of the main topics in science content in fifth-grade elementary school. In this study, analysis was carried out, data on students' science knowledge competencies. Instruments were used in the form of tests To obtain this research data. The test used in this research was carried out two times, during the pre-test and post-test. The pre-test was carried out before the two groups were given treatment. At the same time, the post-test was carried out after the treatment was given by applying the Project Based Learning Model in the experimental group and conventional learning in the control group. Before giving the test to students, a validity test, discrimination test, difficulty index, and reliability test are first carried out. The results of tests that are valid or tested will be given to students in the experimental group and the control group in order to be able to find out the science knowledge competencies that are given unequal treatment. The class taught with the Project Based Learning Model and the class taught with conventional learning. The preparation of the instrument grid is used to facilitate testing the validity of the test content and avoid the preparation of instruments that are not by the

indicators and can be used as a guideline for compiling test items. The instrument grid is presented in Table 2.

**Table 2.** Science Knowledge Competency Instrument

| Basic competencies | Indicator | | Cognitive Domain | Question Item Number | Question Form |
|---|---|---|---|---|---|
| 3.5 Analyze the water cycle and its impact on events on Earth and the survival of living things | 3.5.1 | Analyze the functions and benefits of water for the survival of living things | C4 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 28 | Multiple choice |
| | 3.5.2 | Analyzing the process of the water cycle. | C4 | 10, 11, 12, 13, 14, 15, 16, 17 | Multiple choice |
| | 3.5.3 | Distinguish the types of the water cycle | C3 | 18, 19 | Multiple choice |
| | 3.5.4 | Select factors that influence water availability. | C4 | 21, 22, 31, 32 | Multiple choice |
| | 3.5.5 | Compare the quality and role of water for living creatures and the surrounding environment. | C5 | 20, 23, 24 | Multiple choice |
| | 3.5.6 | Analyze the impact of the water cycle on life | C4 | 25, 26 | Multiple choice |
| | 3.5.7 | Choose ways to save water availability. | C4 | 33, 34, 38, 39, 40 | Multiple choice |
| | 3.5.8 | Analyze activities that maintain the continuity of the water cycle | C4 | 35 | Multiple choice |
| | 3.5.9 | Analyze human activities that can disrupt the water cycle | C4 | 27, 29, 30, 36, 37 | Multiple choice |

In this research, the analytical techniques used to analyze research data are inferential and descriptive statistics. Inferential statistical analysis is a technique used in analyzing sample data, where the results obtained from testing a hypothesis will be applied to the population. Inferential statistical analysis is a technique that can be used as a guide when carrying out sample data analysis, and the results are given to the population (Sugiono, 2015). Meanwhile, descriptive statistical analysis is an analytical technique that describes or provides an overview of the studied object.

## 3. RESULT AND DISCUSSION

### Result

The data obtained in this study is data related to the science knowledge competence of fifth-grade students in Cluster III, Sukawati District. The data obtained is then analyzed using previously established analysis techniques. By conducting a pre-test on 31 students in the experimental group with a maximum ideal score = 25, results were obtained concerning the science knowledge competency data: the highest score was 21, and the lowest score was 5. For more details, see the pre-test scores of science knowledge competence of students in the experimental group. Then, proceed with a descriptive analysis of calculating the number of classes interval = 6 score range = 17 class length = 3, mean = 14, standard deviation = 3.01, and variance = 9.06.

By conducting a pre-test on 36 students in the control group with a maximum ideal score = 25, the results obtained regarding the science knowledge competence data, the highest score is 19, and the lowest score is 5. Then, proceed with descriptive analysis, calculating the number of class intervals = 6, score range = 15, class length = 3, mean = 12.41, standard deviation = 4.02, and variance = 16.16. By conducting a post-test on 31 students in the experimental group with a maximum ideal score = 25, results were obtained concerning the science knowledge competency data: the highest score was 24, and the lowest score was 10. Then, proceed with descriptive analysis consisting of calculating the number of class intervals = 6, score range = 15, class length = 3, mean = 18.80, standard deviation = 2.74, and variance = 7.50. By conducting a post-test on 36 students in the control group with a maximum ideal score = 25, the results were obtained regarding the science knowledge competence data: the highest score was 23, and the lowest score was 9. Then, proceed with descriptive analysis consisting of calculating the number of

class intervals = 6, score range = 15, class length = 3, mean = 15.33, standard deviation = 3.18, and variance = 10.11. In this research, assumption or prerequisite testing is carried out before hypothesis testing using the t-test. The prerequisite tests include data normality tests and variance homogeneity tests. First, a normality test of the data distribution is conducted to determine whether the data obtained is normally distributed. Conclusions are drawn based on the results of Chi-Square data processing. The data distribution normality test was carried out on the science knowledge competency data of the experimental and control groups. Based on the data analysis that has been carried out, the results of the normality test for the distribution of pre-test and post-test data for science knowledge competence in the experimental and control groups can be seen in Table 3 and Table 4.

**Table 3.** Summary of Normality Test Results for Pre-Test Data Distribution for Experimental and Control Groups

| No | Science Knowledge Competency Data | $\chi^2_{count}$ | $\chi^2_{table}$ | Conclusion |
|---|---|---|---|---|
| 1 | Pre-Test Experiment | 6.42 | 11,07 | Normal |
| 2 | Pre-Test Control | 5.52 | 11,07 | Normal |

**Table 4.** Summary of Normality Test Results for Distribution of Post-Test Data for Experimental and Control Groups

| No | Science Knowledge Competency Data Group | $\chi^2_{count}$ | $\chi^2_{table}$ | Conclusion |
|---|---|---|---|---|
| 1 | Post-Test Experiment | 6,52 | 11,07 | Normal |
| 2 | Post-Test Control | 2,87 | 11,07 | Normal |

The variance homogeneity test was carried out based on data on science knowledge competence in the experimental and control groups. The provisions in this test are if F-count ≤ F-table, then the two data groups are declared homogeneous. On the other hand, if F-count > F-table, then the two data groups are said to be heterogeneous. A summary of the results of the pre-test and post-test homogeneity of variance tests between the experimental and control groups is presented in Table 5.

**Table 5.** Pre-Test Results of Homogeneity of Variance Tests for Experimental and Control Groups

| Data | $F_{count}$ | $F_{table}$ | Conclusion |
|---|---|---|---|
| Pre-Test Experimental Group and Control Group | 1,78 | 3,98 | Homogenous |
| Post-Test Experimental Group and Control Group | 1,34 | 3,98 | Homogenous |

**Discussion**

The discussion explains that the research results that have been obtained show differences in science knowledge competency scores between students who are taught using the Project Based Learning model and students who are not taught using the Project Based Learning model. This difference shows a significant influence of applying the Project Based Learning model on the science knowledge competency of fifth-grade students in Gugus III, Sukawati District.

To support the application of the Project Based Learning model, of course, it still requires activities that can stimulate curiosity, creativity and the active role of students. A project for making diorama media is implemented in the learning process, which will later produce dioramas (Adnyani et al., 2017; Rai Sawitri et al., 2018; Romaliyana et al., 2019). Dioramas can provide an overview of an atmosphere or place that is difficult to reach. Thus, each learning activity will become more meaningful, and students will more quickly understand the material contained in the lesson content. The diorama media produced through the project work are expected to provide meaningful learning experiences and new knowledge, foster creativity and interest in student learning, and increase students' competence in science knowledge. In applying the Project Based Learning Model, participants will seek their knowledge through diorama media creation projects with group members (Dharma et al., 2019; Pramita Dewi et al., 2018; Yuliani, 2018). Thus, students can put the knowledge gained as a product as a Diorama, which will be presented in front of the class at the end of the learning activity. Plus, when students learn in groups, which can directly foster a sense of collaboration within the group to understand the teaching material jointly, students will, of course, creatively and actively look for sources of information by reading books,

looking for references, or discussing. In the control group, those in the learning process did not use the Project Based Learning model. The learning process that takes place could be more interesting and exciting. The learning process applies more lecture, question and answer, and assignment methods. The teacher only conveys concepts or information to students where the information must be memorized without applying models or media as tools in the learning process (Romaliyana et al., 2019; Wira Dharma et al., 2018). Thus, learning cannot develop students' thinking abilities but is only directed at the ability to memorize and remember. Based on the data analysis that has been carried out, the results show an influence between groups of students who are taught using the Project Based Learning model and students who are not taught with the Project Based Learning model. This research implies that it can use appropriate and appropriate selection, such as appropriate and innovative learning models, and can influence the science knowledge competency that will be measured. In this research, it is explained that the choice of the Project Based Learning model helps increase student activity, can create a fun and meaningful learning process so that students are very enthusiastic in participating in the learning process, students are actively involved in the learning process, making students more active in finding solutions to problems where will produce a product in the form of a Diorama. In addition, in the learning process, the Project Based Learning model can foster cooperation in groups to jointly understand and carry out discussions related to the project to be implemented. Thus, students who are taught with the Project Based Learning model have a higher average than students who are not taught with the Project Based Learning learning model. The results of this study can be used in the population, fifth-grade students at SDN Gugus III, Sukawati District, and can also provide references for teachers to be more innovative in the learning process.

## 4. CONCLUSION

Based on the results of data analysis, it was found that there was a significant influence of the Project Based Learning model on the science knowledge competence of fifth-grade students in elementary school. It was concluded that the Project Based Learning model could improve the science knowledge competence of fifth-grade elementary school students. This model helps increase students' enthusiasm for learning.

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