PUBLISHED BY
JR
EDUCATION

Available online at http://ijite.jredu.id

International Journal of Information Technology and Education (IJITE) 3 (2), (March 2024) 122-130

International Journal of Information Technology and Education (IJITE)

http://ijite.jredu.id

# Effectiveness of Geometry Learning Based on PPG Daljab Student Technology through the Project-Based Learning Model in Elementary School Students

**Deitje A. Katuuk[1]*, Deysti T. Tarusu[1]**

[1]Faculty of Education and Psychology, Universitas Negeri Manado, Indonesia

*Corresponding author: deitjekatuuk@unima.ac.id

ARTICLE INFO
Article history:
Received: January 25, 2024; Received in revised form: February 27, 2024; Accepted: March 07, 2024;
Available online: March 08, 2024;

## ABSTRACT

Difficulties in understanding the mathematical concepts that occur when students learn geometry, one of which is an abstract geometry concept that is not followed by effective learning as an effort to help students' understanding is the main problem in this study. This study aims to determine the effectiveness of technology-based geometry learning carried out by PPG Daljab students through the Project Base Learning model in elementary school students. This study uses a quantitative approach with the type of Quasi-Experimental Design research with the Nonequvalent Control Group Design form. The population in this study is all elementary school fifth students in the North Tomohon Cluster, Tomohon City totaling 62 students. The sampling technique used in this study was Pusposve Sampling which was taken by two schools with the same level of activity and learning achievement. The experimental class was SD Inpres Kakasasen Satu and SD Inpres Kayawu with 31 students, while the control class was SD Inpres Kakasasen Dua and SD Inpres Kakasasen Tiga with 31 students. Data collection techniques using the Geometry Understanding Test Instrument. The instrument validity test uses the Pearson Product Moment formula and the reliability test uses the Alpha-Cronbach formula. The hypothesis test in this study uses the T-test test. Based on the study's results, the Project Based Learning Model can be described effectively against technology-based geometry learning in elementary school students.

**Keywords:** Effectiveness of Geometry Learning, Elementary school, Project Based Learning, Technology

## INTRODUCTION

The rapid development of innovation and technology in the 21st century encouraged the field of education in various countries to analyze and look for types of learning in the classrooms that match the 21st-century demands 21(Rahayu, 2021). The development of the times marked by the advancement of internet-based information technology with the name of the Industrial Revolution 4.0 is one of the challenges for every educator in building and forming knowledgeable people, improving the quality of human resources, and achieving national development goals following the Constitution of the Republic of Indonesia in 1945, namely educating the life of the nation (Wahyudi et al., 2021).

Learning mathematics starts from the level of elementary school education (SD) to college, therefore mathematics is very important for students to learn (Prastitasari et al., 2022). Mathematics is among the many fields of science that are the main in the advancement of science both in the fields of science and technology. This is a scourge in life because it is felt that mathematics has complicated knowledge and is difficult to understand(Tarusu & Adiansha, 2020). Implementation of Program for International Student Assessment (PISA) in 2012 in general concluded that the achievements of students in the field of mathematics greatly determine the success and progress of the nation, both in improving the quality of education and in political participation (Handayani, 2023).

Geometry is one of the mathematical materials that has been taught since elementary school level. The material has long been considered a place for students to learn to prove a geometric theorem, geometry aims to invite students to analyze the characteristics of geometric shapes, as well as use visualization, spatial reasoning, and geometric modeling to solve problems (Abdullah et al., 2015). Van de Walle (2008) Classified four materials in geometry, namely (Firdaus et al., 2024) forms, and properties that include learning the properties of two and three-dimensional forms and the relationship that is built from these properties, (Rahayu, 2021) transformation that includes translational learning, reflection, rotation, symmetry, and the concept of ease, (Nu'man & Azka, 2023) Locations that refer to the geometry of coordinates or other ways in determining how objects are located in the plane and space, (Wahyudi et al., 2021) Visualization which includes the introduction of the forms of the surrounding environment, the development of the relationship between two-dimensional objects with three dimensions and the ability to describe and recognize the shapes of various points of view.

Exploration of teaching strategies to strengthen geometry learning is an important effort in improving the ability to solve various geometric problems, one of the effective strategies is a problem-based approach or familiar with the term Project Based Learning model, where students are allowed to explore and solve geometric problems in a way independent or groups (Kunfiana et al., 2024). This learning model allows them to develop a deeper understanding of geometric concepts and improve their problem-solving skills through direct experience. The project Based Learning Model (PJBL) known as a problem-based learning model is a learning model that uses real problems encountered in

the environment as a basis for gaining knowledge and concepts through critical thinking skills and solving problems (Prastitasari et al., 2022)

In addition, the application of technology in learning geometry can also be an effective strategy. The use of dynamic geometry software, for example, allows students to visualize geometric concepts more clearly and interactively. Students can experiment with various geometry manipulations and observe changes that occur directly, which can help them in their understanding of geometric concepts.

In line with research conducted by PPG Daljab students at the elementary school level found during the learning process, students cannot always absorb the information provided by the teacher as a whole because elementary school students need concrete objects that vary and are close to the lives of students to facilitate it in understanding learning so that it gives Learning means, even students find it difficult to understand various concepts, especially in mathematics subjects that contain many concepts that are complex and abstract. In understanding a complex concept, students must be able to link one concept with another concept correctly, and as well as in understanding abstract concepts, students are required to be able to think even harder in solving problems that cannot be observed directly. Difficulties in understanding mathematical concepts also occur when students learn geometry so the purpose of learning geometry which is very useful is very possible not to be obtained by students. The abstract geometry concept is not followed by effective learning as an effort to help students 'understanding and students' attention to geometry learning is also lacking. In this case, the level of material abstraction (Intrinsic Cognitive Load) is not balanced with learning offerings that help (extraneous cognitive load) so that difficult material will be increasingly difficult for students to understand.

Thus, based on existing problems researchers are interested in researching the effectiveness of technology-based geometry learning through the Project Based Learning Model.

## METHODS

This study aims to determine the effectiveness of learning geometry based on PPG Daljab Student Technology through the Project Based Learning model in elementary school students. The type of research used is pseudo-experimental research (quasi-experiment) and has a control group. The following is presented the research chart (Sugiono, 2013). See Table 1.

**Table 1.** Research design

| Grup | Pretest | Variabel Bebas(X) | Posttest |
|---|---|---|---|
| KE | Y1 | X | Y2 |
| KK | Y1 | – | Y2 |

Information:

KE = experimental class

KK = control class

X = Implementation of the PJBL learning model
- = implementation of conventional learning
Y1 = Pretest
Y2 = Posttest

This research was conducted at elementary schools in the Tomohon Selatan Cluster Tomohon District. The population in this study amounted to 62 students from all class V students in 4 elementary schools in the North Tomohon Cluster, Tomohon City. The sampling technique used in this study was Purpose Sampling, which was taken by two schools with the same level of activity and learning achievement, so that the experimental class was SD Inpres Kakasasen Satu and SD Inpres Kayawu with 31 students, while those who became the control class namely SD Inpres Kakasasen Dua and SD Inpres Kakasasen Tiga. Data collection techniques used in this study are tests with research instruments, namely geometric understanding test questions. Data analysis techniques using t-tests with prerequisite tests, namely normality tests and homogeneity tests.

## RESULTS AND DISCUSSION

This research aims to determine the effectiveness of technology-based Geometry learning for PPG Daljab students through the Project-Based Learning Model for Elementary School Students. This research began by carrying out a needs assessment to find out the problems that exist in class V elementary school students in the North Tomohon cluster, Tomohon City. Based on the results of the needs assessment, it was found that during the learning process, students are not always able to absorb the information provided by the teacher completely because elementary school students need concrete objects that are varied and close to students' lives to make it easier for them to understand learning to provide meaningful learning, even students find it difficult to understand. various concepts, especially in mathematics subjects which contain many complex and abstract concepts. In understanding a complex concept, students must be able to relate one concept to another concept correctly and likewise in understanding abstract concepts, students are required to be able to think harder in solving problems that cannot be observed directly. Difficulty understanding mathematical concepts also occurs when students study geometry so the very useful goals of studying geometry may not be achieved by students. Abstract geometric concepts are not followed by effective learning as an effort to help students' understanding and students' attention to learning geometry is also lacking. In this case, the level of abstraction of the material (intrinsic cognitive load) is not balanced with helpful learning offerings (extraneous cognitive load) so that difficult material will be increasingly difficult for students to understand.

The next stage is to test the validity and reliability of the Technology-based Geometry learning understanding test instrument. The validity test aims to find out whether the technology-based geometry learning test instrument can be trusted. The validity test was carried out on 24 respondents and then tested using the help of the IBM SPSS Ver 27 for Windows application with decision-making criteria, namely if $R_{count} > R_{tahle}$ then the instrument is said to be valid. Below are presented the results of the validity test of the technology-based geometry learning instrument. See Table 2.

**Tabel 2.** Validity Test Results

| No. Item | $R_{table}$ | $r_{count}$ | Information | No Item | $R_{table}$ | $r_{count}$ | Information |
|---|---|---|---|---|---|---|---|
| Item 1 | 0.3494 | 0.347 | Invalid | Item 16 | 0.3494 | 0.508* | Valid |
| Item 2 | | 0.224 | Invalid | Item 17 | | 0.530** | Valid |
| Item 3 | | 0.270 | Invalid | Item 18 | | 0.435* | Valid |
| Item 4 | | 0.773** | Valid | Item 19 | | 0.342 | Invalid |
| Item 5 | | 0.387 | Valid | Item 20 | | 0.286 | Invalid |
| Item 6 | | 0.667** | Valid | Item 21 | | 0.323 | Invalid |
| Item 7 | | 0.510* | Valid | Item 22 | | 0.759** | Valid |
| Item 8 | | 0.307 | Invalid | Item 23 | | 0.510* | Valid |
| Item 9 | | 0.510* | Valid | Item 24 | | 0.242 | Invalid |
| Item 10 | | 0.491* | Valid | Item 25 | | 0.447* | Valid |
| Item 11 | | 0.489* | Valid | Item 26 | | 0.491* | Valid |
| Item 12 | | 0.229 | Invalid | Item 27 | | 0.509* | Valid |
| Item 13 | | 0.536** | Valid | Item 28 | | 0.416* | Valid |
| Item 14 | | 0.632** | Valid | Item 29 | | 0.536* | Valid |
| Item 15 | | 0.322 | Invalid | Item 30 | | 0.632 | Valid |

Based on the Pearson product-moment test presented in the table, 10 of the 30 technology-based geometry learning test items were found to be invalid and 20 questions were valid or suitable for use for understanding technology-based geometry learning.

The next stage is to carry out a reliability test which aims to see whether the technology-based geometry learning test instrument can be trusted or can be used as a tool for collecting data. The basis for decision-making in the reliability test is based on the significance value, namely > 0.60. The reliability test in this research was tested with the help of the IBM SPSS Ver 27 for Windows

application. Below are the results of the reliability test of the technology-based geometry learning instrument test. See Table 3.

**Table 3.** Reliability Test Results

| *Reliability Statistic* | |
|---|---|
| *Cronbach's Alpha* | *N of Item* |
| 0.865 | 30 |

Based on the reliability test using the Cronbach's Alpha test, the Cronbach's Alpha value was 0.844 > 0.60, so it can be concluded that the learning outcomes instrument is reliable in the Very High category.

Following the aim of this research, namely, to determine the effectiveness of technology-based Geometry learning for PPG Daljab students through the Project-Based Learning Model for Elementary School Students, the data obtained in this research needs to be tested prerequisites consisting of a normality test and a homogeneity test. The normality test was calculated using Kolmogorov-Simirmov with the help of the IBM SPSS ver 27 programs. Below are presented the results of the normality test. See Table 4.

**Table 4.** Normality Test Results

| Class | Variables | Kolmogorov-Smirnov | | Conclusion |
|---|---|---|---|---|
| | | Z | *Sig.* | |
| Control Class (Conventional Learning) | Pretest understanding of technology-based geometry learning | 0.140 | 0.125 | Normal |
| | Posttest understanding of technology-based geometry learning | 0.146 | 0.091 | Normal |
| Experimental Class (using the PJBL Learning model) | Pretest understanding of technology-based geometry learning | 0.143 | 0.109 | Normal |
| | Posttest understanding of technology-based geometry learning | 0.146 | 0.091 | Normal |

Based on the research results described in Table 4, shows that the sig value is greater than 0.05, so H0 is accepted. Thus, based on the test data for understanding technology-based geometry learning which consists of a control class with conventional learning and an experimental class using the Project Based Learning learning model, the samples are normally distributed.

The next stage is to carry out a homogeneity test. The homogeneity test in this research was carried out using IBM SPSS Ver 27. Below are presented the results of the homogeneity test. See Table 5.

**Table 5.** Homogeneity Test Results

| Test for homogeneity of learning outcomes data | | | | |
|---|---|---|---|---|
| No | Data Type | Value S*ig.* | Condition | Description |
| 1 | Experimental Class (using the PJBL Learning model) and Control Class (Conventional Learning) | 0.276 | >0.05 | Homogeneous |

Based on the homogeneity test data presented in Table 5, the significance value obtained for understanding technology-based geometry learning is 0.276. Based on these results, the existing data is homogeneous so that it can be continued in the next test.

After the prerequisite tests are met, the next stage is to test the hypothesis. The hypothesis test carried out in this research is the t-test with the help of the IBM SPSS Ver 27 for Windows application. Below are presented the results of the hypothesis test. See Table 6.

**Tabel 6.** Anova Test Results

| Understanding technology-based geometry learning with learning models Project Based Learning | | |
|---|---|---|
| **Variable** | **$F_{count}$** | ***Sig.*** |
| technology-based geometry learning | 36.732 | 0.001 |

Based on the results of the ANOVA test presented in Table 6, it can be concluded that for the technology-based geometry learning variable for class V students at Gugus Tomohon Utara Elementary School, Tomohon City, the Fcount value was 36.732 and the significance value was 0.001 or less than 0.05, so it is based on the agreement rules. in making a decision then 0.001 < 0.05 so that H0 is rejected and it can be concluded that there is a significant influence on the application of the Project Based Learning learning model to technology-based geometry learning in class V of Gugus North Tomohon Elementary School, Tomohon City.

Below are presented the differences in the effectiveness of technology-based geometry learning between the control class and the experimental class with the results of the independent sample t-test. See Table 7.

**Table 7.** Independent sample t-test results

| Class | N | *Sig.* | Mean | Decision |
|---|---|---|---|---|
| PjBL Learning Model | 31 | 0.003 | 86.26 | $H_0$ accepted |
| Conventional | 31 | 0.856 | 72.55 | $H_0$ rejected |

Based on the summary of the t-test results in Table 7, the significance score for the experimental class or class using the Project Based Learning learning model is 0.003 < 0.05, so H0 is accepted. Meanwhile, the control class or class with conventional learning is 0.856>0.06. so it can be concluded that technology-based geometry learning is more effective by using the Project-Based Learning learning model, in contrast to conventional technology-based geometry learning there is no change or is not effective.

Based on the results of the independent sample t-test analysis on understanding technology-based geometry learning, it shows a significance level of 0.003 < 0.05, while the significance level in the control class is 0.856 > 0.05. The average for the experimental class was 86.26, while for the control class, it was 72.55. The research results show that in experimental classes or classes using the Project-Based Learning model, there are significant differences, this is in line with research conducted (Zahra, 2024) that the Project Based Learning learning model has a significant effect on understanding technology-based geometry learning. The same is true of research conducted (Sukenti & Medan, 2023) that the Project Based Learning learning model has a positive and significant effect on understanding technology-based geometry learning with an approach that is contextual and easy for students to understand.

Based on the analysis of research results that support this research, it can be concluded that the Project Based Learning learning model is more effectively used in understanding technology-based geometry learning than conventional learning.

## CONCLUSION

Based on data analysis and discussion that has been conducted, the conclusions in this study are that the Project Base Learning Model is more effectively used in understanding technology-based geometry

learning compared to conventional learning conducted on fifth-grade students of the North Tomohon Group, Tomohon City.

## REFERENCES

Abdullah, A. H., Abidin, N. L. Z., & Ali, M. (2015). Analysis of students' errors in solving Higher Order Thinking Skills (HOTS) problems for the topic of fraction. Asian Social Science, 11(21), 133–142. https://doi.org/10.5539/ass.v11n21p133

Firdaus, N. N., Mulyadiprana, A., Rijal, M., Muharram, W., Pendidikan, U., & Kampus, I. (2024). Analisis asesmen diagnostik kognitif materi geometri di kelas IV sekolah dasar. 07(01), 170–177.

Handayani, S. (2023). JOTE Volume 4 Nomor 3 Tahun 2023 Halaman 264-270 JOURNAL ON TEACHER EDUCATION Research & Learning in Faculty of Education Metode Pendidikan Islam Perspektif Hadits. 4, 264–270.

Kunfiana, E., Rahmatika, T. I., Prihantoro, I. F., & Susilo, I. E. (2024). Studi Literatur: Implementasi Pendekatan Saintifik dalam Peningkatan Kemampuan Penalaran Matematis Siswa SMP Materi Geometri. PRISMA, Prosiding Seminar Nasional Matematika, 7, 475–481. https://proceeding.unnes.ac.id/prisma

Nu'man, M., & Azka, R. (2023). Kesulitan Siswa dalam Menyelesaikan Masalah Geometri. Journal in Mathematics Education, 3(2), 1–7.

Prastitasari, H., Jumadi, J., Marhamah, E., Purwanti, R., & Sari, R. (2022). Penggunaan Model Pairing Untuk Meningkatkan Motivasi, Aktivitas, Dan Hasil Belajar Matematika Siswa Sekolah Dasar Pada Materi Geometri. Primary: Jurnal Pendidikan Guru Sekolah Dasar, 11(1), 276. https://doi.org/10.33578/jpfkip.v11i1.8763

Rahayu, E. (2021). Problema Kesulitan Siswa Sekolah Dasar dalam Pembelajaran Geometri. AtTàlim : Jurnal Pendidikan, 7(1), 2548–4419.

Sukenti, A., & Medan, U. N. (2023). Penerapan Model Pembelajaran berbasis Masalah Berbantuan Aplikasi Geogebra Untuk Meningkatkan Hasil Belajar Siswa Pada Materi Transformasi Geometri Kelas XI IPAS – 1 SMA Negeri 7 Medan Pendahuluan. Jurnal Multidisiplin Ilmu, 2(2), 461–472.

Tarusu, D. T., & Adiansha, A. A. (2020). 1* , 2 , 3 1. 6(2), 170–175.

Wahyudi, W., Rokhmaniyah, R., & Suryandari, K. C. (2021). Penerapan Project Based Learning untuk Meningkatkan Pembelajaran Geometri Secara Online pada Mahasiswa PGSD di Masa Pandemi Covid-19. DWIJA CENDEKIA: Jurnal Riset Pedagogik, 5(2), 211. https://doi.org/10.20961/jdc.v5i2.53877

Zahra, A. (2024). Analisis Kesulitan Siswa Pada Materi Geometri Melalui Model Problem Based Learning ( PBL ). 2(1), 132–141.