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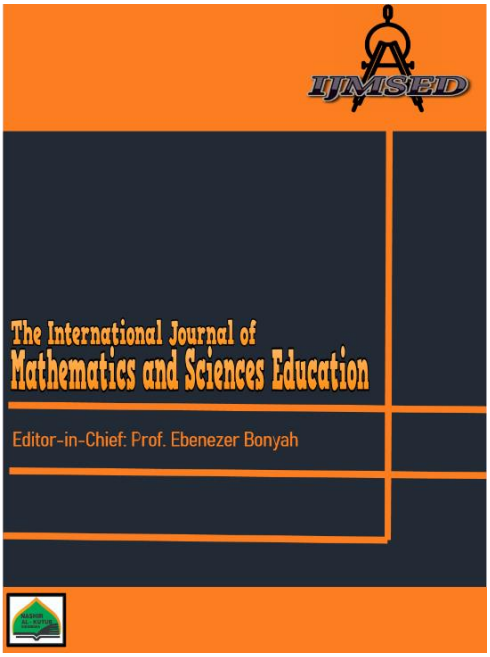


# Improving geometric thinking skills through *learning cycles* assisted by interactive geometry books

**Jihan Jamilatul Fatihah[a], Sudirman[b], Mellawaty[c]**
[a]Universitas Wiralodra , West Java Indonesia, jihanjf94@gmail.com
[b]Universitas Terbuka, Banten, Indonesia, sudirman@unwir.ac.id
[c] Wiralodra Universitas Wiralodra, West Java Indonesia, mellawaty@unwir.ac.id

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**Original Article**

# Improving geometric thinking skills through *learning cycles* assisted by interactive geometry books

**Jihan Jamilatul Fatihah[a*], Sudirman[b], Mellawaty[c]**
[a]Universitas Wiralodra , West Java Indonesia, jihanjf94@gmail.com
[b]Universitas Terbuka, Banten, Indonesia, sudirman@unwir.ac.id
[c] Wiralodra Universitas Wiralodra, West Java Indonesia, mellawaty@unwir.ac.id

*Corresponding Author: jihanjf94@gmail.com

**Abstract**
This research aims to analyze the increase in geometric thinking skills after using the Learning Cycle assisted by an interactive Geometry Book. The research design used is an experiment Design. In addition, the participants in this research were students in class VIII B at a private school in Indramayu Regency. Apart from that, the test instrument in this research is a test sheet in the form of a description. Next, the data obtained from the pre-test and post-test were analyzed statistically using the paired samples t-test. Based on the research results, it shows that the N-gain score shows an average value of 0.8903 or 89.03%, which is included in the high category. Furthermore, based on the normality test of the pre-test and post-test data, it shows that both data are normally distributed. Apart from that, based on the results of the paired samples test calculation, the Sig value is known. (2-tailed), namely 0.000 < 0.05, then Ho $_{is}$ rejected and Ha is accepted. Therefore, this study concludes that there is a difference in the average increase in students' geometric thinking abilities before and after using the interactive learning cycle assisted by interactive geometry books.
**Keywords:** Geometry thinking skills, Learning cycle, interactive 3D Geometry Book

## 1. Introduction

The ability to think geometrically plays a crucial role as a foundation for understanding other mathematical concepts (Sudirman et al., 2023; Sudirman et al., 2023). However, unfortunately, many students experience difficulties in carrying out a series of geometric thinking processes (Özerem, 2012; Tan-sisman & Aksu, 2016), so this not only affects their ability to understand geometry itself, but also has the potential to affect their overall mathematical skills. and problem-solving abilities. In the educational sphere, this challenge demands a more holistic and effective approach to developing students' geometric thinking abilities. If detailed further, some misunderstandings often arise when students are involved in a series of geometric thinking activities such as measuring length, surface area, and volume of 3D geometry (Özerem, 2012; Tan-sisman & Aksu, 2016). According to Özerem (2012), errors in measuring area and volume are generally caused by students' prior knowledge background, students' lack of ability to think logically, and errors in applying basic operations when carrying out geometric measurements. Meanwhile, in calculating volume, students need good spatial understanding (Tan-sisman & Aksu, 2016). This problem reflects difficulties in understanding geometric concepts, especially among junior high school (SMP) students. The results of observations by researchers who interviewed several students in class VIII and mathematics teachers at Muhammadiyah Kandanghaur Middle School showed that around 50% of students still had difficulty understanding geometry material.



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Based on the identification of this problem, the problem to be researched will be studied further by formulating the problem, namely whether l *Learning Cycle learning* assisted by interactive geometry books can improve students' geometric thinking abilities in one of the private junior high schools in Indramayu Regency? The *Learning Cycle* learning model is a learning model that consists of several learning cycles that provide opportunities for students to construct their knowledge and understanding. In the implementation of the Learning Cycle model, there are five stages, namely "generating interest, exploration, explanation, elaboration, and evaluation ". The stages in this learning have the potential to help students carry out geometric thinking processes.

## 2. Methods

The research method used in this research is experimental research. According to Sugiyono (2014), the experimental method is an experiment that has the aim of finding out and proving a hypothesis. " *Pre-experimental design* is a research design that involves one group being given tests before and after treatment, the group referred to in this research is the class chosen as research subjects." The experimental research design used was a one-group pre-post test design, namely experimental research carried out on only one group selected at random.

Creswell ( 2015) states that a population is a group of individuals who have the same characteristics. The population consists of objects and subjects that have certain characteristics and qualities chosen by the researcher to be explored so that the researcher can find conclusions in inside. The population in this study was the geometric thinking ability of students who used *the Learning Cycle assisted by a* 3D interactive geometry book for class VII I at a private sector in Indramayu Regency in the 2023/2024 academic year, totaling 288 students, divided into 8 classes. Based on this number, 1 class, namely class VIII B, was selected as the sample for this research.

According to Arikunto (2013) , the sample is a portion or representative of the population studied. Sampling was carried out with the consideration that the existing population was very large, so it was not possible to examine the entire existing population, so a representative population was formed. The sample for this research was selected using a *purposive sampling* technique . *Purposive sampling is a technique or method of sampling* based on consideration of its relationship to the objectives and objects to be studied without considering the equality of opportunities for each other member of the population to be taken as a sample. (Senjaya, 2020) .

In this study, data collection techniques using tests were used. A test is a series of questions or exercises as well as other tools used to measure skills, knowledge, intelligence, abilities, or talents possessed by individuals or groups. (Arikunto, 2013) . The test instrument in this research is a test sheet in the form of a description relating to class VIII geometry material to test students' geometric thinking abilities. The tests in this study were divided into two types of tests, namely: pre-test and post-test. Next, the data obtained from the pre-test and post-test were analyzed statistically using the paired samples t-test.



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## 3. Research Results and Discussion

The experiment was carried out at VIII B SMP Muhammadiyah Kandanghaur in 2023/2024. The experiment produced data in the form of scores from a test of students' ability to understand representations in geometry material using *the Learning Cycle* assisted by the interactive 3D *Geometry Book* for the sample class. These data will be used to test the hypothesis.

Based on descriptive calculations, it shows that the maximum score in the *post-test experimental class* based on scores is 100 and the minimum *post-test score based on scores is 65 from the ideal maximum score of 100. Meanwhile, the maximum score in the post-test* experimental class based on scores is 20 and the minimum score is 13 from the ideal maximum score of 20. Furthermore, based on the results of the *N-gain score* test calculation above, it shows that the average N-gain score for the experimental class ( *Learning Cycle* assisted by an interactive 3D *geometry book* ) is 0.8903 or 89 .03% is included in the high category. Thus, it can be concluded that the use of *the Learning Cycle* assisted by an interactive 3D *geometry book* is very effective in improving students' ability to understand representations of geometry material.

The data normality test aims to determine the normality of the data from the pre-test and post-test results. Testing the normality of the data in this study used the Kolmogorov Smirnov test using the SPSS version 25 program with a significance level of 5%. To determine whether the distribution was normal or not, the test criteria were carried out by comparing the significance values. If the sig probability value is > 0.05 then the distribution is normal, and if the sig probability value is < 0.05 then the distribution is not normal. Based on Kolmogov-Smirnov calculations it is 0.169 and sig or p-value = 0.093. Because, 0.093 > 0.05, thus the pre-test data for experimental class students is normally distributed, while for the post-test data, the statistical value for Kolmogorov Smirnov is 0.204 and sig or p-value = 0.131, because 0.131 > 0.05, therefore the post-test data test students in the experimental class were normally distributed.

Table 1
*Hasil Uji Paired Sampel t test*

**Paired Samples Test**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | Pre_test - Post_test | -26,356 | 2,746 | 1,467 | -44,736 | -49,024 | -37,654 | 32 | ,000 |

Based on Table 1 of the Paired Samples Test output above, the Sig value is known. (2-tailed), namely 0.000 < 0.05, then HO $_{is}$ rejected and Ha is accepted. So it can be concluded that there is an average difference in students' geometric thinking abilities before and after using the interactive *learning cycle* assisted by interactive geometry books.

**Discussion**

The results of this research are in line with Kolb's (1984) statement that *the Learning Cycle* is by the constructivist approach which emphasizes that learning is



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a process of knowledge construction by individuals through active interaction with the environment. *The learning cycle* is a teaching model that is based on constructivism and can help improve students' mathematical representation abilities as the results of this research are in line with research findings by Fazelian, et al., (2010) concluding that the 5E learning design integrated with GeoGebra software can be used in geometry learning 3D and improve students' ability to understand 3D geometry material. Then Tezer & Cumhur (2017) showed that the use of 5E-IM in geometric materials can improve performance and problem solving efficiency.

Then research by Annisa et al, (2019) shows that the application of the Deeper *Learning Cycle model* with the help of the Wingeom application can improve students' mathematical representation abilities. The results of research by Yaniawati et al (2023) show that the AR application is designed to help teachers explain and explore 3D geometry concepts with a material menu and evaluation function. Therefore, mobile augmented reality has potential as a pedagogical resource and can improve students' understanding of geometric concepts and learning attitudes.

## 4. Conclusion

Based on the results of the research conducted, there is a significant difference in students' geometric representation abilities before and after learning using *the Learning Cycle* assisted by the Interactive Geometry Book. The results of statistical analysis show a significant increase in students' geometric representation abilities after participating in learning using this model. Suggestions Further research can be carried out to explore the potential for using other interactive technologies in geometry learning. Apart from the 3D geometry book, various digital resources and applications can be used to deepen students' learning experience. Through further research, an innovative and effective learning model can be developed to provide students with geometric representation abilities.

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