



# Geometry Pop-Up Book Learning Media in Increasing Understanding of the Concept of Building Space in Students

Aisyah Aulia Eka Apriliana<sup>1\*</sup>, Dwi Avita<sup>2</sup>, Wahyudi<sup>3</sup>

<sup>1,2,3</sup> Pendidikan Matematika, Universitas Muhammadiyah Ponorogo, Ponorogo, Indonesia

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## ABSTRACT

Media use in the learning process helps teaching and learning activities. Using media in the learning process makes it easier for students to understand the learning provided. However, if they do not utilize media in the learning process, students will become less active in learning activities because the material presented is less attractive. This research aims to analyze the effect of using the Pop-Up Book of Geometry learning media on class students' understanding of building space. A quantitative approach with experimental methods was used in this research. The population was all class IV ICC Pahang students, totaling 18. The data analysis technique uses the related sample t-test to test the hypothesis. The analysis of learning completeness showed an average pretest score of 43.61 and a posttest of 77.78. This research showed that based on the hypothesis test results, it was found that Pop Up Book learning media influenced the learning outcomes of class IV students. It was concluded that Pop Up Book learning media can improve the learning outcomes of fourth-grade elementary school students.

## 1. INTRODUCTION

Geometry is an important concept that must be understood and used in studying mathematical topics. Students' mathematical thinking skills can be improved with high geometry skills, making it easier for students to solve everyday problems well (Anugrah & Pujiastuti, 2020; Faturohman & Afriansyah, 2020; Marasabessy et al., 2021). The field of study on geometry studied at the basic education level, especially grade IV, is space building material. In this learning, students are required to be able to understand the definition of building space, its types, properties, parts, then determine its surface area and volume (Khotimah & Risan, 2019; Yao & Manouchehri, 2020).

However, the fact is that there are still many students who have difficulty in solving math problems building space. Some of the difficulties experienced by students, including students having difficulty in understanding concepts and definitions, students having difficulty in applying formulas because students do not understand the concepts thoroughly, and students have difficulty in calculations because they still do not master algebraic operations (Khoirunnisa et al., 2020; Üce & Ceyhan, 2019).

The difficulty of students in understanding the concept of building space is influenced by several factors, namely the lack of student interest because learning seems monotonous, students have difficulty memorizing many formulas, and teachers in delivering less interesting material because of the absence of the use of teaching aids in learning activities (Pramestika, 2020; Safitri & Setyawan, 2022). The lack of use of teaching aids or learning media in the learning process, especially in mathematics learning which is

known to use many formulas in learning will reduce student interest in learning. Not only that, less student interest will reduce students' understanding of the material presented because students will tend to be bored and not pay attention to the material presented by the teacher (Fajari, 2020; Putro & Setyadi, 2022).

The same difficulty was also felt by grade IV students at ICC Pahang Malaysia. One of the reasons for the difficulty of grade IV students at ICC Pahang Malaysia in understanding the concept of building space is because the learning process carried out by teachers has not used learning media. The absence of teaching aids, learning media and conventional methods used by teachers makes students become disinterested when learning takes place. This causes students to not focus and not pay attention to the material brought by the teacher. The learning process without using interesting learning media will make students become inactive when learning takes place, so that students' ability to understand the material presented by the teacher will be difficult for them to understand.

One solution to solve this problem is to use interesting learning media. Learning media is one of the learning resources that can channel messages so as to help teachers deliver learning materials more easily and effectively (Fajari, 2020; Yudasmara & Purnami, 2015). To overcome learning problems, students can understand the concept of building space materials can use concrete and interesting learning media and understand the differences about building space as a whole. In the exploratory view, it is shown that student learning outcomes can be improved by involving learning media in building space materials. This undoubtedly makes it easier for educators to achieve learning targets (Khotimah & Risan, 2019; Yaacob & Lubis, 2022). The use of interesting learning media will make students more interested in paying attention to the metrics presented, especially the media used has creative and very innovative visual effects that will attract the attention of students, especially those who are still in elementary school (Abdulkarim et al., 2018; Muhsyanur et al., 2021).

One of the appropriate media to use is Pop-up Book-based learning media. This is because overall elementary school students still need concrete media in learning (Diyantari et al., 2020; Fitri & Karlimah, 2018). Pop-up Book media can create interesting learning activities with the combination of colors and images contained in the book. Pop-up Books can also provide a surprise effect for students because each page that is opened will show a 3-dimensional spatial shape. This will increase students' curiosity to turn to the next page (Fajriah et al., 2022; Hartanti et al., 2020). That way student will be more interested and motivated in participating in learning activities.

Several previous studies have explained the use of learning media in increasing students' understanding of space building materials, which found that by observing geometry in Pop-Up Books, students were able to design cube and block drawings according to predetermined volumes correctly. This shows that by using Geometry Pop-up Book learning media, students' understanding of building space material also increases (Habibi & Setyaningtyas, 2021). Furthermore, previous research in the exam showed that Pop-up Book learning media for mathematics materials formed a space that could really be reached from a legitimate, reasonable and interesting point of view to be used as a learning medium in grade V SDN 45 Mataram. This is shown by the improvement of student learning outcomes (Pradiani et al., 2023).

One of the previous studies also in their exams also tracked that when leading tests at two class meetings, specifically the control class and the exploration class, remarkable contrast was found with respect to the adequacy of Pop-up Book learning media on student learning outcomes. Where as far as exploration shows that there is an expansion of student learning outcomes when using Pop-up Book learning media compared to the pool of students who do not use learning media. This shows the critical impact by utilizing Pop-Up Book learning media on student mathematics learning outcomes (Winarti & Setiani, 2019). In addition, subsequent research found that the use of Pop-Up Book learning media completely affected students' science learning outcomes on level structure material. This is for the reason that by utilizing learning media students become fresher and more dynamic during the educational experience, so that is how student learning becomes fresher (Solichah & Mariana, 2018).

Based on several previous studies, learning media using Pop-Up Books has been widely applied to improve the understanding of the concept of building student space. From several previous studies, it can be seen that pop-up book media can significantly affect and improve the understanding of the concept of building a student room. This research with several previous studies has differences ranging from the application of learning media, analysis methods and also the learning material provided. The difference found is learning media where from several previous studies, which use pop-up book media as learning media, there has not been found a pop-up book media that emphasizes the discovery of the formula for surface area and volume of space in the media. The application of space building material is limited to building flat side space and its use is limited only to helping students visualize the shape of building space on real objects and show its elements. Apart from that, the level of education that the researchers used was the concept of building space at the grade IV level of elementary school, in contrast to previous studies,

some used the secondary school education level and some used the elementary school level at the grade V level (Anisa Fitri, 2018; Nursela et al., 2022).

Based on the problems in the field, a research article was compiled with the aim of utilizing Pop-Up Book Of Geometry learning media in increasing the understanding of the concept of building space in elementary school students and to see how the influence of the use of Pop-up Book media on the understanding of the concept of building space for grade IV students of ICC Pahang Malaysia. Therefore this study aims to analyze the influence of the use of Pop-Up Book of Geometry learning media on the understanding of the concept of building a classroom student.

## 2. METHOD

The type of research used is experimental research. The method used in this study is quantitative research method. In this study, teaching and learning activities were carried out with the help of Pop Up media. Then, students will be given a test of mathematical problem solving ability to build space at the end of learning. The research design used was a experimental design in the form of onegroup pretest posttest design. One Groups Pretest-Posttest Design is a research design that contains a pretest before treatment and posttest after treatment (Surur et al., 2020). Thus it can be known more accurately, because it can compare before treatment and after treatment. The design of this study can be illustrated in Table 1.

**Table 1.** One Group Pretest Posttest Design Research Design

Pretest	Treatment	Posttest
$O_1$	X	$O_2$

Remarks :

$O_1$  : Pretest Value

X : Treatment (PUBG Learning Media)

$O_2$  : Posttest Value (Posttest Administration)

The independent variable in this study is the Pop Up Book learning media. A dependent variable is an output that is affected by an independent variable. The dependent variable in this study is the learning outcomes of learners. The population in this study was all students of grade IV ICC Pahang Malaysia, amounting to 18 students. Assessment of student learning outcomes in this study used pretest and posttest from student test results to see whether after the implementation of Pop-up Book learning media student learning outcomes at the time of posttest increased compared to pretest time. Data analysis techniques use t-test-related samples to test hypotheses.

## 3. RESULT AND DISCUSSION

### Result

To find out the results of the difference in understanding the concept of building student space before using the media and after using Pop-Up Book Geometry learning media, the data is processed using frequency distribution. For the calculation results can be seen on Table 2.

**Table 2.** Comparison of Pretest and Posttest Results of Class IV Students of ICC Pahang Malaysia

Number	Statistics	Pretest	Posttest
1	Sum	785	1400
2	$\bar{X}$	43.61	77.78
3	$X_{\max}$	60	90
4	$X_{\min}$	30	70
5	$\sigma^2$	122.958	50.654
6	$s^2$	11.089	7.117

Based on Table 2, it can be seen that there are differences in students' grades during the pretest and posttest. If you look at the minimum completeness criteria (KKM) at ICC Pahang Malaysia, which is 70, it can be seen that at the time of the pretest the student's score is below the minimum completeness criterion value, this can be seen from the  $X_{\max}$  score at the time of the pretest which is still below 70. Meanwhile, when the posttest students' overall scores have met the minimum completeness criteria score,

this can be seen in the  $X_{\min}$  score when the posttest has reached 70 and above. Then if you look at the average score of students at the time of the posttest is higher when compared to the grades of students at the time of the pretest.

Furthermore, a Correlation Coefficient Test ( $r$ ) is carried out before testing the hypothesis, the value of the correlation coefficient between the two research variables is first calculated. This is necessary because in the calculation of the hypothesis test, the value of the correlation coefficient ( $r$ ). Based on the data from the pretest and posttest results, a coefficient correlation test was carried out where the  $r$  value was found to be 0.518.

After conducting the coefficient correlation test, the last is to conduct a Hypothesis Test to prove the hypothesis of this study, then hypothesis testing is carried out. The data used for hypothesis testing are pretest and posttest result data. Based on the data from the final test results of the research sample, the average value ( $\bar{x}$ ) for the posttest was 77.78, the standard deviation ( $s$ ) was 7.117 and the variance ( $s^2$ ) was 50.654. As for the pretest, the average ( $\bar{x}$ ) was 43.61; The standard deviation is ( $S$ ) 11.089 and the variance ( $S^2$ ) is 122.958. The value of the correlation coefficient ( $r$ ) is 0.518. After conducting the correlation coefficient test, a hypothesis test was then carried out using the related sample t-test. The results of hypothesis testing using the t-test sample related can be seen in [Tabel 3](#).

**Table 3. Related Sample T-Test Results**

Number	Statistics	Pretest	Posttest
1	N		18
2	t-count		2.420
3	t-table		1.746
4	$H_0$		Rejected

From the results of the calculation as show in [Table 3](#),  $t_{\text{count}}$  value of 2.420 was obtained and then consulted on a  $t_{\text{table}}$  With a significant level of 0.05 and  $dk = n_1 - 2 = 18 - 2 = 16$ . Furthermore, the value of  $t_{\text{table}}$  is determined with  $dk = 16$  i.e.  $t\text{-table} = 1.746$ , so  $t\text{-count} > t\text{-table}$  i.e.  $2.420 > 1.746$  or  $t\text{-count} = 2.420$  does not lie in the interval:  $-1.746 \leq t \leq 1.746$  which means  $H_0$  is rejected and  $H_a$  is accepted. From these results, it can be concluded that there is an influence of Pop Up Book of Geometry learning media on the understanding of the concept of building student space.

## Discussion

In this research there are two stages, namely the pretest stage where students have not been introduced to learning media in the teaching and learning process and the second is the posttest where students have used learning media during the teaching and learning process. Based on the results of research during the pretest or before the Pop Up Bool Geometry (PUBG) learning media was used, students' understanding of the concept of building space was still very low. This can be proven from the average score and maximum score of students during the pretest, where students obtained an average score of 43.61 with a maximum score ( $X_{\max}$ ) of 60. This score is still far below the minimum completion criteria score (KKM) of 70. Based on the results observations, students' low understanding of the concept of building space because the learning process tends to be passive due to the lack of learning media used ([Khasanah et al., 2021](#); [Musliha & Revita, 2021](#)).

However, after using the Pop-Up Book Geometry (PUBG) learning media, students' understanding of the concept of building space increased and they met the minimum completeness standard (KKM) score. This can be seen from the posttest results where the student's average score increased to 77.78 and the student's lowest score ( $X_{\min}$ ) was 70. This shows that the use of learning media is really needed to increase students' understanding of the concept of spatial structure. This is also proven by the discovery of the influence of using Pop-Up Book Geometry (PUBG) media on students' understanding of the concept of building space ([Elmunyah et al., 2019](#); [Yara & Taufik, 2021](#)). Where the results of hypothesis testing using the related sample t-test, it was found that the calculated t-value was greater than the  $t_{\text{table}}$  value ( $2.420 > 1.746$ ) which means that  $H_0$  was rejected. So it can be concluded that the use of Pop-Up Book Geometry media influences the understanding of the concept of building space for class IV students at ICC Pahang Malaysia.

In accordance with research conducted by previous study that state the use of Pop-Up Book media affects the understanding of the concept of building space in students, it can be seen after using learning media using Pop-Up Book, student learning outcomes are better than before using Pop-Up Book learning media ([Solichah & Mariana, 2018](#)). This can be seen from the difference in understanding the concept of building student space when students have not learned to use learning media compared to after students learn to use learning media. By applying learning media during the educational experience, it tends to be



guaranteed that understudies can expand how they might interpret the material that has been given, understudies become more invigorated, more inventive, and more dynamic and an alternate climate is made during the growing experience in light of the fact that Pop Up Book media utilized is extremely fascinating for understudies, so understudies can take care of issues better.

The use of learning media in the teaching and learning process is very necessary to increase students' understanding of mathematical concepts, especially in geometric materials. Using learning media will make students more active in the teaching and learning process. Whether or not learning media is used in the learning process will affect students' ability to understand the material provided. One of the obstacles that students need to overcome in understanding the concept of spatial shapes is that students' ability to do spatial geometry calculation problems using the correct formula is still very low. Therefore, using learning media such as the Geometry Pop-Up Book, which in this media displays mathematical formulas in calculating geometric shapes, is the right solution to overcome student problems (Anisa Fitri, 2018; Bustanika, 2019; Elfiani et al., 2019).

This is also supported by research conducted by previous study which found that there is a comparison of understanding the concept of building student space during the pretest and posttest where the scores of the test results obtained by students at the time of the posttest are higher when compared to the scores at the time of the pretest (Pradiani et al., 2023). Other study revealed several advantages of using Pop-Up Book media during learning, which allows students to increase their understanding of the concept of building space, students also become more active during the learning process (Pradiani et al., 2023).

The use of PUBG learning media is very helpful for students in understanding the material to build the space studied. Students not only listen to the explanation of the material from the teacher but also observe and construct the building of space directly. PUBG learning media makes learning more interesting, effective, and creative because students, especially elementary school students, still think concretely, everything conveyed by teachers must be proven directly with their eyes. This study has limitations and weaknesses, where in this study the number of student samples used is very limited. Then, in the application of learning media is still not optimal enough, there are still many shortcomings that need to be corrected even though the results shown can increase student understanding, but can still be improved again to be more optimal so that students' understanding of mathematical concepts can also be further improved.

#### 4. CONCLUSION

Based on the results of research findings based on data analysis and hypothesis testing, the conclusion that can be stated in this study is that there is an influence of Pop Up Book learning media on increasing understanding of the concept of building ICC Pahang Malaysia student space. The use of Pop-Up Book Of Geometry Learning Media has a high level of effectiveness in learning. This is evidenced by the increase in students' scores at the time of the posttest compared to the time of the pretest.

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