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EFFECTIVENESS OF POLYHEDRONS MULTIMEDIA USING ARTICULATE STORYLINE BASED ON EXPERIENTIALISM THEORY TOWARD STUDENTS' LEARNING OUTCOMES AND MEMORY RETENTION

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Abstract:
Learning outcomes and memory retention play a crucial role in mathematical learning. However, many students still show low learning outcomes and memory retention, especially in the polyhedron topics. The objective of this study is to examine the effectiveness of multimedia based on Articulate Storyline, oriented to the experientialism theory, student learning outcomes, and memory retention. The study uses a quantitative approach with a quasi-experimental design of the pretest and posttest non-equivalent control group types. The research population is all grade VIII students in one of the Middle schools in Wonosobo Regency. A total of 32 students from class VIII B were assigned as the experimental group, while 32 students from class VIII C served as the control group. The data collection instruments consisted of multiple-choice tests to measure students' learning outcomes and essays to measure students' memory retention. Both have been tested for validity and reliability. Data analysis involved the use of inferential and descriptive statistics. The findings revealed that the learning achievements of students in the experimental group were significantly higher than those in the control group. Additionally, the memory retention of students in the experimental group was also superior to that of the control group. These results provide valuable insights for educators and instructional media developers in creating meaningful learning experiences to enhance students' understanding and memory retention.

Keywords: Articulate Storyline, Experiential Learning Theory, Learning Outcome, Memory Retention, Multimedia

EFEKTIVITAS MULTIMEDIA BANGUN RUANG MENGGUNAKAN ARTICULATE STORYLINE BERBASIS TEORI EKSPERIENSIALISME TERHADAP HASIL BELAJAR DAN RETENSI MEMORI SISWA

Abstrak:
Hasil belajar dan retensi memori berperan penting dalam pembelajaran matematika. Namun, banyak siswa masih menunjukkan hasil belajar dan retensi memori yang

rendah, khususnya pada topik bangun ruang sisi datar. Penelitian ini bertujuan menguji efektivitas multimedia berbasis Articulate Storyline yang berorientasi pada teori eksperiensialisme terhadap hasil belajar dan retensi memori siswa. Penelitian menggunakan pendekatan kuantitatif dengan desain quasi-experimental tipe pretest and posttest non-equivalent control group. Populasi penelitian adalah seluruh siswa kelas VIII di salah satu SMP Negeri di Kabupaten Wonosobo. Sampel terdiri dari 32 siswa kelas VIII B sebagai kelas eksperimen dan 32 siswa kelas VIII C sebagai kelas kontrol. Instrumen pengumpulan data terdiri dari tes pilihan ganda untuk mengukur hasil belajar siswa dan uraian untuk mengukur retensi memori siswa. Keduanya telah diuji validitas dan reliabilitasnnya. Analisis data dilakukan dengan statistik inferensial dan deskriptif. Hasil penelitian menunjukkan bahwa hasil belajar siswa kelas eksperimen lebih tinggi dibandingkan kelas kontrol. Retensi memori siswa kelas eksperimen juga lebih baik dibandingkan kelas kontrol. Temuan ini memberikan implikasi bagi pendidik dan pengembang media pembelajaran dalam merancang pengalaman belajar yang bermakna untuk meningkatkan pemahaman dan daya ingat siswa.

Kata Kunci: Articulate Storyline, Teori Belajar Eksperiensial, Hasil Belajar, Retensi Memori, Multimedia

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INTRODUCTION

The success of education in Indonesia is determined by the students' ability to understand concepts and by their ability to retain that knowledge for the long term, which depends on memory retention (Firdayanti, Asfar, Asfar, & Ulfayanti, 2019). Memory retention is the ability of students to store, remember, and reapply the knowledge they have learned (Silmiati, 2017). In mathematics learning, retention includes memory, deep understanding, and continuous integration of concepts (Mosia & Egara, 2024). Therefore, understanding mathematics learning concepts requires good memory retention support (Afiyah & Sutriyani, 2024). Good memory retention will make it easier for students to understand the next mathematics learning. Strong memory retention will make it easier for students to follow math learning in the later stages. Thus, students need to have good memory retention in order to achieve optimal learning outcomes.

Mathematics learning outcomes reflect the learning process's success and can be an indicator of the effectiveness of student memory retention (Sudjana, 2009). Optimal learning outcomes show that students remember information and can relate to and use that knowledge logically and systematically (Atika, Idris, Abrar, & Majid, 2020). Therefore, students need to have good learning outcomes to show overall mastery of the material, and teachers can also adjust learning strategies to improve the quality of student understanding and retention in mathematics.

However, in reality, the retention of students' memory and learning outcomes is still relatively low, which is caused by students' lack of active involvement in the learning process and the lack of integration of mathematical concepts with daily life (Suhasto, Nasikhah, Zulaiha, & Rosfalia, 2025). This is supported by the results of initial observations and structured interviews with teachers and grade VII students at one of the State Junior High Schools in Wonosobo Regency, which showed that students had difficulty in reconstructing conceptual understanding of the characteristics, surface area formulas, and volumes of building spaces such as cubes, rectangular prism, prism, and pyramid. They also encounter obstacles in drawing logical conclusions from the properties of polyhedron and understanding the effect of dimensional changes on their volume. In addition, the observations show that students are less able to remember and apply the basic principles of polyhedron in solving simple problems. They also have difficulty connecting concepts they have learned to solve problems, and often make mistakes in identifying relevant information with the right answer. Therefore, appropriate efforts are needed to overcome low learning outcomes and student memory retention to support the mastery of geometry concepts thoroughly. One of the solutions that can be applied to improve student memory retention is using multimedia-based learning media (Mattoliang, Jabal, Nur, & Riswandi, 2022; Saputri & Nugrahaeni, 2021).

Multimedia combines various digital media such as text, images, sound, and video in one interactive presentation to convey information in a multisensory manner (Neo & Neo, 2004). According to Worang, Rantung, and Parinsi (2021), multimedia combines two or more communication media with interactive characteristics to produce an engaging presentation. In mathematics learning, multimedia was developed to improve students' conceptual understanding and memory retention, especially in polyhedron materials, by utilizing Articulate Storyline software (Saputro & Lumbantoruan, 2020).

Articulate Storyline allows the presentation of materials such as building spaces, lines, and angles in text, audio, video, animation, and interactive evaluations with a Microsoft PowerPoint-like display (Iswara & Cahdriyana, 2022). Selvia, Rochmah, and Sati (2024) added that using Articulate Storyline can help students connect information to solve problems and improve learning outcomes. For the multimedia application to be more effective in building a deep and sustainable understanding, it needs to be supported by the theory of experiential learning that emphasizes learning through action and reflection (Darmayoga, 2023).

According to Kolb (1984), Experientialism or Experiential learning theory is a learning approach that emphasizes the process of knowledge construction through experiential transformation, which involves active thinking and action activities. This means the learning process involves students' hands-on experience to develop new understandings (Hariri & Yayuk, 2018). Therefore, the application of Experientialism theory in learning design enhances both student involvement and the development of long-term memory. Mubarokah (2014) stated that learning that applies the theory of Experientialism has a positive impact because students can identify information, connect concepts, and choose the right answers, thus improving learning outcomes.

Studies concerning the effectiveness of multimedia in mathematics learning have been widely conducted before. Some of them were carried out by Pratiwi, Prananosa, and Egok (2024) related to the development of interactive multimedia based on Articulate Storyline in mathematics learning, Worang, Rantung, and Parinsi (2021) regarding multimedia-based learning media, Saputri and Nugrahaeni (2021) regarding the development of multimedia-based thematic teaching materials, Oktaviani and Purwanto (2024) related to the use of interactive multimedia to enhance students' learning abilities, Muzakkir, Pomalato, and Katili (2022) related to the effectiveness of interactive multimedia smartphone-based. Rahmawati, Buchori, and Endahwuri (2016) who examine multimedia in the context of realistic mathematics education (RME) learning. However, from these studies, no studies have been found that specifically test the effectiveness of multimedia with Articulate Storylines oriented to the theory of experientialism on learning outcomes and student memory retention in polyhedron materials. Therefore, an in-depth study is needed to analyze the effectiveness of Articulate Storyline multimedia oriented to experiential learning theory in mathematics learning, given the importance of improving memory retention and students' conceptual understanding of complex

geometric materials such as polyhedron. This research is important because low learning outcomes and retention can cause students to experience difficulties in understanding and applying the concept of polyhedron in the context of advanced learning and daily life. This research can also provide new insights into the application of technology in improving students' learning outcomes and memory retention through a more interactive and reflective learning experience.

Based on this description, the problem statement of this study is: How effective is the multimedia Articulate Storyline oriented to the theory of experientialism on learning outcomes and student memory retention in polyhedron materials? Therefore, this study aims to test the effectiveness of Articulate Storyline multimedia oriented to the theory of experientialism on learning outcomes and student memory retention in polyhedron materials. This study hypothesizes that students who receive learning using multimedia Articulate Storyline oriented to experientialism theory have better learning outcomes and memory retention compared to students who do not use the multimedia. This study also opens future research opportunities to explore the application of Experientialism-based multimedia on other complex geometry topics or different levels of education, as well as to investigate long-term effects on students' conceptual understanding and engagement.

METHODS

The present research uses a quantitative-quasi-experimental approach with a pretest-posttest nonequivalent control group design (Creswell & Creswell, 2017; Reichardt, 2019). This method suits real classroom settings where random assignment is not possible, yet still allows for comparison between groups and controls for initial differences. Unlike a true-experimental design that requires random assignment, the quasi-experimental approach acknowledges pre-existing classroom settings while still applying rigorous measurement through pretests and posttests. The research design is illustrated in figure 1. This study has two variables: the independent variable (a multimedia polyhedron with an Articulate Storyline based on experiential learning theory) and the dependent variables (learning outcomes and student memory retention).

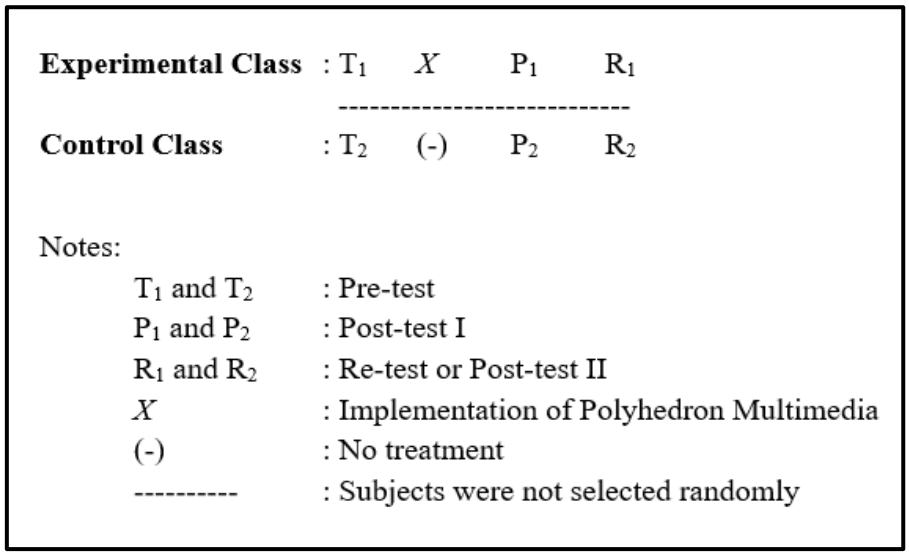

Figure 1. Research Design

The population of this research involved all eighth-grade students in the even semester from a public middle school located in Wonosobo Regency. The study sample was not randomly selected because it used a pretest and posttest nonequivalent control group design (Sutama, Hidayati, & Novitasari, 2022). The pretest and posttest consisted of equivalent items in terms of structure and cognitive level, but differed in numerical values or contexts to avoid memorization effects. A total of 32 students in class B and class C were used as research samples, which were then separated into two groups, specifically an experimental class and a control class. Class B is designated as the experimental class, while class C is the control class. The experimental class received treatment in the form of mathematics learning on polyhedron using multimedia Articulate Storyline based on experiential learning theory. Meanwhile, the control class received conventional learning using PowerPoint media. Both learning and treatments were carried out in one meeting. This research was carried out in the period from January to March 2025.

Data was collected using two types of instruments: instruments to measure mathematics learning outcomes and student memory retention. Student learning outcomes were measured using test instruments in five essay questions designed based on indicators of competency achievement on polyhedron (see table 1). The five essay questions were used in pre-test and post-test I. The essay questions used in the pre-test and post-test were not identical, but were designed to be equivalent in terms of difficulty level, structure, and content coverage. As for memory retention, a test instrument

consisting of 20 items in multiple-choice format on polyhedron. The questions are arranged based on memory retention indicators, which can be seen in table 2 (Hilgard & Bower, 1975; Umainingsih, Alexon, & Kurniah, 2017).

The multiple-choice questions were used in post-test II to measure students' memory retention. These multiple-choice questions were arranged using the same mathematical problems as the essay questions. Both instruments have undergone validity and reliability tests before being used in data collection.

Table 1. Indicators of Competency Achievement on Polyhedrons

Core Competencies	Indicators of Competency Achievement
3.9 Differentiating and calculating the surface area and volume of various polyhedron (cubes, rectangular prisms, prisms, and pyramids)	3.9.1 Identifying polyhedron elements (cube, rectangular prism, prism, and pyramid)
	3.9.2 Calculating the surface area of polyhedron (cube, rectangular prism, pyramid, and prism)
	3.9.3 Determining the volume of polyhedron (cube, rectangular prism, prism, and pyramid)
4.9 Solving problems related to the surface area and volume of polyhedron (cube, rectangular prism, pyramid, and prism), as well as their combinations	4.9.1 Solving problems related to the surface area and volume of polyhedron (cube, rectangular prism, pyramid, and prism

Source : Mendikbud RI (2018)

The validity test involved two experts in mathematics education and was analyzed using the Content Validity Index (CVI) based on the Aiken coefficient (Aiken, 1980). All essay questions have a CVI value of > 0.80, which indicates high validity. The validity of memory retention test results showed that 17 items obtained a CVI score of > 0.80, indicating a high level of validity. In comparison, the other three items had a CVI value between 0.60 as well as 0.79, which is classified as moderate validity and required minor revision (Almanasreh, Moles, & Chen, 2019). Meanwhile, Cronbach's Alpha was employed to assess the reliability (Taber, 2018). Cronbach's Alpha was selected to test the reliability of both the essay and multiple-choice instruments because it is a widely

accepted method for assessing internal consistency. The essay test obtained a Cronbach's Alpha value of 0.74, and the multiple-choice test obtained a Cronbach's Alpha value of 0.71. Both values are included in the reliable category (Sujarweni, 2014; Taber, 2018), so the instrument is suitable for the research.

Table 2. Memory Retention Indicators

Memory Retention Aspects	Indicators
Recall	Restating a fact, concept, or procedure that has been learned.
	Re-explaining the concept in their own words.
	Restating relevant information without looking at the source.
Recognition	Identifying the correct information among multiple options.
	Matching a concept with an example.
	Choosing the appropriate answer based on a specific image, table, or situation.
Reintegrative	Connecting some concepts or information to solve a problem.
	Making conclusions based on interrelated information.
	Implementing the information learned in a new context or situation.

Furthermore, based on the research design used (see figure 1), the data collection instrument was applied in three stages: pre-test, post-test I, and post-test II (re-test). The pre-test was conducted to measure students' initial ability in the experimental group and the control class as a basis for determining the initial equivalence between the groups. Post-test I aims to analyze the difference in student learning outcomes in polyhedron material after the treatment is given. The post-test II (re-test) is carried out three weeks after post-test I to measure students' memory retention of the polyhedron material that has been studied (Gowasa, Harahap, & Suyanti, 2010).

Data analysis used inferential statistical tests to test the differences comparing the experimental group with the control group. An independent t-test is applied if the data meet the requirements for normality and homogeneity. Conversely, if the data do not meet both conditions, then the Mann-Whitney test serves as a non-parametric substitute (Nikitina & Chernukha, 2022). In addition, data analysis also uses descriptive statistics to determine the classes with the

best memory retention capabilities. The class with the highest average score or the best median will be considered to have better retention capabilities.

RESULTS AND DISCUSSION

1. Pre-Test Data Analysis

Pre-test score data is used to determine the feasibility of selecting research samples before being given treatment. This eligibility is determined based on the equivalence of students' initial abilities in the experimental class and the control class. For this purpose, an independent t-test is used. However, before that, the normality and homogeneity tests were conducted using the SPSS 16 software.

Table 3. Normality Test Results of Pre-test Data

Class		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Scores	Experiment	.106	32	.200	.975	32	.650
	Control	.128	32	.200	.979	32	.760

Shapiro-Wilk was applied for the normality test due to the sample size being fewer than 50. The results showed significance values of 0.65 (experimental class) and 0.76 (control class), both of which were greater than α = 0.05 (see table 3). This means that the data is distributed normally. The homogeneity test yielded a significance value of 0.223 (> 0.05), so the variance of the two classes could be considered homogeneous (see table 4).

Table 4. Homogeneity Test Results of Pre-test Data

		Levene's Test for Equality of Variance	
		F	Sig.
Scores	Equal variances assumed	1.515	.233
	Equal variances not assumed		

Since the assumption of normality and homogeneity is met, the independent t-test can be used. Table 5 presents the independent t-test results on the pre-test value data, which shows a significance value of 0.3 (> α = 0.05). This means there is no significant difference in the average pre-test score

between the experimental and control classes. Thus, it can be concluded that both classes have equal initial abilities and are suitable for sampling in this study.

Table 5. Independent-t Test Results Pre-test Score

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of The Difference	
							Lower	Upper
Scores	Equal variances assumed	1.045	62	.300	2.766	2.647	-2.525	8.057

2. Post-Test I Data Analysis

After the implementation of the pre-test, post-test I is given to students after they take part in the polyhedron topic learning. Learning activities in the experimental class utilized multimedia created with Articulate Storyline, based on the principles of experiential learning theory. Post-test I aims to determine if there is a difference in learning outcomes between the experimental and control classes. For this reason, an independent t-test is used. Before that, normality and homogeneity tests were carried out using SPSS 16.

Table 6. Normality Test Results of Post-test I Data

Class		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Scores	Experiment	.170	32	.019	.844	32	.000
	Control	.105	32	.200	.984	32	.898

Shapiro-Wilk was applied for the normality test due to the sample size being fewer than 50. Based on table 6, the significance value in the experimental class was 0.000, and in the control class was 0.898. The sig. value in the experimental class was less than $\alpha = 0.05$, which indicates that the data is not normally distributed. Therefore, the independent t-test cannot be used and is replaced by a non-parametric Mann-Whitney test.

Table 7. Mann-Whitney Test Results of Post-test I Data

		Score
Mann-Whitney U		.000
Wilcoxon W		528.000
Z		-6.876
Asymp. Sig. (2-tailed)		.000
Mean Rank	Experimet class	48.500
	Control class	16.500
Sum of Rank	Experimet class	1552.000
	Control class	528.000

Table 7 presents the Mann-Whitney test results, indicating a significance value of 0.000 (< 0.05), suggesting a notable difference in students' learning outcomes between the two classes. In addition, the mean rank in the experimental class (48.5) was higher than that of the control class (16.5), which shows that students in the experimental class had better polyhedron learning outcomes. Thus, using multimedia Articulate Storyline based on experientialism theory effectively improves student learning outcomes. The next analysis will discuss the effectiveness of multimedia on student memory retention based on posttest II (re-test) data.

3. Posttest II (Re-Test) Data Analysis

Posttest II (re-test) score data analysis was carried out to measure students' memory retention of polyhedron material. This analysis covers three aspects. First, an analysis was carried out on the difference in post-test I and post-test II scores in the experimental class to evaluate the retention power of students after receiving treatment. Second, an analysis was carried out on the difference in post-test I and post-test II values in the control class to determine the tendency of memory retention without treatment. Third, a comparison of post-test score II was carried out comparing the experimental group and the control group to see if differences existed in memory retention ability between the two classes.

Table 8. Normality and Homogeneity Test Results Posttest II in Experimental and Control Classes

	Assumption test	Class	Sig.
Post-test 2	Normality Test	Experimental Class	0.000
		Control Class	0.084
	Homogenity Test	Experiment and Control Class	0.000

a. Post-test i and post-test II experimental class

The data of post-test I and post-test II of the experimental class were not normally distributed (see table 6 and 8), so a non-parametric Wilcoxon test was performed. sig. values = 0.278 > α = 0.05 were obtained, so there was no significant difference in posttest scores I and II in the experimental class (see table 9). This means that students in the experimental class can retain the knowledge acquired after learning using multimedia Articulate Storyline based on experiential learning theory, thus showing good memory retention power.

Table 9. Wilcoxon Test Results: Posttest I and II Scores in Experimental Classes

	Experiment 2 – Experiment 1
Z	-1.085[a]
Asymp. Sig. (2-tailed)	.278

a. Based on positive ranks
b. Wilcoxon Signed Ranks Test

b. Post-test I and post-test II control class

Control classes I and II post-test data were normally distributed (see table 6 and 8) and had homogeneous variance (see table 10). Therefore, a paired sample test was carried out. Sig. = 0.000 < α = 0.05 was obtained, resulting in a difference in posttest scores I and II in the control class (see table 11). In addition, the average post-test I = 51.55 > post-test II = 42.2 was also obtained. This means that students in the control class experience a decrease in learning outcomes after a certain time gap, which indicates low memory retention of polyhedron material.

Table 10. Homogeneity Test Results of Posttest I and II Scores in Control Class

		Levene's Test for Equality of Variance	
		F	**Sig.**
Scores	Equal variances assumed	.077	.782
	Equal variances not assumed		

Table 11. Paired Sample Test Results of Posttest I and II Scores in the Control Class

Paired Differences					t	df	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
			Lower	Upper			
9.344	6.200	1.096	7.108	11.579	8.525	31	.000

c. Post-test II experimental class and control class

The data of posttest II values in the experimental class were not normally distributed (see table 8), so a non-parametric Mann-Whitney test was performed. Based on the results of the test (see table 12), a significance value of 0.000 (< α = 0.05) was obtained, indicating a significant difference between the post-test II score in the experimental class and the control class. In addition, the mean rank value of the experimental class is higher than that of the control class. This means that students in the experimental class have better memory retention skills than students in the control class.

Table 12. Results of the Mann-Whitney Test: Posttest II Scores in Experimental and Control Class

		Score
Mann-Whitney U		12.000
Wilcoxon W		540.000
Z		-6.762
Asymp. Sig. (2-tailed)		.000
Mean Rank	Experimet class	48.120
	Control class	16.880
Sum of Rank	Experimet class	1540.000
	Control class	540.000

The learning outcome and memory retention of grade VIII students in one of the public Middle schools in Wonosobo Regency, in learning polyhedron materials, are still relatively low. To overcome these problems, the researcher applied interactive multimedia-assisted learning developed with Articulate Storyline and based on the experiential learning theory. Figure 2 shows the initial slide of the multimedia. In general, this interactive multimedia consists of learning outcomes, introducing contextual problems about polyhedron, presenting the area and volume material on cubes, blocks, prisms, and limas developed based on these contexts, and multiple-choice evaluation questions. It

also includes an animated video of polyhedron nets and examples of problems and their solutions.

Figure 2. Polyhedron Multimedia Initial Display

Learning begins with presenting contextual problems that are close to students' lives, such as the problem of bathtubs, to introduce the shape of cubes and blocks, reflecting the concrete experience stage in the experiential learning theory. Next, students are guided to observe the shapes and relate them to their geometric representations, corresponding to the reflective observation stage (see figure 3). Then, students are directed to study the properties of polyhedron and develop conceptual understandings through simulations and animated videos, including the invention of the formula of surface area and volume, which reflects the cycle of abstract conceptualization. Finally, students work on quizzes and interactive exercises designed to test the application of concepts in various new contexts, which correspond to the cycle of active experimentation. These four stages run sequentially and support each other to strengthen students' memory retention of the material learned.

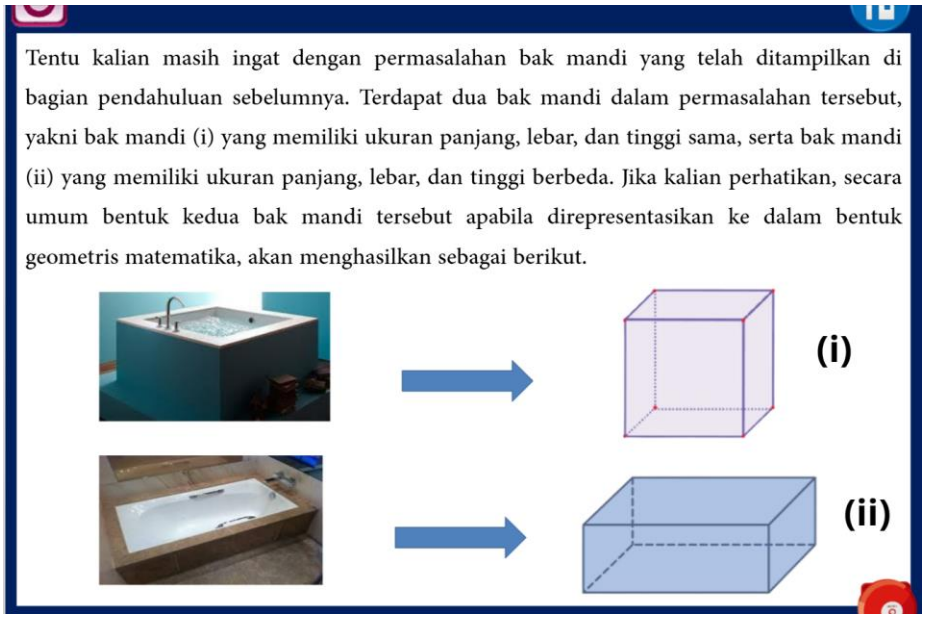

Figure 3. Illustration of Two Types of Bathtubs and Their Geometric Representations

The post-test data analysis results showed a significant difference in polyhedron learning outcomes comparing the experimental class and the control class, which was proven by the Mann-Whitney test with a value of sig. = 0.000 < α = 0.05. The average rank of the experimental class was 48.5, higher than the control class, which was only 16.5, showing the superiority of student learning outcomes in the experimental class. This finding aligns with the opinion of Nurmawati, Masduki, Prayitno, and Dartani (2020) that using interactive multimedia can improve mathematics learning outcomes. Furthermore, Articulate Storyline, as one of the interactive multimedia development tools, has proven to be effective in improving student learning outcomes (Ratnaningsih, Husain, Patmawati, Sukirwan, Hidayat, & Romdiani, 2024). In addition, Etyarisky and Marsigit (2022) found that interactive multimedia based on a contextual approach contributes positively to students' understanding of concepts, ultimately impacting learning outcomes. This is also in line with the theory of experientialism, which begins with presenting contextual problems as stages of concrete experience (Kolb, 2014).

Then, the analysis of post-test II (re-test) data showed that students in the experimental class tended to maintain memory retention. On the other hand, students in the control group showed a decline. This is supported by the Wilcoxon test results in the experimental group between post-test I and II, indicating no significant difference (sig. = 0.278 > α = 0.05). In contrast, the

control class showed significant differences based on a paired t-test (sig. = 0.000 < α = 0.05), with the average post-test score II (42.2) lower than that of post-test I (51.55). In addition, the results of post-test II (re-test) indicated that the experimental class exhibited stronger memory retention compared to the control class. The results of the Mann-Whitney test showed a significant difference between the two groups (sig. = 0.000 < α = 0.05), with the mean rank value of the experimental class (48.12) being higher than that of the control class (16.88).

The findings align with those. Some opinions stated that learning media combining text, audio, animation, and video can improve students' memory retention. Furthermore, Articulate Storyline has features that support the creation of meaningful learning experiences that positively influence a person's memory by enabling deeper understanding and longer-lasting recall (Hadianto, Hidayat, & Atikah, 2023; Vallori, 2014). In addition, an experientialism-based approach allows students to reflect on experiences and relate them to the knowledge they already have (Kolb, 2014), which, according to Yan, Bjork, and Bjork (2016), supports storing information in long-term memory through deep thinking.

Based on this explanation, these findings show the effectiveness of using interactive multimedia with an Articulate Storyline based on experiential learning theory in improving learning outcomes and retention of students' memory or memory, especially in polyhedron materials. Among the interactive features in the Articulate Storyline are animations, simulations, and practice questions designed contextually, which aid in understanding and enhance meaningful learning (Ramadhani & Asrul, 2024). The experientialism approach that involves concrete experiences, reflection, conceptualization, and active experimentation also encourages the strengthening of long-term memory (Kolb, 2014), so that students can better retain the information that has been learned.

CONCLUSION

This study aimed to examine the effectiveness of interactive multimedia developed using Articulate Storyline and grounded in experiential learning theory on the learning outcomes and memory retention of grade VIII students in the topic of polyhedron. The findings show that students who learned with interactive multimedia performed significantly better in both learning outcomes and memory retention than those who received conventional instruction. These results suggest that integrating experientialism principles into multimedia

design can enhance students' understanding and retention of mathematical concepts by providing more engaging and meaningful learning experiences. Thus, multimedia based on experientialism theory is effective in improving students' learning outcomes and memory retention, especially in polyhedron. These findings serve as a basis for educators and researchers of learning media developers to design meaningful and immersive learning experiences that focus on understanding and strengthening students' memory. However, this research was limited by its small sample size and focus on a single topic (polyhedron) and grade level. Future research is encouraged to examine the long-term effects of such multimedia across diverse mathematical content areas, different student populations, and various educational settings to validate and extend the generalizability of these findings.

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