ISSN 2502-5872 (Print)
ISSN 2622-3627 (Electronic)

Volume 9 Number 4, November 2024, 1107-1117

THE EFFECT OF UTILIZING MACROMEDIA FLASH ON CONE MATERIALS ON THE CONCEPTUAL COMPREHENSION OF NINTH-GRADE STUDENTS

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ABSTRACT

This research seeks to ascertain the impact of Macromedia Flash on the conceptual comprehension of ninth-grade students at SMP Negeri 5 Pagaralam regarding cone content. This research employs an experimental design utilizing a Pre-test - Post-test control group methodology. The research utilized observation sheets and essay-format test question sheets as instruments. This study included 29 students who engaged with Macromedia Flash media and 30 students who received conventional instruction. Data gathering methods are conducted by observation and testing. The research findings demonstrate that students utilizing Macromedia Flash learning media exhibit a superior comprehension of topics compared to those engaged in traditional learning methods. The average percentage score for concept understanding indicators was 83.28 in the experimental class and 67.07 in the control class. The experimental class surpasses the control class. Consequently, the utilization of Macromedia Flash affects pupils' comprehension of topics.
Keywords: Educational Media, Macromedia Flash, Conceptual Comprehesion

How to Cite: Aswita, N., Widiawati, Widyaningrum, I. (2024). The Impact of Macromedia Flash Utilization in Cone Material on Class IX Students' Conceptual Comprehension. *Mathline: Journal of Mathematics and Mathematics Education, 9*(4), 1107-1117. http://doi.org/10.31943/mathline.v9i4.683

INTRODUCTION

The study of cones is a compelling subject in mathematics for both educators and learners. A cone is a geometric shape characterized by a circular base and a curving surface that is symmetrical around the axis that traverses the center of the circle (Suharjana, 2008) . In our daily activities, we frequently encounter challenges that necessitate the computation of the surface area and volume of a cone. Nonetheless, pupils' comprehension of concepts and application of formulas remains insufficient. Insufficient comprehension frequently results in challenges for students while addressing diverse topics. The primary reason for pupils' inadequate comprehension of mathematics is their inclination to remember concepts instead of genuinely comprehending and mastering the underlying processes. (Hardiyanti, 2016) .

The challenges students frequently encounter stem from their lack of comprehension regarding the objective or meaning of the issue, as well as their difficulty to grasp an equation

(Naisunis et al., 2018) . Students must possess a fundamental comprehension of the necessary concepts while confronting mathematical issues. Nonetheless, there remain students who have not comprehended this concept (Teapon & Indonesia, 2024) . To address this problem, it is anticipated that visual mathematics learning aids will enhance students' cognitive processes and serve as an alternative for teachers and students in comprehending concepts. Interactive learning media is a crucial educational tool for pupils (Suseno et al., 2020) . The utilization of interactive educational media is anticipated to enhance students' performance in learning activities (Nurrita, 2018) . The utilization of educational media can assist instructors in delivering instructional content (Hamid et al., 2020). The introduction of a new paradigm in educational technology aims to enable teachers to conduct engaging and relevant learning activities for pupils. This can be achieved through numerous methods, one of which is utilizing technology, such as video or educational media, to communicate messages efficiently and engagingly (Zhuhuri et al., 2023) . The utilization of learning resources is a crucial component in the application and execution of curriculum concepts (Kurniasih & Sani, 2014) . Macromedia Flash software is frequently utilized as a learning tool. Macromedia Flash facilitates the creation of visual presentations that integrate many media types, such as video recordings, animations, graphics, and audio. This program is highly useful in developing engaging and captivating educational applications. The advantage of Macromedia Flash resides in its capacity to engage students' interest in learning, as the material is conveyed in a comprehensible manner. By pressing the Play button, students can automatically view the animation, facilitating their comprehension of the information presented (Utama, 2012) .

Current advancements pertaining to Macromedia Flash educational media, including. The utilization of Macromedia Flash-based educational tools continues to exhibit numerous deficiencies, particularly in the creation of media that emphasizes solely visual elements. Numerous aspects remain amenable to enhancement, both regarding content and its presentation (Rahmi et al., 2019 ; Wardani & Setyadi, 2020) . The utilization of Macromedia Flash in the educational process can offer advantages for students in the study of mathematics (Umam & Yudi, 2016) . The production of learning media occurs through a sequence of procedures, commencing with the inception stage, progressing to the development stage, and concluding with the validation stage (Meilinda & Nuraisyah, 2018) . The utilization of Macromedia Flash in the creation of educational media is anticipated to facilitate teachers in elucidating abstract concepts while simultaneously enhancing

students' engagement and focus during instruction. This is anticipated to enhance the engagement of maths learning.

Comprehending concepts is a fundamental element of the learning process (Santrock, 2011) . Comprehension of concepts is intricately linked to students' engagement in learning (Holf & Sascha, 2019) and their problem-solving abilities (Barmby et al., 2014) The National Council of Teachers of Mathematics (NCTM) identifies the primary objective in mathematics education as mastering key concepts (Bartell et al., 2013) . Students who have grasped a mathematical idea will exhibit more fluency in problem-solving during mathematics lessons. Mathematics is a discipline in which comprehension of concepts evolves progressively (Beatty, 2011) .

This research seeks to evaluate the impact of Macromedia Flash on class IX pupils' comprehension of cone material. As students' comprehension of a topic improves, it is anticipated that their proficiency would likewise enhance.

RESEARCH METHODOLOGIES

This study employs experimental methodologies. Researchers will assess the impact of Macromedia Flash on conical content concerning the conceptual comprehension of ninth-grade students at SMP Negeri 5 Pagaralam. Researchers will evaluate the conceptual knowledge of pupils across two sample groups: the control group and the experimental group. The experimental design utilized was a control group with pre-test and post-test measurements.

Table 1. *Control Group Pre-test – Post-test*

E	O_1	X	O_2
K	O_3	X	O_4

(Arikunto, 2020)

The study sample comprised 59 students from two classes: class IX.3, which included 29 students as the experimental group, and class IX.2, consisting of 30 students as the control group. This study employs data collection methods via observation and experimentation. The assessment employed is a written examination of five essay questions that adhere to the idea comprehension skills criteria. The criteria for assessing student comprehension of the subject are summarized in Table 2.

Table 2. Assessment Criteria Proportion of Students' Comprehension Proficiency

Indicator	Score	Student responses to questions
Restating a Concept	0	Blank answer
	1	The capacity to rearticulate a concept exists, although it is erroneous.

	2	Revealing an incomplete concept
	3	Restates a concept correctly but in less detail
	4	Re -express a concept completely and correctly
Classifying objects according to certain properties (according to the concept)	0	Blank answer
	1	There is the ability to categorize objects according to specific characteristics according to relevant but incorrect concepts
	2	Categorize objects according to specific characteristics based on relevant but incomplete concepts
	3	Categorize objects according to specific characteristics based on relevant concepts correctly but incompletely
	4	Categorize objects according to specific characteristics based on relevant concepts correctly and completely
Give examples and non-examples of a concept	0	Blank answer
	1	There is the ability to provide illustrations of examples and non- examples of a concept but are wrong
	2	Provides illustrations of examples and non- examples of a concept but is incomplete
	3	Provide illustrations of examples and non-examples of a concept correctly but incompletely
	4	Provide illustrations of examples and non-examples of a concept correctly and completely
Apply concepts or algorithms to problem solving	0	Blank answer
	1	There is the ability to implement concepts or strategies to solve problems but they are wrong
	2	Implement concepts or strategies to solve problems but are incomplete
	3	Implement concepts or strategies to solve problems correctly but incompletely
	4	Implement concepts or strategies to solve problems correctly and completely

(Utami et al., 2021)

This research employed data analysis procedures including observation, tests, normality tests, homogeneity tests and t tests. Where in this research using *SPSS 2 2.0 for Windows* .

RESULTS AND DISCUSSION

This study comprised 59 students divided into two groups, class IX.2 and class IX.3, at SMP Negeri 5 Pagaralam. The assessment consists of five essay questions previously utilized in other courses. The validity, reliability, difficulty index, and distinguishing power have been assessed using SPSS version 22.0 for Windows. The subject of the examination pertains to cones. This research was conducted over a two-week period, with three meetings in each class involved in the study. During the initial meeting, the researcher administered a pretest to evaluate the students' conceptual comprehension of the cone content prior to the

commencement of instruction. Following the pretest, instruction utilizing Macromedia Flash was conducted on cone material. The students were divided into four groups, each including 7 to 8 people, with one laptop allocated to each group. Figure 1 illustrates the stages of the learning process.

Figure 1. Students Observe Cone Net Material

In Figure 1, students are given the opportunity to use Macromedia Flash learning media according to their respective groups. During the learning process with Macromedia Flash , students can operate it smoothly. However, there were several obstacles, as experienced by group 1. They had difficulty moving from the slide explaining cone nets to the next slide . This difficulty arises due to students' lack of understanding of the shape of these nets. However, after the researcher provided additional explanation and guidance, group 1 finally managed to overcome the problem and continued to the next slide.

Figure 2. Difficult Group

In Figure 2, the researcher conducted another round of observations and inquired with additional groups about any difficulties encountered with the Macromedia Flash learning media. Additionally, researchers inquired of students about aspects of the information that remained unclear during the learning process.

Figure 3. Students Respond to The Enumerated Questions Within The Macromedia Flash Program

In Figure 3, if students comprehend the steps of the material presented on the preceding slide, they may advance to the subsequent screen to respond to the evaluation questions. Prior to posing the question, students must first input the name of their group, which is then shown on the laptop screen. Four evaluation questions encompass measures of student comprehension of ideas. Students complete the procedures on blank paper and engage in group discussions to verify the accuracy of their answers.

At the conclusion of the meeting, a posttest was administered to assess students' comprehension of cone topic following the learning process. At the outset of the meeting, a pretest was administered to the students, during which numerous participants provided careless responses, and many answers were left blank. The students' responses on the final test indicate that they effectively addressed each topic, attributable to the activities conducted in the preceding session.

Based on the discussion above, data from observations and tests can be analyzed. Observation results show indicators of students' comphrehension of concepts during learning involving the utilize of Macromedia Flash media in cone material. The average percentage can be seen in the following picture.

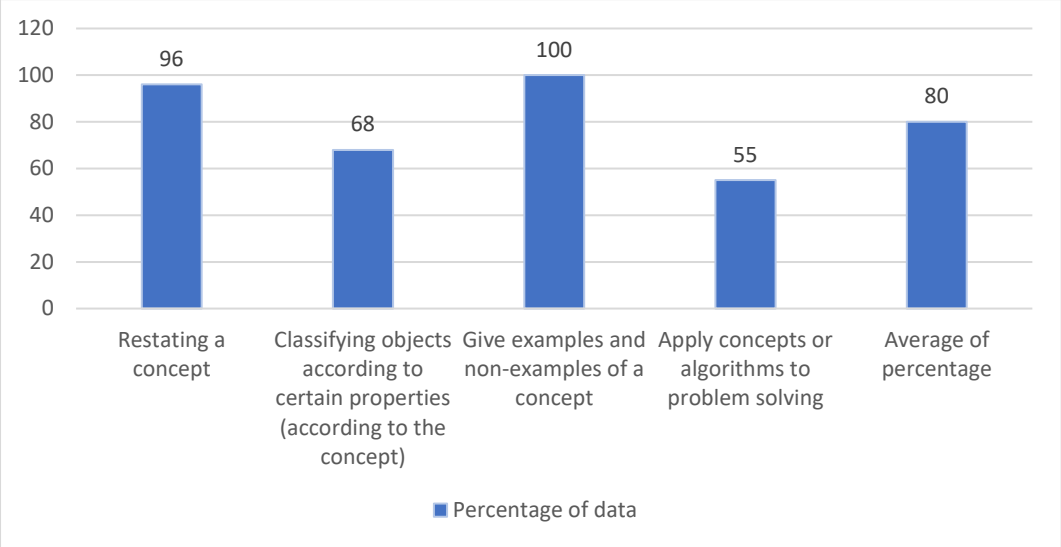

Figure 4. Data on Conceptual Comprehension Observation

In Figure 4, illustrates students' skills derived from observation sheets collected during meetings: the total average of students' conceptual comprehension is 80%, signifying a classification of high proficiency. This suggests that pupils possess a solid comprehension of the topics during conical learning facilitated by Macromedia Flash.

1. Normality test

A normality test was conducted to ascertain the normal distribution of data from both the experimental and control classes.

Table 3. Normality of *Pretest* and *Posttest Data*

Class		Kolmogorov-Smirnov [a]		
		Statistics	df	Sig.
Comprehension of concepts	Pretest IX.3	,142	29	,140
	Pretest IX.2	.141	30	.133
Comprehension of concepts	Experiment Posttest	.144	29	.128
	Control Posttest	.106	30	,200

Table 3 reveals that the pretest results for classes IX.3 and IX.2 in the *Kolmogorov-Smirnov test* yield values of 0.140 > 0.05 and 0.133 > 0.05, signifying a normal distribution of the data. Additionally, the posttest findings indicated significance values of 0.128 > 0.05 and 0.200 > 0.05. The conclusion drawn was that the data had a normal distribution.

2. Homogeneity Test

The homogeneity test is a statistical method used to indicate that a sample group, which consists of one or more groups of sample data, has the same origin from a population and variance .

Table 4. Homogeneity

Comprehension of Concepts				
	Levene Statistics	df1	df2	Sig.
Pretest	2,249	1	57	,139
Post-test	,951	1	57	,334

According to Table 4, the pretest findings for classes IX.3 and IX.2 yield a significance value of 0.139, which above 0.05, signifying that the data is homogeneous. The pretest results for classes IX.3 and IX.2 are normally distributed and homogeneous, thereby qualifying as a research sample. Additionally, the posttest findings indicate a significant value of 0.334, which above 0.05, thereby demonstrating the homogeneity of the data.

3. Hypothesis Testing

The statistical test that will be used is the t-test utilizing the SPSS Version 22 software.

H_0: $\mu_1 = \mu_2$: The comprehension of concepts by students utilizing Macromedia Flash is equivalent to that of students engaged in traditional learning methods.

H_1: $\mu_1 > \mu_2$: The comprehension of concepts by students utilizing Macromedia Flash surpasses that of students engaged in traditional learning methods.

Table 5. *Independent Samples Test*

		t-test for Equality of Means		
		t	**df**	**Sig. (2-tailed)**
Students' comprehension of concepts	Equal variances assumed	6,027	57	,000

Table 5 indicates a Sig (2-tailed) value of 0.000, which is less than 0.05. Subsequently, the null hypothesis H_0 was rejected, and the alternative hypothesis H_1 was adopted. This indicates that the research hypothesis is affirmed. It can be determined that students' proficiency in comprehending concepts through Macromedia Flash surpasses that of their counterparts utilizing traditional learning methods. This indicates that the utilization of Macromedia Flash in cone material affects class IX students' comprehension of concepts.

The researcher subsequently administered five descriptive test questions to students to assess potential variations in conceptual knowledge between those utilizing Macromedia Flash media and those employing conventional means. A graph illustrating the percentage of indications of students' comprehence of concepts between the experimental and control classes is presented in the following image.

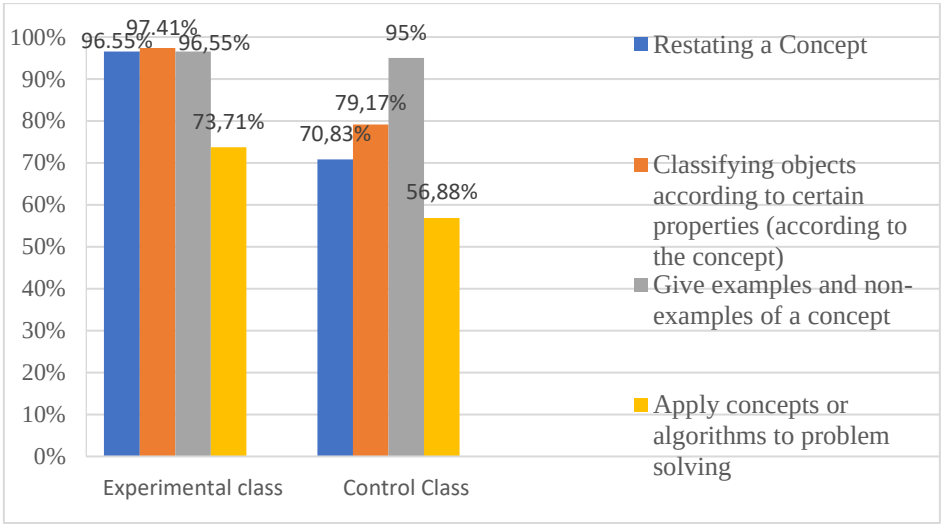

Figure 6. Percentage of Indicators for Students' Comprehension of Concepts

From Figure 6, you can see the average indicator of students' comprehension of concepts ability in the experimental class and the control class. The greatest indication, identifying items based on specific properties according to the concept, attains 97.41%. Moreover, indicators that reiterate a concept and those that furnish examples and non-examples of a concept constitute 96.55%. Nevertheless, the indicator with the least comprehension is the capacity to implement concepts or algorithms in problem-solving, which stands at 73.71%. Consequently, the experimental class pupils exhibited a superior comprehension of topics compared to those in the control class. In line with research by Utami et al (2021) , where students' ability to understand mathematical concepts is categorized as very high. The ability to understand systematic concepts of students in treatment classes is better than the ability to understand concepts of students in conventional classes (Angkat, 2022) . The advantage of Macromedia Flash in conical material in students' understanding of concepts is that it is easier for students to understand a concept with the help of animated images which are more interesting for students to learn. Here the researcher also knows which of the students do not understand the concept with the help of Macromedia Flash. In the first indicator, namely restating a concept, students can see a slide in Macromedia Flash where students must understand the concept of what a cone is and how to find the formula for the surface area and volume of a cone. The second indicator is classifying objects according to certain properties (according to the concept), in this indicator students must understand what the parts of the cone are. The third indicator is giving examples and non-examples of a concept. In this indicator, students must know which shapes are examples of cones in everyday life. The final indicator is applying concepts or algorithms to problem solving. In this indicator, students must understand how and how to proceed in solving problems on questions. In this

Macromedia Flash application, if students make a mistake or don't understand one of the concept, they are unable to proceed to the subsequent indicator or slide.

CONCLUSION

Students' comprehence of concepts is crucial during the learning phase as it can impact their overall accomplishment. The application of Macromedia Flash in educational contexts related to cone material has demonstrated an impact on students' comprehension of concepts. Consequently, it is advisable for educators to focus on this growth. The utilization of Macromedia Flash educational media and inquiry is to facilitate the comprehension of concepts, fostering a durable habit that enables students to address mathematical problems more comprehensively.

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