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The Effect of Using Multimedia-Based Learning on Motivation and Learning Outcomes

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Abstract: Science subject is one of the lessons that does not only convey theory, but requires practice to gain direct experience for students. Weak learning motivation in students causes the low quality of student learning outcomes. The objective of this study is to determine whether usage has any effect multimedia-based learning media on student motivation and learning outcomes of sixth-grade students on solar system material. This study is a quantitative descriptive methodology using a control group with a pretest-posttest design. The participants in this study are Elementary school in Bekasi and 56 students were included in the sample. This study's findings show that the experimental class's N-Gain percentage scores were higher than average, which are 48.1% higher in characteristics of learning motivation and in the control class on N-Gain percentage score is only 29.67%. Similar to the learning motivation, the experimental class's N-Gain percentage score for learning outcomes is 71.02%, while the control class demonstrated a result of 46.58%. As a result, it is possible to conclude that the usage of multimedia-based learning resources has an effect on the sixth-grade students' solar system science learning motivation and learning outcomes.

Keywords: Motivation; Multimedia-based learning; Outcomes learning; Science

Introduction

In this current era 4.0 globalization, technology is increasingly advanced and developed. Technology and the internet have a significant impact on daily life because they influence the activities undertaken out both in social behavior or communicating interpersonally and in groups (Sarıtaş et al., 2022). The educational system in Indonesia, especially at the elementary school level, the majority of schools are still oriented towards memorizing and teacher-centered activities, the consequence is elementary school students' learning becomes dull (Rorimpandey et al., 2022). The learning process are starting to experience renewal following current conditions by employing information and communication technology, such as digital platforms. In order to enhance the effectiveness of the educational process, technological development play an important role (Prasetyo, 2017). The development technology in education has also support teachers to present more images, diagrams, graphs, videos, photos and others in learning process (Mutlu-bayraktar et al., 2019). Science in elementary school also aims to optimize science concepts to helped and be relevant in everyday life (Fitria et al., 2021). Science subjects require basic knowledge, understanding, and application of various concepts to achieve the supposed learning objectives (Deliany et al., 2019). There are several factors that cause science subjects not being able to deliver learning outcomes in elementary schools in line with the curriculum. The choice of learning media is one among them and the low motivation of students to learn in science subjects (Firdaus et al., 2020). The unavailability of technology-based infrastructure that supports science in elementary schools is also one of the strong reasons that is less relevant in today's digital era which allows learning to be done inside and outside the classroom.

Learning motivation is strongly related to the desired learning outcomes or learning process that are

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less enjoyable. Weak learning motivation in students causes the low quality of students learning achievement. Psychic driving force in students can increase learning motivation to achieve a goal (Sularsih et al., 2022). One of the causes for the current digitization era is the learning process with traditional learning (Rimbarizki et al., 2017). One of them is science subject which needs a high level of education motivation for developing thinking skills that might exploited to enhance learning outcomes for students (Khalida et al., 2021). According to Huda et al. (2021), some students are inadequate maximum in science subjects. This is due lack of student activity in learning activities going on. Learning outcomes related to learning motivation. In other words, science subjects require motivation high learning to develop thinking skills which will impact the results of students' learning outcomes (Khalida et al., 2021).

One example of how technology is used in education field is multimedia, which is a medium that has includes all types of media (Sebayang et al., 2023). The definition of "multimedia" is a synthesis of music, text, animation, video, and/or art that is distributed by technology or another media device (Vagg et al., 2020). According to Munir quoted by Pertiwi (2014), the role of multimedia in education has advantages that other media do not have, including: 1) Computer-based multimedia, 2) Multimedia integrates various media, 3) Able to present unreachable objects or events, such as the moon, sun, planets, or orbits, 4) Able to create a pleasant learning atmosphere while increasing students interest and motivation to learn. The reason of multimedia-based learning is that it allows learners to understand instructional information when engaging in active learning (Park et al., 2019).

According to the prior researcher that has done at one of the South Bekasi public schools, it is known that the majority of the grade VI students experience low learning outcomes and motivation to learn science after two years of online learning due to the pandemic. Meanwhile, the tools or media for learning needs at the school are categorized as sufficient with the availability of projectors, speakers, and even a computer lab. With these facilities, multimedia-based learning in schools can run optimally and have an impact on students' motivation and success in learning. Solar system material is supposed to be more understandable by sixth-grade students if it is delivered in the right media and in accordance with technological advances. This is related to multimedia, which combines various types of media that will be used as a visualization of the solar system (Ihzandy, 2016). With multimedia-based learning, students getting to know planets and other space object is clearer than visuals in books. Besides that, the solar system includes both phenomena that must be observed and ideas that are abstract and cannot be seen with the human eye. Students need to focus on what they are learning as a result (Permata et al., 2023). In accordance with the problems and challenges of the development of the era that has been described, we need to use appropriate teaching materials to increase students' learning motivation and outcomes, especially in science subjects.

Method

This study's methodology is a non-equivalent control group design with a quantitative descriptive approach. Students in the sixth grade at one of public Elementary Schools served as the study's subjects. Give a general description of the subject's or object's condition at the present time based on existing facts in a systematic, accurate, factual, and in-depth manner (Musfirah et al., 2022). This method was chosen with the aim of describing research data regarding the impact of using multimedia-based learning media on student motivation and learning outcomes. The design is presented in Table 1 (Handayani et al., 2020).

Table 1. Study Design

Pretest	Implementation	Posttest
0_1	X	0_2
0_3		0_4

Note:

X : Treatment using Multimedia-Based learning
0_1 : Pretest in experimental class
0_2 : Posttest in experimental class
0_3 : Pretest in control class
0_4 : Posttest in control class

The students who participated in this study were students of class VI-B and VI-C. The students had been split into two class; an experimental class composed of 26 students, and a control class consisting of 30 students. To obtain the data, researchers based on tests and questionnaires instrument in the form of pretest-posttest and questionnaire that had been prepared in a structured manner. The questions asked examine students' views on formative assessment, namely motivation and outcomes learning of student. In testing the hypothesis In order to find out whether the use of multimedia based learning media with predetermined variables had an effect, the researcher calculated using a statistical package published for social sciences in version 26 of Social Sciences Programming Software (SPSS). Non-parametric analysis (Mann-Whitney U test) was performed after the preliminary normality test showed a parametric test discrepancy. The Mann-Whitney U test is an alternative test used for t-test. This non-parametric test compares two population means of

the same population and determines whether one of the media is similar (Syamsuar et al., 2022). P < 0.05 was considered statistically significant and P < 0.01 as highly significant (Mat et al., 2022).

The questionnaire consists of 12 questions regarding about motivation in learning about the solar system. The researcher will provide information about system solar material through multimedia-based learning. The Science Motivation Questionnaire II (Glynn et al., 2011) and Mathematics Motivation Questionnaire (MMQ) (Fiorella et al., 2021) was used to create the questionnaire instrument. The construct id shown in Table 2.

Table 2. Questionnaire of Learning Motivation

Aspect	Indicator	Questions	Item number
Learning Motivation	Intrinsic motivation	I find learning about science is interesting	1
		I enjoy when learning solar system	2
		I am curious in discovering sciences	3
		I like science that challenges me	4
		The knowledge that I learned in science corresponds to real life	5
		Learning Solar System science makes my life more useful	6
	Self-regulation	I use strategies to make sure I study about Solar System material well	7
		I put enough effort in studying the material of the Solar System	8
		I studied hard before taking the Solar System material test	9
	Self-efficacy	I am sure that I can complete my tasks for material science about the solar system successfully	10
		I am confident that I can accomplish solar system materials in science tests	11
		I believe that I can get a "100" grade in solar system material	12

A Likert scale with values of 1 to 4 is used to score the questionnaire instrument criteria, with 4 representing "very suitable", 3 representing "suitable", 2 representing "not suitable" and 1 representing "very inappropriate" (Zulherman et al., 2021).

In accordance with the normalized gain value (N-Gain), the effect of multimedia-based learning media on motivation to learn and learning outcomes for students is examined. For the purpose of determining N-Gain score, the formula shall be as follows:

$$N - Gain = \frac{posttest\ score - pretest\ score}{SM1 - pretest\ score} \quad (1)$$

The highest or lowest N-Gain levels are defined according to these criteria (Handayani et al., 2020).

Table 3. Criteria Value N-Gain

Values of N-Gain	Criteria
N-Gain ≥ 0.70	High
0.30 < N-Gain < 0.70	Medium
N-Gain ≤ 0.30	Low

Result and Discussion

The result of the normality and Mann Whitney tests are presented in this section. The data were analyzed using the statistical packages from version 26 of the SPSS. Table 4 display the normality test results utilizing Kolmogorov-Smirnov and Shapiro-Wilk.

Table 4. Test Normality of Learning Motivation

Test Normality of Learning Motivation						
Class	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Experimental Pretest	0.178	26	0.033	0.920	26	0.046
Experimental Posttest	0.111	26	0.200	0.952	26	0.255
Control Pretest	0.201	30	0.003	0.867	30	0.001
Control Posttest	0.115	30	0.200	0.957	30	0.680

a. Lilliefors Significance Correction

According to Table 4, the outcomes of the Kolmogorov-Smirnov normality test of motivation to learn shows significant (p-value) ≤ α (0.05), p 0.200 ≥ α (0.05). It means that only the posttest value has a significance value higher than the alpha value. The outcome is that is not regularly distributed.

According to Table 5, the results of the Kolmogorov-Smirnov test of learning outcomes normality showed that only the pretest control class showed significant (p-value) ≤ α (0.05), p 0.157 ≥ α (0.05) with a p value greater than the significant value. Meanwhile the significant value for experimental class showed (pretest = 0.030, posttest = 0.000) is smaller than

the alpha significance value. As a result, it is produces insignificant results indicating that the data are not normally distributed. According to the findings of the normality test, researchers used the Mann Whitney test as a non-parametric alternative for hypothesis testing. In addition, non-parametric methods are useful for comparing group mean score to ensure that all outliers and results are accounted for accurately.

Table 5. Learning Outcomes Normality Test

Normality Test of Learning Outcomes						
Class	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Experimental Pretest	0.180	26	0.030	0.960	26	0.396
Experimental Posttest	0.286	26	0.000	0.721	26	0.000
Control Pretest	0.137	30	0.157	0.969	30	0.257
Control Posttest	0.156	30	0.061	0.918	30	0.020

Lilliefors Significance Correction

The Effect of Using Multimedia Based-Learning on Learning Motivation

The researcher uses the normalized gain calculation (N-Gain) to determine whether there is an influence or increase in motivation and learning outcomes between classes using multimedia-based learning media and classes using traditional learning materials. Table 6 shows the results of the N-Gain learning motivation test.

Table 6. N-Gain Score Learning Motivation

Aspect	Class	N Gain Score (%)	Min	Max
Learning Motivation	Experimental	48.1%	-10.53	17.14
	Control	29.67%	-8.06	14.10

Based on table 6 above, N-Gain percentage scores are shown to be higher in aspects related to learning motivation of the experimental class, namely 48.1%. While the control class's N-Gain percentage score is only 29.67%. The maximum value of the experimental class shall also be greater than that of the control class (17.14 > 14.10). In accordance with the criteria N-Gain value, whenever the N-Gain percentage score is higher than 0.30 but lower than 0.70, it indicates Medium. So it can be concluded that there is an effected on classes that use multimedia-based learning media.

The Mann Whitney U test's findings on learning motivation and learning outcomes are presented in this section. The data gained will be shown in Table 7. Based on table 7, the researcher found that the results of Mann-Whitney U test having a value 210.000 and Wilcoxon W is 738.500, and also Sig (2-tailed) is .000, indicating that the p value is less than the alpha value. Considering the criteria in the Mann-Whitney test (Sig. 2-tailed < 0.05) means it reject H_0 and accepts H_1. The statistical significance of the use of multimedia educational technology on learning motivation for sixth- grade students is confirmed.

Table 7. Mann-Whitney U Test Learning Motivation

	Learning Motivation
Mann-Whitney U	210.000
Wilcoxon W	738.500
Z	-3.807
Asymp. Sig (2-tailed)	.000

Grouping Variabel: Class

The Effect of Using Multimedia Based-Learning on Learning Outcomes

The increase in science learning outcomes on solar system material was obtained from the difference in the percentage of pretest and posttest. Normalized gains (N-Gain) have been calculated for the purpose of determining whether multimedia-based learning media can produce an effect on learning outcomes of Solar System materials in experimental class. Table 8 shows the results of calculating N-Gain percentage score for both experiments and control classes.

Table 8. N-Gain Score Learning Outcomes

Aspect	Class	N Gain Score (%)	Min	Max
Learning Outcomes	Experimental	71.02	0.00	100.00
	Control	46.58	-35.00	100.00

Based on table 8 above, the results show that for each learning class category, there are differences in the value of learning outcomes (N-Gain). The experimental class showed a result of 71.02% while the control class showed a result of 46.58%. Both classes have the same maximum value, which is 100.00. But at the minimum value, experimental class showed a result of 0.00 and the control class showed a result of -35.00. Based on the N-Gain criteria value, the researcher concluded that the experimental class had a high score and there was an increase in student learning outcomes by using multimedia-based learning media.

Table 9. Mann-Whitney U test Learning Outcomes

	Learning Outcomes
Mann-Whitney U	243.000
Wilcoxon W	771.000
Z	-3.387
Asymp. Sig (2-tailed)	.001

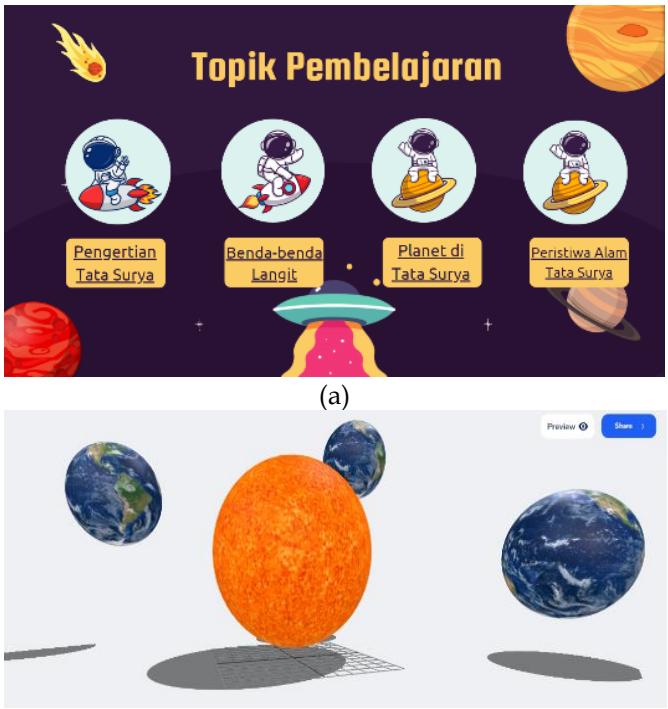
Grouping Variabel: Class

Based on table 9, using the Mann Whitney U test a substantial difference was discovered in the learning outcomes obtained from an experiment class (used

multimedia-based learning) and control class (Non-used multimedia-based learning media) that (U = 243.000, Z = -3.387, and Sig. 2-tailed = 0.001), which means the class of experiments has been better than the class of control.

Discussion

According to the research scenario, the two groups were treated differently. During the learning process treatment was carried out with multimedia-based learning media in an experiment class. In the meantime, multimedia-based learning media were not used by students in the control class. After explaining the material, the researcher distributed the questionnaire again with pretest and posttest questions to students with the aim of finding out how much material was understood about the solar system and whether there was an increase from before using multimedia-based learning media. In implementing the treatment design, the researcher used an inquiry learning strategy where learning focused on the process of critical thinking and analysis to answer questions. Learning activities include questions and answers that formulate various questions relevant to the material being taught to encourage student curiosity. The multimedia-based learning media used uses the *Canva* application in designing learning materials. Apart from that, researchers also introduced a 3D version of the planets using *Assembler Edu*. Where students can imagine the shape and movement of the planets in the solar system.



(a)

(b)

Figure 1. Multimedia-based learning. (a) Learning materials; (b) Shape the planets in 3D

Students' learning outcomes and learning motivation after learning science using multimedia-based learning media experienced an increase in the average score by being included in the medium category when compared to conventional learning. The questionnaire instrument used obtained detailed answers to students' motivation with a presentation score of 48.1%. Supported by previous research (Çeken et al., 2022), it describes the processes that occur in students' minds during meaningful learning from multimedia instruction. Students also play an active role in joining the learning process. This process starts from selecting words and images through vision and hearing sensors. It is then organized into mental interpretations and integrated with existing information from long-term memory. Learning using multimedia-based learning media is also able to help students understand the material more quickly and create interaction between teachers and students in class. This is different from conventional learning, where teachers need to review learning approaches. Multimedia-based learning media makes it easier for teachers to explain learning material, especially the Solar System.

The findings of this study proved that learning using multimedia-based learning in Science Learning had a positive impact on students' motivation and learning outcomes. The results of learning motivation and increased learning outcomes support that using multimedia-based learning media facilitates student learning by imparting knowledge that learns concepts, theories and skills broadly. Supported by previous research quoted from (Gede et al., 2022), that the learning process using multimedia-based learning media is able to help students understand the material and create interaction between teachers and students. Other support from previous research Tuhuteru et al. (2023) confirms that learning for students under 12 years of age feels happy to learn while playing with various multimedia models and has been proven successful. Students are very enthusiastic about the learning materials. Students are also skilled and independent in carrying out their assignments. Have a high curiosity and facilitate learning individually or cooperatively. With strong audio and visual elements, students gave a very satisfying response. Learning is carried out with enthusiasm and joy because the learning delivered by the teacher is not boring.

Conclusion

According to the study's findings, there learning about the solar system uses multimedia-based learning using 56 students as the sample and a Pre-Post Control Group Design research methodology. This research

begins with giving a Pre-Test to measure students' initial abilities and also a questionnaire to determine students' initial motivation before learning to use multimedia-based learning. It may be concluded that the usage of multimedia-based learning media has an impact on student motivation and learning results in the sixth-grade subject of the solar system. This indicates a significant difference between the scores of those who receive treatment through multimedia-based learning media as opposed to students receiving traditional learning.

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Author Contributions
Sausanti Eka Putri: writing-original draft preparation, result, discussion, methodology, conclusion, and editing; Fitri Alyani: analysis and proofreading.

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