Exploring the Correlation between Conceptual Understanding and Creativity Using Google Sites in Physics Learning

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Abstract - *This study is one of the first to explore the potential of Google Sites as an interactive medium to simultaneously enhance conceptual understanding and creativity in physics education. The research aimed to determine the relationship between conceptual understanding and students' creativity. This study was conducted at SMA Negeri 1 Narmada with the research subjects being students of class XI MIPA 5. Data were collected using a test instrument. The correlation test analysis was conducted based on the results of the students' pretest and posttest. The results showed that the average pretest and posttest of students were obtained respectively of 39.80 and 84.71 for conceptual understanding and 36.76 and 80.91 for creativity. The analysis revealed a significant positive correlation between conceptual understanding and students' creativity, with a sig. (2-tailed) value of <0.001. The correlation coefficient was 0.567 for the pretest, indicating a moderate strength of relationship, and 0.787 for the posttest, suggesting a strong relationship. These findings suggest that integrating Google Sites into physics learning can effectively foster both conceptual understanding and creativity, potentially offering a scalable solution for improving critical educational outcomes.*

Keywords*: Relationship; Concept Understanding; Creativity; Google Sites*

INTRODUCTION

Physics is the study of natural phenomena, including heat, motion, pressure, sound, magnetism, electricity, and more. It encompasses concepts, principles, and laws governing both real-world and abstract physical occurrences. This complexity necessitates a strong visual understanding (Al-Qoyyim et al., 2022). Effective physics learning requires a mature and readily comprehensible grasp of concepts to enable students to efficiently and effectively solve physics problems (Hidayat et al., 2022). Consequently, conceptual understanding is a crucial indicator of successful physics learning.

Zuhdi and Makhrus (2020) and Murniati et al. (2020) emphasized the importance of deep conceptual understanding in physics learning. This understanding does not only involve memorization, but also the ability to apply concepts in various situations. To achieve deep understanding, an active learning approach is essential. Recent research by Peşman et al. (2024) shows that through active investigation and direct experience can improve students' conceptual understanding. In addition to conceptual understanding, creativity is essential to solve physics problems effectively (Kosim et al., 2019).

Creativity is the ability to create new patterns and solve problems by exploring one's potential (Sahidu, et al., 2018). Effective learning is not only oriented towards transferring knowledge, but also towards developing students' creativity. By stimulating creative thinking, we can create a fun and effective learning environment (Oo et al., 2024). However, a strong conceptual understanding is the foundation for the growth and development of creativity. Conceptual errors can hinder

students' creative process. Therefore, the use of appropriate learning media is the key to improving students' conceptual understanding and creativity. According to Gunawan (2015), learning media functions to convey information and stimulate students' thinking. In addition, Harjono et al. (2020) added that learning media acts as an effective communication intermediary in the teaching and learning process. One example of potential learning media is interactive media based on Google Sites which can encourage students to be more creative.

Google Sites is one of the potential learning media to improve students' conceptual understanding and creativity. According to Johdi et al. (2024), Google Sites can increase student engagement. However, the study has not examined student creativity in the context of using Google Sites. Hidayat et al. (2023) also highlighted the use of Google Sites for educators and can improve students' conceptual understanding, but there has been no research that has examined in depth the relationship between students' conceptual mastery and creativity in the context of using Google Sites.

The use of Google Sites as a learning medium has shown potential in improving students' conceptual understanding. Specifically, this study will examine the relationship between conceptual understanding and student creativity in physics learning through the use of interactive learning media based on Google Sites.

RESEARCH METHODS

This research was conducted at SMA Negeri 1 Narmada with a population of class XI MIPA 5 students. The selection of this sample was based on the consideration that all students in the class had relatively homogeneous backgrounds, so as to minimize the influence of external variables on the research results. The research instrument used was a test question consisting of questions that measure students' conceptual understanding and creativity. Before being used, the test question instrument had gone through a validation process by a material expert validator. Validation was carried out to ensure that the questions compiled were relevant, valid, and could measure the constructs to be measured. This instrument was used in the form of a pretest and posttest. The pretest was conducted before the learning treatment was given, while the posttest was conducted after the treatment was given. The results of the pretest and posttest were then analyzed to determine the increase in students' conceptual understanding and creativity after being given the treatment. Data obtained from the pretest and posttest results were analyzed using a correlation test. The correlation test is used to determine the direction of the relationship, the strength of the relationship, and the significance of the strength of the relationship between students' conceptual understanding and creativity. The strength of the relationship between the two variables is expressed by a statistical measure called the correlation coefficient (Roflin, et al., 2022).

RESULTS AND DISCUSSION

Results

The research data obtained were in the form of pretest and posttest scores of conceptual understanding and creativity of class XI MIPA 5 students of SMA Negeri 1 Narmada. The average score of conceptual understanding and creativity of students can be seen in Figure 1.

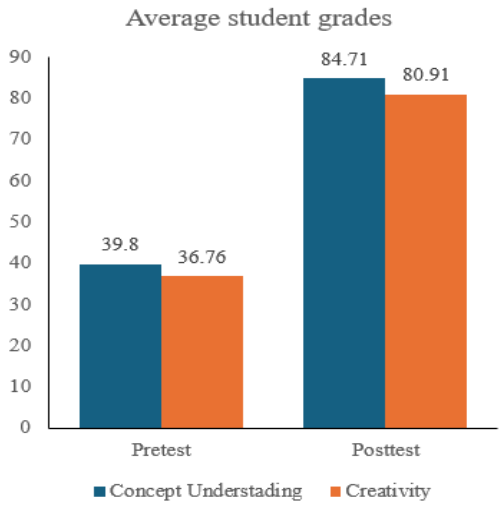

Figure 1. Average student grades

Before the correlation test was conducted, a normality test was conducted to determine whether the data was normally distributed or not. The normality test was conducted using SPSS and the results of the normality test of conceptual understanding are presented in Figure 2.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
pretest copcept	.215	34	.000	.894	34	.003
posttest copcept	.314	34	.000	.818	34	.000

a. Lilliefors Significance Correction

Figure 2. Tests of normality concept understanding

Based on Figure 2 above, it can be concluded that the sig. value in the pretest of conceptual understanding < 0.05 so that it is not normally distributed and the sig. value in the posttest of conceptual understanding < 0.05 so that it is not normally distributed. The results of the creativity normality test can be seen in Figure 3.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
pretest creativity	.134	34	.127	.927	34	.026
posttest creativity	.183	34	.005	.917	34	.013

a. Lilliefors Significance Correction

Figure 3. Tests of normality creativity

Based on the results of the normality test of student creativity in Figure 3, it can be concluded that the sig. value in the creativity pretest < 0.05 so that it is not normally distributed and the sig. value in the creativity posttest < 0.05 so that it is not normally distributed. The results of the normality test above state that the data is not normally distributed so that to conduct a correlation test, the Spearman correlation test is used. The Spearman rank correlation test is used if the data is not normally distributed. The results of the Spearman rank correlation analysis for the pretest are shown in Figure 4 and the Spearman rank correlation analysis for the posttest are shown in Figure 5.

Correlations

			pretest concept	pretest creativity
Spearman's rho	pretest concept	Correlation Coefficient	1.000	.567**
		Sig. (2-tailed)	.	.000
		N	34	34
	pretest creativity	Correlation Coefficient	.567**	1.000
		Sig. (2-tailed)	.000	.
		N	34	34

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 4. Correlations pretest

Correlations

			posttest concept	posttest creativity
Spearman's rho	posttest concept	Correlation Coefficient	1.000	.787**
		Sig. (2-tailed)	.	.000
		N	34	34
	posttest creativity	Correlation Coefficient	.787**	1.000
		Sig. (2-tailed)	.000	.
		N	34	34

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 5. Correlations posttest

Discussion

The results of the study showed a significant increase in both conceptual understanding and student creativity after using Google Sites in physics learning. An increase of 44.91% in conceptual understanding and 44.15% in creativity indicates that Google Sites has succeeded in creating an interactive and collaborative learning environment, encouraging students to actively build their own understanding. This shows that the use of Google Sites as a physics learning medium has succeeded in significantly increasing both conceptual understanding and student creativity.

Correlation analysis on pretest and posttest data of class XI MIPA 5 students of SMA Negeri 1 Narmada as shown in Figure

4 and Figure 5, shows a relationship between students' conceptual understanding and creativity. Figure 4 displays a correlation coefficient of 0.567 in the pretest, indicating a strong positive correlation between the two variables before the intervention. After the implementation of Google Sites as a medium in learning, the correlation coefficient increased significantly to 0.787 as shown in Figure 5. These results indicate a very strong relationship between students' conceptual understanding and creativity. These results also show that the integration of Google Sites as a medium in the learning process has succeeded in improving students' abilities in understanding concepts and thinking creatively. Thus, these findings broaden educators' understanding of the potential of technology in supporting student-centered learning.

This study shows a relationship between conceptual understanding and student creativity. The results of the pretest and posttest strengthen these findings, where the better the student's understanding of a concept, the higher the level of creativity they show. This significant positive relationship shows that deep conceptual understanding is the foundation for the emergence of creative ideas. This finding is in line with Adeyele's (2024) research which shows that the use of interactive learning media such as simulations and multimedia can improve student achievement. This result is also in line with research conducted by Gunawan, et al. (2017) which states that the use of interactive multimedia in learning can improve the understanding of prospective teachers. The use of interactive multimedia in learning can overcome the limitations of facilities in visualizing abstract concepts in electrical concept lectures. In this study, Google Sites as a learning platform with various interactive features has facilitated the formation of a strong relationship between conceptual understanding and student creativity.

There is a relationship between conceptual understanding and student creativity because conceptual understanding in physics learning allows students to be more creative in solving problems and applying their knowledge, while creativity can deepen their understanding of these concepts. According to Arifuddin, et al. (2022) that with this strong understanding, students can more easily develop creative solutions in solving problems and find new, more efficient approaches. Conversely, creativity encourages students to understand physics concepts in different ways, deepen understanding, and deepen the learning experience.

CONCLUSION

Based on data analysis, a very strong positive relationship was found between conceptual understanding and creativity of class XI MIPA 5 students of SMA Negeri 1 Narmada. This result indicates that increasing conceptual understanding significantly contributes to increasing student creativity. This finding has important implications for learning practices, where teachers can focus more on developing deep conceptual understanding to stimulate student creativity. For further research, it is recommended to explore the influence of other variables such as learning styles and learning environments on creativity, as well as comparing the effectiveness of various learning strategies in improving conceptual understanding and creativity.

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