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Use of Multimedia Interactive based on PjBL (Project Based-Learning): Study Effectiveness of Student Creativity in Subject Natural Sciences

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Abstract

21st-century learning requires holistic learning oriented towards developing higher-order thinking skills. The results of the Program for International Student Assessment (PISA) show that the performance of Indonesian students in science is still low and few have high-level thinking skills. The purpose of this study was to determine the effectiveness of using interactive multimedia based on PjBL in increasing student creativity in science subjects. This type of research is a Mix Mathods with one group pre test-post test design. The results of this study indicate that interactive multimedia based on PjBL is quite effective in increasing student creativity in science subjects so that it can be used as a media to support science learning.

Keywords: *Interactive Multimedia; Project Based Learning; Science Learning; Elementary Schools*

Introduction

21st-century learning is the development of multiple intelligences which requires a holistic learning system with the aim that students reach their maximum potential (Liu & Low, 2015). 21st-century learning is taught using: (1) a contextual approach, where students are invited to discover knowledge independently (Sing et al., 2015). (2) Multi-disciplinary and intra-disciplinary learning developed in collaboration between students (Muhali, 2019). (3) Technology as a medium in facilitating learning (Redhana, 2019; Sahin, 2009; Sing et al., 2015). (4) Project-based learning, which requires a project to produce a product as the result. (5) Utilizing high-order thinking (HOTS) (Sing et al., 2015) through various assigned tasks. (6) Collaborative learning in every learning activity to understand concepts and task completion (Redhana, 2019; Sing et al., 2015). (7) Oriented to problem-solving (Redhana, 2019; Sing et al., 2015), all learning is designed to help get used to solving problems. (8) Meanwhile, the assessment in 21st-century learning is carried out by authentic assessment (Redhana, 2019; Sing et al., 2015) and transparent (openness) to students.

The results of the Program for International Student Assessment's (PISA) (Avvisati et al., 2018) show that the performance of Indonesian students (Science) is only a small percentage of Indonesian students (7% on average OECD) are at level 5 or level 6, students creatively and independently

implement knowledge about science in various situations. These results show that students' high-level thinking skills in implementing knowledge are classified as very low.

Creative thinking is one of the 21st-century skills that students need in solving problems, especially in Natural Sciences (IPA) lessons (Yanti et al., 2018). One way to foster creativity in the classroom is by changing teaching and learning materials (Kassim, 2013). The integration of science and technology learning can help foster creative thinking in science, by allowing students to debate, work together, ask or answer questions (Daud et al., 2012).

Interactive Multimedia based on PjBL is a computer-based multimedia product combined with a project-based learning model (PjBL) as teaching materials to support science learning (Acesta et al., 2021; Habib et al., 2020). Multimedia as computerization of several types of media is composed of text, images, audio, and video in the form of applications or intuitive multi-touch presentations that function as a means of conveying information.(Akbar, 2016; Ejem et al., 2017; Nunuk et al., 2018).

Multimedia instruction refers to the presentation of words and images in the form of illustrations, narration, animation, videos, computer-based interactive games (Michelle Rudolph, 2017; Munir, 2015), simulations, or activities that include spoken or printed text intended to foster learning (Iasha et al., 2020; Mayer, 2017). In interactive multimedia, there are interactive applications that have a menu that can be clicked to display certain information (Akbar, 2016).

Research on the use of multimedia has been carried out a lot. Several multimedia research results found that interactive multimedia was effective in improving learning outcomes (Rachmadtullah et al., 2019), activities, interests, learning motivation (Akbar, 2016; Iasha et al., 2018; Kurniawati et al., 2018; Riza et al., 2018), and high-level thinking skills (Liliasari et al., 2016) including critical thinking skills, problem-solving (Altas, 2015; Avianty & Cipta, 2018), and creative thinking (Hakim et al., 2017; Kassim et al., 2014).

The use of multimedia, improving content visualization and user interaction, contributes to the cognitive and affective development of students (Pramujiono et al., 2020; So et al., 2019). Besides, students can actively learn and use higher-order thinking skills such as analysis, synthesis, evaluation, and reflection to solve problems (Liliasari et al., 2016). The use of multimedia can stimulate students' cognitive confrontation and have an active attitude, personal reflection, critical thinking, imagination, creativity, and interactivity, where students are forced to interact with others to complete tasks (Tudor, 2013).

Kassim et al., (2014), in their research found that using multimedia, helps students associate information so that the ability to think creatively (flexible and original ideas) can increase, but it cannot be said to be creative. Research by Hakim et al., (2017) & Liliasari et al., (2016), states that there is an increase in creative thinking in aspects of originality, flexibility, fluency, and elaboration. From some of the things above, it shows that interactive multimedia is effective for fostering student creativity (Juniarso et al., 2020; Setiawan et al., 2021).

Based on the identification of problems and relevant research, this research will focus on the effectiveness of using interactive multimedia based on PjBL on student creativity in science subjects.

Methodology

Research Design

This study aims to find out how effective the use of interactive multimedia based on PjBL is in increasing the creativity of elementary in science subjects. This study used a Mix Mathods because this research is a test of the effectiveness of part of the product development research interactive multimedia based on PjBL. The pre-test and post-test scores were compared to determine whether there were differences in students' creativity scores before and after learning.

Respondents

The population in this study were students of class V SDN Trangkil 01. The sampling technique was purposive sampling with a total sample of 30 people. Sampling was following the considerations of the fifth-grade teacher and the students' heterogeneous abilities.

Instrument

The instrument used in this study was a test item, containing 12 description questions. The questions were adapted from UN questions and several other questions used to determine student creativity.

Data Analysis

Data collection techniques in this study were through pre-test and post-test. The pre-test is used to determine the creative ability of students before learning. Post-test is used to measure students' creative abilities after learning using interactive multimedia based on PjBL. This was done to determine whether there was a difference in the average score before and after learning using interactive multimedia based on PjBL. The test performed was the Paired Sample T-Test with a significance level of 0.05. If there is a difference in average, an N-Gain test is conducted to determine how effective the use of interactive multimedia based on PjBL is. Both tests were carried out with the help of SPSS 24 software.

Results

The results of the analysis in this study are aimed at finding out the effectiveness of PjBL-based interactive multimedia in increasing student creativity in science subjects. It will be explained in the Table 1.

Table 1. Paired samples statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	**pretest**	29.47	30	3.461	.632
	postest	42.00	30	2.901	.530

Based on Table 1, the average score of student creativity before using PjBL-based interactive multimedia is 29.47. Meanwhile, after being given treatment in the form of using interactive multimedia based on PjBL, the average score of student creativity became 42. From the data, there were differences in the average value before and after learning using interactive multimedia based on PjBL. For more details, it can be seen the comparison of the average results of students' creativity scores in the Figure 1.

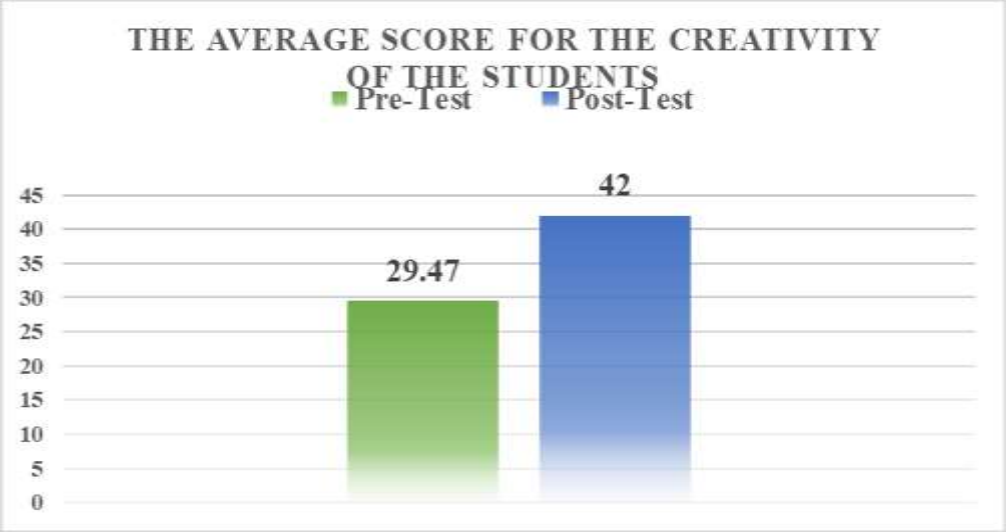

Fig. 1 The average results of students' creativity scores

Tabel 2. Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	**pretest & postest**	30	.931	.000

In Table 2, it is found that the correlation coefficient with the analysis of learning before and after using interactive multimedia based on PjBL on student creativity in science subjects is .931 with sig, or p-value $0.000 \leq 0.05$ or significant.

Table 3. Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	**pretest - postest**	-12.533	1.306	.238	-13.021	-12.046	-52.562	29	.000

In Table 3, the mean difference is -12,533, showing the difference in the average score of students' creativity using interactive multimedia based on PjBL. It shows the value after learning using interactive multimedia based on PjBL is greater than before being given treatment. Furthermore, the results of the Paired Sample T-Test with t = -52,562 with df 29, it is known that the sig value. (2-tailed) of 0,000. The value is 0.000<0.05, then Ho is rejected and Ha is accepted. So it can be concluded: There is an average difference between the pre-test and post-test creativity scores, which means that there is an effect of using interactive multimedia based on PjBL on student creativity in science subjects.

Table 4. The average value of the N-Gain Score

		Statistic	Std. Error
Ngain_Score2	**Mean**	.6890	.02002
	Std. Deviation	.10967	
	Minimum	.53	
	Maximum	.92	

In Table 4, the average value of the N-Gain Score is 0.6890 which is included in the medium category. Thus, it is concluded that interactive multimedia based on PjBL is quite effective in increasing student creativity in science subjects.

Discussion

Through the Paired Sample T-Test in this study, it was found that there were differences in the average pre-test and post-test results as well as the effect of using interactive multimedia based on PjBL in increasing the creativity of grade V SDN students in science subjects. It was proven in this study by increasing the creativity of students through the average N-Gain score between the pre-test and post-test with a value of 0.6890. The N-Gain score obtained was interpreted quite effectively.

During the use of interactive multimedia based on PjBL, students were seen to be active and more enthusiastic in completing projects. Following with the research results of (Iasha et al., 2018), the development and use of multimedia has a positive impact on learning, including student-centered learning, helping to increase student interest and motivation to learn (Akbar, 2016; Kurniawati et al., 2018; Riza et al., 2018) so that learning is more effective.

The results of research by (Rahimi & Allahyari, 2019) show that the use of multimedia in learning have a positive impact on student development, learning situations, and helps students understand abstract concepts. In fact, (Nugroho & Surjono, 2019) found that learning using multimedia makes students more active and creative in carrying out their activities.

By Mayer, (2017) explains how multimedia learning (Cognitive Theory of Multimedia Learning) works, processing auditory sensory, and visual sensory information helps students activate relevant previous knowledge and integrate with new information then stored back into long-term memory. Multimedia provides an auditory and visual learning experience, where students use both sensory skills simultaneously. The use of interactive multimedia makes students happy, not bored, and improves students so that it makes learning meaningful (Reffiane & Bayutama, 2019). Meaningful learning materializes depending on the way students understand various knowledge through conducive learning situations and increased visualization and user interaction in learning about abstract concepts. In accordance with Mayer's (2017) explanation, meaningful learning depends on students involved during learning including selecting, organizing and integrating information.

Creativity for young children involves cognitive processes that develop through social interaction, play, and imagination (Leggett, 2017). The existence of matching projects and games in interactive

multimedia based on PjBL can help increase social interaction between group students to hone creative thinking skills to find new things during the process of completing a project.

Interactive multimedia based on PjBL (Project Based-Learning) developed can increase creativity and collaboration between students in completing projects. Research by Wijayati, Sumarni, & Supanti, (2019) & Yamin, Permanasari, Redjeki, & Sopandi, (2020) found that creative thinking skills can be developed through the application of project-based learning. Research Sugandi & Rasyid, (2019) & Ummah, In'am, & Azmi, (2019) found that the use of project-based learning can increase student creativity. Flexible and original ideas, even though they are not yet complex, can be seen from the results of the posttests that the students do smoothly. Research by Kassim et al., (2014) found that the use of animation in multimedia can increase students' creative thinking to form flexible and original ideas, but they are still partial.

This is where interactive multimedia based on PjBL plays a role in helping to create a conducive learning situation, increasing student activity, interest, and development in understanding concepts by optimizing new information obtained through auditory and visual sensory sensing to create meaningful learning. Also, animated features and interactive multimedia projects based on PjBL help students increase student collaboration and creativity.

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