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EFFECTIVENESS OF WORDWALL-ASSISTED PROBLEM BASED LEARNING ON PROBLEM-SOLVING IN SCIENCE AND TECHNOLOGY

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ABSTRACT

This study aims to evaluate the effectiveness of the Problem Based Learning (PBL) learning model assisted by Wordwall media on the problem-solving ability and learning outcomes of students in science subjects in class V elementary school. Using a quantitative experimental design, the study involved two groups: experimental (Wordwall-assisted PBL) and control (media-free PBL). Data were collected through pre-test and post-test, with the results of the N-Gain analysis showing that the experimental group had an average effectiveness of 78.4% (effective category) compared to the control group's 68.9% (moderately effective category). The T-Test showed significant differences between the two groups, supporting the superiority of Wordwall media use. This research confirms that Wordwall-assisted PBL not only improves problem-solving skills but also makes the learning process more engaging and interactive.

KEYWORDS *Problem Based Learning, Wordwall, problem-solving skills*

INTRODUCTION

The curriculum is a learning tool in the educational teaching unit that is used to achieve national education goals. Schools can also use the curriculum to help with student development, such as structuring or organizing lessons and evaluating student learning (Hidayani, 2017). The change of the 2013 Curriculum to the Independent Curriculum gives schools and educational institutions the freedom to develop education in accordance with this curriculum (Rusmiati et al., 2023). In the Independent Curriculum, teachers have the freedom to create their own learning programs and curriculum. This allows teachers to be more creative and be able to do something new (Mulyasa, 2023). The concept of independence in the Independent Curriculum is in line with the values of Ki Hajar Dewantara, which emphasizes unrestricted education enabling kids to acquire knowledge autonomously and innovatively (Ardianti & Amalia, 2022). In elementary schools, the Independent Curriculum integrates scientific with social studies disciplines into IPAS (Natural and Social Sciences), which in the 2013 Curriculum, science and social studies subjects are taught separately (Wijayanti & Ekantini, 2023).

Natural Sciences (IPA) is one of the subjects related to daily life (Ariani, 2020). The purpose of learning science in elementary school is so that the subject has educational values, namely the capacity to influence the child's whole personality. By doing this learning, students will gain knowledge and understanding of useful science concepts that can be applied in daily life (Yeni et al., 2020). The objectives of learning science in elementary school also include increasing comprehension and application of scientific principles that are beneficial in

everyday life. (Rochimah & Mujiyono, 2015). Students are expected to gain a deeper understanding of the environment through science lessons that focus on questions and actions, because this learning contains questions that can help them learn about themselves and the environment (Pratama et al., 2022). Teachers must make the learning process attract students' attention, a less interesting learning process can make students bored (Retnaningsih, 2023). In addition, in teaching science subjects, teachers can use the right learning model so that the learning process can be easily understood by students. One of the learning models that can be applied is the Problem Based Learning (PBL) learning model, where this learning model emphasizes the formation of student competencies (Indarta et al., 2022).

The problem-based learning paradigm emphasizes the active engagement of students in problem-solving activities, this model starts with the problems found in the work environment so that students can independently gather and integrate new knowledge (Aslan, 2021). This learning model also prioritizes the engaged involvement of pupils in problem-solving (Andriyani & Suniasih, 2021). The Problem Based Learning paradigm use real-world situations as the initial stage for students to acquire fundamental information and ideas from prior learning materials, hence facilitating the formation of new knowledge (Darwati & Purana, 2021). PBL closely concentrates on professional practice and is grounded on genuine evidence-based issues (Bosica et al., 2021).

The advantages of the PBL model are that PBL is an excellent method to understand the content of the lesson, PBL can improve students' learning activities, PBL can challenge students' abilities while making them happy to discover new things, and PBL is considered more fun and liked by students (Marbun & Kembaren, 2023). PBL as a learning model has several advantages, namely, Project-Based Learning (PBL) is an effective method for enhancing comprehension of lesson content, challenging students' capabilities, and fostering satisfaction through the discovery of new knowledge. It promotes student engagement, facilitates the application of knowledge to real-world problems, and encourages the development of new insights while instilling a sense of responsibility in their learning process. Moreover, it can stimulate students to do their own assessments, offer possibilities for the practical application of their information, and cultivate their interests (Aminah, 2022).

In addition to implementing a learning model, one of the factors that causes learning to be boring for students is that teachers prefer conventional learning approaches, where they only talk without learning media (Febrianti et al., 2024). Learning media plays a very essential and irreplaceable role in the educational process in schools, its presence as an inseparable part makes it a key element in achieving learning goals efficiently and effectively (Permana et al., 2024).

Technology-based learning media is currently an interesting thing to discuss, technology as a learning medium in supporting creativity and success in the world of education because it can help human life to do things that cannot be done by relying on empty hands, technology also provides many uses that can make it easier for humans to carry out activities and get information, such as in the world Education, through existing technology, students and teachers can easily access information, read news, read knowledge books and others on the internet and educators can use media such as Power Point, YouTube and other media to make learning more interesting (Julita & Purnasari, 2022).

One of the digital Media applicable in the Wordwall educational process. Wordwall is an application that serves as a learning medium, educational resource, or online e valuation tool that is engaging for pupils (Sari & Yarza, 2021). In science learning, students must be able to spur students to become critical thinkers, students with critical thinking will be able to solve problems that they will later apply to solving problems in real life, so that science learning has a close relationship with students' problem-solving skills (Ramadhani, 2020). Problem-solving abilities are essential for effectively disseminating teaching materials that facilitate student mastery of learning in educational settings (Hanifah & Indarini, 2021). Indicators of problem solving include understanding the problem, developing a strategy or solution plan, solving the problem according to the plan that has been made, and rechecking the answer.

Based on interviews, teachers rarely use digital media due to the lack of LCD Projectors. In the learning process, teachers use media in the form of learning videos and Canva media. Based on the results of interviews with classroom teachers at State Elementary Schools in the Kartini Group, it shows that in the learning process, teachers rarely train students' problem-solving skills in the classroom and teachers rarely create activities that involve students in practicing problem-solving skills. The problem-based learning model has not been used comprehensively, although several other learning models have been given. In learning that applies the Problem Based Learning model, students are required to think critically, actively work together, be able to solve problems and dare to express their opinions to find solutions to existing problems (Handayani & Muhammadi, 2020). Based on conditions in the field and other research results, the application of Problem Based Learning can be used in the learning process. Based on the explanation, the researcher is interested in conducting a study on the effectiveness of Wordwall-assisted problem-based learning on problem-solving ability and student learning outcomes.

RESEARCH METHOD

This study employed an experimental quantitative methodology to assess the efficacy of the Problem Based Learning (PBL) paradigm, augmented by Wordwall media, on the problem-solving skills and scientific learning outcomes of primary school children. The sample was randomly selected from the population of grade V students in the Kartini Cluster, involving two groups: an experiment that received a Wordwall-assisted PBL treatment and a control that used only PBL. The independent variable was the Wordwall-assisted PBL model, while the bound variable was the problem-solving ability. Data were collected through pre-test, post-test, and documentation, with the validity and reliability of the instruments having been tested. Analysis of differentiating power, difficulty level, normality test, homogeneity, and hypothesis test were carried out to ensure the feasibility of the data. The N-Gain analysis results indicated an enhancement in learning outcomes and problem-solving abilities in the experimental group relative to the control group, indicating that the Wordwall-assisted PBL model was effective in improving students' abilities. The data were processed using SPSS, with results that supported the effectiveness of this approach based on the interpretation of the N-Gain category and the partial T test.

RESULT AND DISCUSSION

Analysis of Research Results

The Effectiveness of the Problem Based Learning Model Assisted by Wordwall Media on the Ability to Solve Problems in Science and Technology

In this chapter, the effectiveness of the PBL learning model on problem-solving skills will be discussed in all grade V students of SDN Sidomulyo 04, SDN Gedanganak 02, and SDN Gedanganak 03. In the experimental class that applied the PBL learning model assisted by Wordwall, students' problem-solving skills in the pretest and post-test were as follows.

Table 1. Frequency Distribution of Problem-Solving Ability of Experimental Groups

Statistics			
		Pre-test	**Post-test**
N	Valid	54	54
	Missing	0	0
Mean		43,78	87,91
Std. Error of Mean		1,352	0,670
Median		48,00	88,00
Mode		33	83
Minimum		27	79
Maximum		56	96
Sum		2364	4747

Based on Table 1, it is known that the lowest scores in the pretest and post-test are 27 and 96, while the highest scores in the pretest and post-test are 56 and 96. Problem-solving skills in the control group that applied the PBL learning model in the pretest and post-test are presented in Table 2.

Table 2. Frequency Distribution of Control Group Problem-Solving Capabilities

Statistics			
		Pre-test	**Post-test**
N	Valid	46	46
	Missing	0	0
Mean		43,13	82,30
Std. Error of Mean		0,988	0,973
Median		44,00	81,00
Mode		44	81
Minimum		29	71
Maximum		54	96
Sum		1984	3786

According to Table 2, the minimum scores in the pretest and post-test are 29 and 71, respectively, while the maximum values are 64 and 96. According to Tables 4.3 and 4.4, the experimental group utilising the PBL learning model supplemented by Wordwall achieved a superior post-test score relative to the control group that employed solely the PBL learning

model. The subsequent data presents the average pretest and post-test scores for both the experimental group and the control group.

Table 3. Average Results of Pretest and post-test of Students' Problem-Solving Ability

	Experimental Group	Control Group
Pretest	43,82	43,13
post-test	87,91	82,30
Sum	131,73	125,43
Average	65,87	62,72

According to the average outcomes of the pretest and post-test for both the experimental and control groups presented in Table 3, the experimental group utilising Wordwall demonstrates superiority relative to the control group. The results of the NGain test in both the experimental and control groups are illustrated in the table below.

Table 4. NGain Test Results

Descriptives				
	Group		Statistic	Std. Error
NGain_Percent	Experiment	Mean	78,4375	1,15395
		Minimum	58,70	
		Maximum	92,59	
	Control	Mean	68,9959	1,61449
		Minimum	45,28	
		Maximum	92,00	

The NGain test results in Table 4 indicate that the experimental group has an average score of 78.4375, with a minimum value of 58.70 and a maximum value of 92.59. The experimental group falls inside the effective category on the interpretation of N-Gain efficacy. The control group exhibited an average of 68.9959, with a minimum value of 45.28 and a maximum value of 92.00. According to the classification of NGain efficacy, the control group falls under the moderately effective category.

In addition to using the NGain test, data testing also uses the T-Test NGain test. This was utilized to ascertain if a distinction existed between the experimental group and the control group. Prior to doing the T-Test NGain, it is essential to perform a normality test on NGain Percent to determine if both the experimental and control groups have a normal distribution. The subsequent results pertain to the normalcy test conducted on NGain Percent among both the experimental and control groups.

Table 5. Percent Normality Test Results

Tests of Normality							
		Kolmogorov-Smirnova			Shapiro-Wilk		
	Group	Statistic	df	Mr.	Statistic	df	Sig.
NGain_Percent	Experiment	0,092	54	0,200*	0,970	54	0,193
	Control	0,115	46	0,159	0,969	46	0,264

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

In Table 5, it is known that the NGain Percent of the experimental group has a Sig. value of 0.193 and the control group has a Sig. value of 0.264. Based on the Sig. value, it can be stated that the experimental group is normally distributed because it has a Sig. value of 0.193 > 0.05 and the control group is normally distributed with a Sig. value of 0.264 > 0.05. After the experimental and control groups were declared to have a normal distribution by conducting a normality test, it was followed by the T-Test NGain test to find out if there was a difference between the experimental group and the control group. Here are the results of the T-Test NGain.

Table 6. Statistical Group Output

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
NGain_Percent	Experiment	54	78,4375	8,47980	1,15395
	Control	46	68,9959	10,95001	1,61449

The statistical output in Table 6 indicates that the mean NGain Percent for the experimental group is 78.4%. The interpretation of NGain values (%) indicates that the implementation of the PBL learning model, augmented by Wordwall media in the experimental group, effectively enhances the problem-solving skills of 5th grade elementary students in science for the 2024/2025 academic year.

Additionally, the mean NGain Percent for the control group is 68.9959, which may be rounded to 69%. According to the NGain value interpretation table (%), it can be determined that the implementation of the PBL learning model (in the control group) is moderately successful in enhancing the problem-solving skills of 5th grade primary school students in science for the 2024/2025 academic year.

Thus, statistically descriptively, it can be stated that there is a difference in the effectiveness of the PBL learning model assisted by Wordwall media by only using the PBL learning model in improving students' problem-solving skills. Furthermore, to find out whether there is a significant difference in the effectiveness of media-assisted learning models and those that do not use media, it is necessary to conduct a T-Test NGain test. The following are the output results of the T-Test NGain test.

Table 7. T-Test Results

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
NGain_Percent	Equal variances assumed	3,799	0,054	4,855	98	0,000	9,44160	1,94475	5,58231	13,30088

Independent Samples Test									
	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances not assumed			4,758	84.089	0,000	9,44160	1,98449	5,49529	13,38791

Based on the output results in Table 4.9, it is known that the significance value (Sig) in Levene's Test for Equality of Variances is 0.054. Meanwhile, the value of Sig. (2-tailed) is 0.000.

Discussion

The sample in this study is grade V students at SDN Sidomulyo 04, SDN Gedanganak 02, and SDN Gedanganak 03. Sampling in this study was done using random sampling techniques. Before determining the sample in the study, a homogeneity test was carried out on the population to find out whether the population was homogeneous or not. Homogeneity tests are used to find out if some population variation is true or false (Nasar *et al.*, 2024).

IPAS problem-solving ability with a total of 12 descriptive questions with the number of questions for each indicator of problem-solving ability amounted to 3 questions. The pretest and post-test questions have a maximum score of 100 and a minimum score of 25. Before the large-scale test was carried out, the pretest and post-test were first tested on a small scale, namely 30 grade VI students. This aims to determine whether the pretest and post-test questions are valid and reliable. The validity test assesses the degree of precision and correctness of a measuring instrument (test) in executing its measurement function. A test is deemed to possess high validity if the instrument accurately fulfills its measurement role or yields results that align with the intended purpose of the measurement (Situmorang & Purba, 2019). Reliability tests are not only for test scores, but also important to use when evaluating the use of ratings (Revelle & Condon, 2019). Based on Table 3.4 and Table 3.5, the results of the validity test of pre-test and post-test questions have valid categories. Meanwhile, the results of the reliability test of the pretest and post-test questions showed that the pretest and post-test questions were declared reliable. Based on the results of the test, the pretest and post-test questions can be used on a large scale.

The study of the average pretest scores reveals that the experimental group had a mean of 43.82, whereas the control group had a mean of 43.13, indicating that both groups possess comparable beginning abilities. The study of the average problem-solving abilities in the pretest and post-test revealed an increase in the average score of the post-test for the experimental group compared to the control group. Following the implementation of the media-

assisted PBL learning model Wordwall in the experimental group and the deployment of the PBL learning model without media in the control group, post-test scores were gathered and then analyzed using the NGain test. This aligns with the research done by (Agusti & Aslam, 2022) which indicates that the use of Wordwall media is efficiently implemented in educational contexts, particularly in science topics. According to (Nadia & Desyandri, 2022) the study's results indicate that the utilization of Wordwall learning media positively influences student learning outcomes and enhances the vitality of the learning process.

The study of the NGain exam indicates that the experimental group had superior problem-solving skills relative to the control group. According to the average results, the pretest and post-test scores in the experimental group are higher than those in the control group. The findings of the NGain Percent test corroborate this, revealing that the experimental group attained an average score of 78.4% in the very feasible category, with a minimum score of 58.70 and a maximum score of 92.59. The control group achieved an average score of 68.9% in the feasible category, with a minimum score of 45.28 and a maximum score of 92.

Based on this, the PBL learning model needs to be applied in science and science learning, because this learning model can improve students' problem-solving skills. By applying the PBL learning model, students can face complex situations or cases (Zeliha, 2017). This is in line with research conducted by (Aslan, 2021), that the PBL learning model is the first among the many approaches used to acquire problem-solving skills. Further conveyed by Hendrian *et al.*, 2018, that students who do their PBL learning become more active, creative, able to show good self-confidence, more able to communicate and cooperate in solving problems. Project-Based Learning (PBL) is an engaging method in which students acquire problem-solving skills and knowledge via interaction with peers (Phungsuk *et al.*, 2017).

In addition to using the NGain test, data testing also uses the T-Test NGain test. This was used to find out if there was a difference between the experimental group and the control group. Before the T-Test NGain test is carried out, it is necessary to first conduct a normality test on the NGain Percent. Based on the results of the normality test conducted on the NGain Percent value, it showed a Sig. value of 0.193 in the experimental group and a Sig. value of 0.264 in the control group. Both groups had a Sig. value of more than 0.05 so it can be concluded that the experimental group and the control group were normally distributed.

Following the usual distribution of the two groups, the T Test NGain was conducted. The T-Test NGain findings indicate that the significance value for Levene's Test for Equality of Variances was 0.054, which is more than 0.05. Consequently, it may be inferred that the fluctuation of NGain data (%) for both the experimental and control groups is same or homogenous. The independent test before the t-test for NGain is determined by the significance value found in the Equal variances assumed table. The findings in Table 4.9 indicate that the Sig. (2-tailed) value is 0.000, which is less than 0.05. Consequently, it may be inferred that a substantial disparity exists in the efficacy of media-assisted PBL learning models, such as Wordwall, compared to traditional PBL learning models. The learning process of the PBL paradigm with Wordwall media is participatory; the discussion aspect enhances students' critical thinking abilities as educators supply stimuli beyond just responses (Kusuma et al., 2024). According to Larasati et al. (2024), the implementation of the PBL learning paradigm facilitated by Wordwalls is deemed effective in enhancing scientific learning results.

The findings from the NGain test and the NGain T-Test indicate that the PBL learning model augmented by Wordwall media is more successful than the PBL learning model employed without any learning media assistance.

CONCLUSION

This study demonstrated that the Problem Based Learning (PBL) model assisted by Wordwall media was significantly more effective than PBL without media in enhancing problem-solving skills among grade V elementary school students in IPAS subjects. The N-Gain analysis revealed that the experimental group achieved an "effective" improvement with an average score of 78.4%, compared to the control group's "moderately effective" 68.9%. The T-Test confirmed a significant difference between the groups, underscoring the advantage of integrating Wordwall media into the learning process. This approach not only made learning more engaging and interactive but also fostered critical thinking and problem-solving abilities, leading to better overall learning outcomes. Future research could explore the long-term impact of Wordwall-assisted PBL across different subjects and educational levels to further validate its effectiveness and adaptability.

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