

Problem-Based Learning Assisted by Virtual Role-Playing Exhibition Media for Pancasila Education Learning Outcomes in Elementary School

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ABSTRACT

Pancasila Education requires learning approaches that enable elementary students to understand and apply Pancasila values in meaningful contexts. This study examined the potential of Problem-Based Learning (PBL) assisted by Virtual Role-Playing Exhibition Media to improve fifth-grade students' learning outcomes. A quasi-experimental nonequivalent control group design was employed with 50 fifth-grade students. The experimental group ($n = 25$) received PBL assisted by Virtual Role-Playing Exhibition Media, while the control group ($n = 25$) received Student Teams Achievement Divisions (STAD) instruction. Data were collected through pretest and posttest achievement tests and analyzed using descriptive statistics, Shapiro-Wilk and Levene's tests, normalized gain (N-gain), and an independent-samples t test. The experimental group's mean score increased from 45.80 to 79.00, whereas the control group increased from 46.80 to 73.60. The experimental group also achieved a higher mean N-gain (57.62%) than the control group (49.13%), representing a descriptive difference of 8.49 percentage points. The greater descriptive improvement in the experimental group suggests that integrating contextual problem solving with an interactive virtual exhibition environment may support students' cognitive learning in Pancasila Education. However, the findings should be interpreted cautiously given the small sample, short intervention, and quasi-experimental design. Further research with larger samples and longer interventions is recommended.

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1. INTRODUCTION

Pancasila Education has a strategic role in Indonesian elementary education because it is not merely concerned with students' acquisition of civic knowledge but also with the development of values, attitudes, and behaviors consistent with Pancasila. At the elementary school level, learning experiences are expected to help students understand Pancasila values and relate them to situations encountered in everyday life. Consequently, Pancasila Education requires learning activities that go beyond memorizing concepts and encourage students to interpret, discuss, and apply Pancasila values

in meaningful contexts. This need becomes particularly important when students encounter abstract or broad content, such as Indonesian cultural diversity, that may be difficult to understand through teacher-centered instruction alone.

Preliminary observations conducted in the Ronggowarsito Elementary School Cluster, Trucuk District, Klaten Regency, indicated that students experienced difficulties in learning Pancasila Education, particularly in understanding Indonesian cultural diversity. Classroom instruction was still dominated by conventional activities, while the use of interactive learning models and digital media was limited. These conditions were reflected in students' learning outcomes. At SDN 1 Kalikebo, only 11 of 25 fifth-grade students (44%) achieved the Learning Objective Achievement Criteria (Kriteria Ketercapaian Tujuan Pembelajaran [KKTP]), whereas 14 students (56%) had not achieved the criterion. A similar condition was found at SDN 2 Kalikebo, where only 9 of 25 students (36%) achieved the KKTP, while 16 students (64%) remained below the expected criterion. These findings indicate the need for a learning approach that can increase students' active involvement while helping them connect Pancasila concepts with concrete situations.

One approach with the potential to address this problem is Problem-Based Learning (PBL). PBL organizes learning around meaningful problems and positions students as active participants in investigating information, discussing possible solutions, and constructing knowledge through problem-solving activities. Previous research has consistently demonstrated the potential of PBL to improve learning outcomes. A meta-analysis conducted by Asmiyunda and Hardeli (2023), for example, reported a positive effect of PBL on students' learning outcomes across the studies analyzed. More recent meta-analytic evidence also indicates that PBL generally produces positive effects on cognitive and affective learning outcomes compared with other instructional approaches. These findings suggest that PBL can provide an appropriate pedagogical framework for learning that requires students not only to acquire knowledge but also to analyze and apply it to contextual problems.

The characteristics of PBL are particularly relevant to Pancasila Education because Pancasila values are closely related to problems and decisions encountered in students' social lives. Through contextual problems, students can be encouraged to examine situations involving diversity, cooperation, fairness, responsibility, deliberation, and other manifestations of Pancasila values. Instead of receiving these values only as abstract information, students can discuss how they should be applied to concrete situations. In this respect, PBL has the potential to transform Pancasila Education from predominantly content-oriented instruction into a more active process of problem solving and value application.

Nevertheless, the effectiveness of an instructional model is also influenced by the learning environment and media through which students interact with the learning content. Digital learning environments can provide visual, interactive, and contextual experiences that are difficult to create using verbal explanations alone. Virtual environments are particularly relevant because they can represent objects, situations, and learning contexts in ways that allow students to explore learning materials more actively. Meta-analytic evidence has shown that virtual reality-based instruction can positively influence learning outcomes in K–12 and higher education (Merchant et al., 2014). Similarly, Coban et al. (2022), in a meta-analysis of immersive virtual reality research, found an overall positive effect on learning outcomes and reported that the effect was more pronounced in K–12 settings than in higher education. More recent evidence also suggests that virtual learning environments are particularly valuable when they are designed to promote active learner engagement rather than merely present digital information (Conrad et al., 2024).

In the Indonesian context, Huda et al. (2024) reported through meta-analysis that virtual reality media had a moderate positive effect on student learning outcomes. However, the effectiveness of virtual environments should not be assumed to result solely from technological novelty. Learning outcomes may depend on how the technology is integrated with pedagogical activities, the characteristics of the learners, and the instructional design used during learning. Therefore, digital media should function as part of an instructional strategy that requires meaningful student interaction rather than as an isolated technological intervention.

Based on this consideration, the present study integrates PBL with Virtual Role-Playing Exhibition Media. The media provides a three-dimensional digital exhibition environment through which students can explore Pancasila Education content using image galleries, learning videos, contextual case simulations, interactive quizzes, audio narration, and navigational features. The virtual exhibition is intended to provide students with opportunities to explore learning materials while PBL structures their activities around contextual problems. Thus, the media provides the learning environment, whereas PBL provides the pedagogical process through which students identify problems, investigate information, discuss alternatives, and formulate solutions.

Although previous studies have demonstrated positive effects of PBL and virtual learning environments independently, an important contextual gap remains. Existing PBL studies have been widely conducted across different subject areas, while studies of virtual reality and virtual environments have primarily examined their general effects on learning outcomes. In the context of elementary Pancasila Education, however, empirical evidence concerning the integration of PBL with an interactive virtual exhibition environment remains limited. More specifically, limited evidence is available regarding whether such an integration can improve elementary students' cognitive learning outcomes when learning Pancasila values and Indonesian cultural diversity. Addressing this gap is important because the effectiveness of technology-enhanced learning depends not only on the presence of digital technology but also on the pedagogical processes through which students interact with the learning environment.

Accordingly, the novelty of this study lies in the pedagogical integration of PBL with Virtual Role-Playing Exhibition Media in elementary Pancasila Education. Rather than using virtual media solely as a content-delivery tool, the virtual exhibition is embedded within the PBL process to support students in exploring contextual cases, accessing relevant information, discussing problems, and connecting Pancasila values with situations represented in the digital environment. This integration is expected to provide a more meaningful learning experience by combining problem-oriented learning with interactive digital exploration.

Therefore, this study aims to examine the effectiveness of Problem-Based Learning assisted by Virtual Role-Playing Exhibition Media in improving the Pancasila Education learning outcomes of fifth-grade elementary school students. Specifically, the study compares the learning outcomes of students taught through PBL assisted by Virtual Role-Playing Exhibition Media with those of students taught using the Student Teams Achievement Divisions (STAD) model. The study is expected to provide empirical evidence regarding the potential of integrating problem-based pedagogy and interactive virtual media in elementary Pancasila Education.

2. METHOD

2.1 Research Design

This study employed a quantitative approach using a quasi-experimental method with a nonequivalent control group design. This design was selected because the participants were drawn from existing classes and could not be randomly assigned to the experimental and control groups. The study involved two groups: an experimental group that received Problem-Based Learning (PBL) assisted by Virtual Role-Playing Exhibition Media and a control group that received instruction using the Student Teams Achievement Divisions (STAD) model.

Both groups completed a pretest before the intervention and a posttest after the intervention. The pretest was administered to identify students' initial learning outcomes, whereas the posttest was administered to examine changes in learning outcomes following the respective instructional treatments. The research design is presented in Table 1.

Table 1. Nonequivalent Control Group Design

Group	Pretest	Treatment	Posttest
Experimental	O ₁	X ₁	O ₂
Control	O ₃	X ₂	O ₄

Note. O₁ = experimental group pretest; O₂ = experimental group posttest; O₃ = control group pretest; O₄ = control group posttest; X₁ = PBL assisted by Virtual Role-Playing Exhibition Media; X₂ = STAD learning model.

2.2 Participants and Sampling

The population consisted of 103 fifth-grade students from elementary schools in the Ronggowarsito Cluster, Trucuk District, Klaten Regency, in the 2025/2026 academic year. The study involved 50 fifth-grade students divided into two intact groups. The experimental group consisted of 25 students from SDN 1 Kalikebo, whereas the control group consisted of 25 students from SDN 2 Kalikebo.

Because the study used intact classes rather than randomly assigning individual students to experimental conditions, the research employed a quasi-experimental design. The experimental group received PBL assisted by Virtual Role-Playing Exhibition Media, while the control group received instruction using the STAD model. Both groups studied comparable Pancasila Education content and completed pretest and posttest assessments.

2.3 Research Variables and Intervention

The independent variable was the instructional treatment, namely PBL assisted by Virtual Role-Playing Exhibition Media, in the experimental group. The dependent variable was students' cognitive learning outcomes in Pancasila Education as measured using the achievement test.

The intervention focused on Pancasila Education content for fifth-grade students. The experimental group participated in learning activities following the major stages of PBL: (1) orienting students to contextual problems, (2) organizing students for learning and collaborative problem solving, (3) facilitating investigation, (4) developing and presenting solutions, and (5) analyzing and evaluating the problem-solving process. Virtual Role-Playing Exhibition Media was integrated into these stages to provide students with access to digital learning materials, including visual content, learning videos, contextual cases, interactive activities, and virtual exhibition materials related to Pancasila Education.

The control group studied the same subject matter using the STAD cooperative learning model. Before the intervention, students in both groups completed a pretest. According to the research implementation records, each group received four instructional treatment sessions, resulting in eight treatment sessions across the two groups. Each instructional session consisted of two 35-minute lesson periods. Following the completion of the intervention, both groups completed a posttest using the same learning-outcome construct assessed in the pretest.

2.4 Research Instruments

Data were collected using a learning-outcome test and an observation sheet. The learning-outcome test was used to measure students' cognitive achievement in Pancasila Education before and after the intervention. The observation sheet was used to document the implementation of the learning process during the intervention.

The learning-outcome instrument was developed based on competency indicators derived from the learning objectives of the Pancasila Education content taught during the study. The indicators covered several levels of the cognitive domain, including remembering (C1), understanding (C2), applying (C3), analyzing (C4), and evaluating (C5). The items assessed students' understanding and application of Pancasila values in everyday contexts, including identifying behaviors reflecting the principles of Pancasila, analyzing appropriate behaviors in the school environment, determining forms of deliberation, and evaluating fair behavior.

Before being administered to the research participants, the test instrument underwent validity and reliability testing. Content validity was evaluated by experts to examine the alignment between the test items, learning objectives, indicators, and content of Pancasila Education. Empirical item validity was subsequently analyzed using SPSS version 25.

Instrument reliability was examined using Cronbach's alpha. The analysis produced a Cronbach's alpha coefficient of .958, indicating a high level of internal consistency. Item difficulty and discrimination indices were also examined as part of the instrument analysis before the test was used to measure students' learning outcomes.

2.5 Data Collection Procedure

The research procedure consisted of preparation, pretesting, implementation of the instructional treatments, posttesting, and data analysis. During the preparation stage, the researchers prepared the learning materials, Virtual Role-Playing Exhibition Media, instructional procedures, observation sheets, and learning-outcome test.

Before the treatment was administered, both the experimental and control groups completed a pretest to determine their initial learning outcomes. The experimental group subsequently received PBL assisted by Virtual Role-Playing Exhibition Media, whereas the control group received instruction using the STAD model. Observations were conducted during the instructional process to document the implementation of learning activities. After all treatment sessions had been completed, students in both groups completed a posttest to measure their learning outcomes following the intervention.

2.6 Data Analysis

Data analysis was conducted using SPSS version 25. Descriptive statistics were first calculated to summarize the pretest and posttest scores of the experimental and control groups. The analysis included the mean, standard deviation, minimum score, and maximum score where appropriate.

Before conducting parametric inferential analysis, the assumptions of normality and homogeneity of variance were examined. Because each group consisted of 25 students, the Shapiro–Wilk test was used to assess the normality of the score distributions. Data were considered to satisfy the normality assumption when the significance value was greater than .05. Homogeneity of variance was examined using Levene's test, with a significance value greater than .05 indicating that the homogeneity assumption was satisfied.

Students' improvement from pretest to posttest was examined using normalized gain (N-gain). The N-gain score was calculated using the following formula:

$$\text{N-gain} = (\text{Posttest score} - \text{Pretest score}) / (\text{Maximum score} - \text{Pretest score})$$

The N-gain analysis was used to describe the magnitude of improvement in students' learning outcomes following the instructional intervention. N-gain scores were calculated for the experimental and control groups and were subsequently compared descriptively.

To examine differences in posttest learning outcomes between the experimental and control groups, an independent-samples *t* test was employed, provided that the assumptions required for parametric analysis were satisfied. Statistical significance was determined at an alpha level of .05. A *p*-value below .05 was interpreted as evidence of a statistically significant difference between the two groups.

In addition to statistical significance, the interpretation of the findings considered the magnitude and direction of the observed differences. The results of the inferential analysis were interpreted together with descriptive statistics and N-gain scores to provide a more comprehensive account of the effects of the instructional intervention.

3. FINDINGS AND DISCUSSION

3.1 Findings

3.1.1 Descriptive Statistics of Students' Learning Outcomes

The descriptive analysis indicated an improvement in learning outcomes in both the experimental and control groups following the instructional intervention. The experimental group, which received Problem-Based Learning (PBL) assisted by Virtual Role-Playing Exhibition Media, had a mean pretest score of 45.80 and a mean posttest score of 79.00. Meanwhile, the control group, which received instruction using the Student Teams Achievement Divisions (STAD) model, had a mean pretest score of 46.80 and a mean posttest score of 73.60.

Thus, the experimental group showed an increase of 33.20 points from pretest to posttest, whereas the control group showed an increase of 26.80 points. At the posttest stage, the mean score of the experimental group was 5.40 points higher than that of the control group. Descriptively, these results indicate that both groups improved following the intervention, with a greater increase observed in the experimental group.

Table 2. Descriptive Statistics of Pretest and Posttest Scores

Group	N	Pretest Mean	Posttest Mean	Mean Increase
Experimental	25	45.80	79.00	33.20
Control	25	46.80	73.60	26.80

The posttest standard deviation was 13.229 for the experimental group and 16.490 for the control group. These results show that posttest scores in the control group were more dispersed than those in the experimental group.

3.1.2 Assumption Tests

Before inferential statistical analysis was conducted, the normality and homogeneity assumptions were examined. Because each group consisted of 25 students, the Shapiro–Wilk test was used to assess the normality of the pretest and posttest score distributions.

Table 3. Shapiro–Wilk Normality Test

Data	Statistic	df	p
Experimental pretest	.973	25	.711
Experimental posttest	.956	25	.335
Control pretest	.948	25	.228
Control posttest	.967	25	.560

As shown in Table 3, the significance values for the experimental pretest ($p = .711$), experimental posttest ($p = .335$), control pretest ($p = .228$), and control posttest ($p = .560$) were all greater than .05. Therefore, the normality assumption was satisfied for all four score distributions.

Homogeneity of variance was subsequently examined using Levene's test. The analysis produced a significance value of .164, which was greater than the significance level of .05. Therefore, the homogeneity of variance assumption was considered satisfied.

Table 4. Homogeneity of Variance Test

Variable	Levene Statistic	df1	df2	p
Learning outcomes	1.741	3	96	.164

The results of the assumption tests indicated that the data met the normality and homogeneity requirements for subsequent parametric analysis.

3.1.3 Normalized Gain Analysis

Normalized gain (N-gain) analysis was conducted to describe the magnitude of improvement in students' learning outcomes from pretest to posttest. The experimental group obtained a mean N-gain score of .5762, equivalent to 57.62%, with a standard deviation of .31640. The N-gain scores ranged from $-.50$ to 1.00 .

Table 5. N-Gain of the Experimental Group

Variable	N	Minimum	Maximum	Mean	SD
N-Gain Score	25	$-.50$	1.00	.5762	.31640
N-Gain Percentage	25	-50.00	100.00	57.62	31.64

The control group obtained a mean N-gain score of .4913, equivalent to 49.13%, with a standard deviation of .28536. The scores ranged from $.00$ to 1.00 .

Table 6. N-Gain of the Control Group

Variable	N	Minimum	Maximum	Mean	SD
N-Gain Score	25	$.00$	1.00	.4913	.28536
N-Gain Percentage	25	$.00$	100.00	49.13	28.54

A comparison of the two groups showed that the experimental group obtained a higher mean N-gain percentage (57.62%) than the control group (49.13%), representing a descriptive difference of 8.49 percentage points. Thus, although both groups demonstrated improvement in learning outcomes, the magnitude of improvement was descriptively greater in the experimental group.

It should also be noted that the experimental group contained an N-gain value as low as $-.50$, indicating that improvement was not uniform across all students. The relatively large standard deviations in both groups further indicate considerable individual variation in learning gains.

3.1.4 Comparison of Posttest Learning Outcomes

An independent-samples t test was used to compare the posttest learning outcomes of the experimental and control groups. Descriptive statistics for the two groups are presented in Table 7.

Table 7. Posttest Descriptive Statistics

Group	N	Mean	SD	SE
Experimental	25	79.00	13.229	2.646
Control	25	73.60	16.490	3.298

The experimental group obtained a higher posttest mean ($M = 79.00$, $SD = 13.229$) than the control group ($M = 73.60$, $SD = 16.490$), corresponding to a mean difference of 5.40 points.

Based on the statistical values currently reported in the manuscript, the independent-samples analysis yielded $t(48) = 1.277$, with a mean difference of 5.400 ($SE = 4.228$) and a 95% confidence interval ranging from -3.101 to 13.901 .

Table 8. Independent-Samples t Test of Posttest Scores

Comparison	Mean Difference	SE Difference	t	df	95% CI
Experimental vs. Control	5.400	4.228	1.277	48	$[-3.101, 13.901]$

The positive mean difference indicates that the experimental group obtained higher posttest scores than the control group. However, the 95% confidence interval includes zero. Therefore, based on the t

statistic and confidence interval currently reported in the manuscript, the evidence is insufficient to conclude that the posttest difference between the two groups was statistically significant at the .05 level.

Overall, the descriptive results consistently indicate greater improvement in the experimental group. The experimental group increased from a mean pretest score of 45.80 to a mean posttest score of 79.00 and obtained a higher mean N-gain (57.62%) than the control group (49.13%). Nevertheless, the statistical significance of the between-group posttest difference cannot be established conclusively from the current manuscript because of the inconsistency in the reported independent-samples *t*-test statistics.

3.2 Discussion

The findings indicate that students in both the experimental and control groups improved their Pancasila Education learning outcomes after the instructional interventions. However, the improvement was descriptively greater in the experimental group, which received Problem-Based Learning (PBL) assisted by Virtual Role-Playing Exhibition Media. The experimental group's mean score increased from 45.80 on the pretest to 79.00 on the posttest, whereas the control group's mean score increased from 46.80 to 73.60. Consistent with this pattern, the experimental group obtained a higher mean N-gain percentage (57.62%) than the control group (49.13%). These findings suggest that integrating PBL with an interactive virtual exhibition environment has the potential to support students' cognitive learning outcomes in elementary Pancasila Education.

One possible explanation for the improvement observed in the experimental group is the problem-oriented nature of PBL. Rather than receiving information only through teacher explanation, students were involved in identifying and discussing contextual problems related to the learning material. PBL encourages students to participate actively in the learning process by confronting problems that require investigation and solution development. This characteristic is consistent with Sari and Rosidah (2023), who explained that PBL encourages students to actively engage in problem solving in accordance with the intended learning objectives. Similarly, Khakim et al. (2022) described PBL as an instructional approach that encourages students to be active, creative, innovative, and involved in solving real-world problems.

The application of PBL is particularly relevant to Pancasila Education because the subject involves not only conceptual knowledge but also the application of values to everyday situations. During PBL activities, students are given opportunities to examine contextual problems, discuss possible solutions with their peers, and relate the principles of Pancasila to situations that occur in their social environment. This learning process may help students move beyond simply remembering Pancasila concepts toward understanding and applying them in concrete contexts. Such learning is consistent with the constructivist perspective, in which learners actively construct knowledge through their involvement in learning experiences rather than merely receiving information from the teacher (Ningsih et al., 2024).

The present findings are also consistent with previous studies reporting positive outcomes associated with PBL. Gani et al. (2021) found differences in learning outcomes when problem-based learning was implemented and emphasized its contribution to students' critical thinking and problem-solving activities. Pattiasina and Sopacua (2022) similarly reported the effectiveness of PBL in improving history learning outcomes. In addition, Sari and Rosidah (2023) reported that the implementation of PBL influenced elementary school students' social studies learning outcomes. Although these studies were conducted in different learning contexts, their findings support the proposition that problem-oriented learning can facilitate students' active engagement with academic content.

The higher learning gains observed in the experimental group may also be associated with the integration of Virtual Role-Playing Exhibition Media into the PBL process. Learning media can facilitate the communication of instructional content and help students focus their attention on the material being studied. Adam (2023) reported that audio-visual learning media can contribute to elementary

students' learning interest, while learning media more generally can provide learning experiences that are more engaging than verbal explanation alone. In the present study, the virtual exhibition environment provided visual materials, learning videos, contextual cases, interactive quizzes, and digital exhibition spaces that students could explore as part of the learning activities. These features provided students with additional representations of Pancasila Education content while they worked through the PBL stages.

The role of exhibition-based media in this study is also consistent with the work of Kamila and Hastuti (2023), who developed exhibition media for history learning. Exhibition environments can provide digital representations of learning objects and contexts, allowing learners to explore materials that may otherwise be difficult to present directly in the classroom. In the present study, this characteristic was relevant to learning about Indonesian cultural diversity because students could access visual and digital representations of cultural content through the virtual environment. Consequently, abstract or broad learning material could be presented through a more concrete and explorable format.

Importantly, the contribution of the virtual exhibition should not be viewed separately from the PBL model. The pedagogical value of the intervention lies in how the media was integrated into problem-solving activities. The virtual exhibition provided resources and representations of learning content, while PBL structured how students interacted with those resources. Students were not expected merely to view digital materials; they used the materials while identifying problems, investigating information, discussing solutions, presenting their work, and evaluating their understanding. This integration is consistent with the PBL stages described by Khakim et al. (2022), which include problem orientation, organization for learning, guided investigation, development and presentation of solutions, and evaluation of the problem-solving process.

Despite the higher descriptive improvement in the experimental group, the magnitude of the difference between the two groups should be interpreted cautiously. The experimental group obtained a mean N-gain of 57.62%, compared with 49.13% in the control group, resulting in a difference of 8.49 percentage points. This pattern indicates that the control group also experienced substantial improvement. Such a result is reasonable because the control condition used STAD rather than an untreated or purely conventional comparison condition. Therefore, the findings should not be interpreted as indicating that learning occurred exclusively in the experimental group. Instead, both instructional approaches were associated with improvement, while the experimental group demonstrated a greater descriptive gain.

The moderate magnitude of improvement in the experimental group may also be related to the duration of the intervention and students' adaptation to the learning approach and digital media. The intervention consisted of four instructional treatment sessions for each group. This relatively short implementation period may not have been sufficient for students to become fully accustomed to problem-based learning procedures and the use of the virtual exhibition environment. PBL requires students to participate actively in collaborative investigation, discussion, and problem solving, which may differ from the instructional activities to which they were previously accustomed. Consequently, part of the instructional time may have been required for students to adapt to the learning procedures rather than being devoted entirely to mastering the learning content.

Individual differences in learning gains should also be considered. The experimental group's N-gain scores ranged from -0.50 to 1.00, indicating that the intervention did not produce the same level of improvement for every student. Although the mean N-gain was positive, some students showed little improvement, and at least one score reflected a decline from pretest to posttest. This variation suggests that the effectiveness of technology-supported PBL may depend on students' readiness to participate in collaborative problem solving, their ability to navigate digital learning resources, and their initial understanding of the learning material. Therefore, the mean improvement should not be interpreted as representing an identical effect for all learners.

Several potential sources of bias should also be considered when interpreting the findings. First, students' initial interest in a new digital learning environment may have influenced their engagement

during the intervention. Therefore, the observed improvement cannot necessarily be attributed exclusively to the PBL model itself. Second, differences in the way instruction was facilitated may have influenced students' learning experiences. Third, because the experimental and control groups came from different schools, contextual differences between SDN 1 Kalikebo and SDN 2 Kalikebo may have contributed to the observed outcomes. The quasi-experimental design reduces the extent to which these contextual factors can be controlled compared with a randomized experimental design.

The sample size and research context further limit the generalizability of the findings. The study involved only 50 fifth-grade students, with 25 students in each group, from the Ronggowarsito Elementary School Cluster in Trucuk District, Klaten Regency. Therefore, the findings should not be generalized directly to students at different grade levels, schools, or educational contexts. Future research should involve larger and more diverse samples and longer intervention periods to examine whether the observed learning gains remain consistent across different settings.

Another limitation concerns the outcome measured in this study. The assessment primarily focused on students' cognitive learning outcomes. However, Pancasila Education also aims to develop values, attitudes, social responsibility, and behaviors associated with the principles of Pancasila. Consequently, improved cognitive achievement does not necessarily indicate corresponding changes in students' attitudes or actual behavior. Future studies should therefore examine cognitive, affective, and behavioral outcomes simultaneously to provide a more comprehensive understanding of the potential contribution of PBL assisted by virtual exhibition media to Pancasila Education.

Overall, the findings provide preliminary evidence that integrating PBL with Virtual Role-Playing Exhibition Media has potential for supporting elementary students' Pancasila Education learning outcomes. The experimental group demonstrated higher posttest performance and a higher descriptive N-gain than the control group. The findings are theoretically consistent with the active and problem-oriented characteristics of PBL and with the role of interactive learning media in facilitating students' engagement with learning content. Nevertheless, given the relatively small sample, short intervention period, variation in individual learning gains, use of different schools for the experimental and control groups, and the current inconsistency in the reported inferential statistics, the findings should be interpreted as evidence of a promising instructional approach rather than as definitive evidence of its superiority over STAD.

4. CONCLUSION

This study indicates that Problem-Based Learning (PBL) assisted by Virtual Role-Playing Exhibition Media has the potential to support fifth-grade students' learning outcomes in Pancasila Education. The experimental group showed an increase in the mean score from 45.80 on the pretest to 79.00 on the posttest, while the control group increased from 46.80 to 73.60. The experimental group also demonstrated a higher mean N-gain (57.62%) than the control group (49.13%), indicating a greater descriptive improvement in learning outcomes. These findings suggest that integrating contextual problem-solving activities with an interactive virtual exhibition environment may provide a meaningful learning experience for Pancasila Education. Nevertheless, the findings should be interpreted cautiously, considering the relatively small sample size, short intervention period, use of different schools for the experimental and control groups, and variation in individual learning gains. Future research should involve larger and more diverse samples, longer interventions, and assessments that extend beyond cognitive achievement to include students' attitudes, values, and social behaviors related to Pancasila.

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