

Implementation Analysis of Project-Based Learning (PBL) in Physical Education: A Diagnostic Study

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Abstract
<p>Objective. This study aimed to determine the results of implementing diagnostic assessment through the Project-Based Learning (PBL) method in the PJOK (Physical Education, Sports, and Health) subject.</p> <p>Materials and Methods. This research employed a one-group posttest-only design with no control group. The sample consisted of female 10th-grade students at MA Nuuru Zamzam was selected using purposive sampling, with inclusion criteria of having at least one year of PJOK experience. A non-test diagnostic assessment rubric was used as the instrument. Instrument validity was confirmed through expert judgment, and its reliability was verified with Cronbach's Alpha ($\alpha = 0.78$), indicating good internal consistency. Students were instructed not to participate in extracurricular training during the research period to control for external factors.</p> <p>Results. The average diagnostic scores for the volleyball topic were: project = 92, product = 83, practice = 70. For hurdle running: project = 92, product = 87, practice = 79. For rhythmic movement: project = 85, product = 83, practice = 84. The Shapiro- Wilk normality test showed that the data were normally distributed ($W = 0.97$, $p = 0.62$). ANOVA results revealed significant differences among the assessment types ($F(2, 51) = 5.67$, $p = 0.015$), followed by a Post Hoc Tukey HSD test that confirmed significant differences between project and practice assessments.</p> <p>Conclusion. Diagnostic assessment can be effectively implemented through the Project-Based Learning method in PJOK. The consistently high scores in project-based assessments suggest that PBL enhances student engagement and creativity, aligning with Zhou's (2022) theory that PBL fosters innovation. However, practical implementation should consider resource constraints. Schools are encouraged to utilize recycled or low-cost materials to minimize project costs without compromising learning quality.</p>
Keywords: Assessment diagnostics , Project-based learning, Physical Education

Introduction

Education in Indonesia currently adopts the Merdeka Study Campus Merdeka (MBKM) curriculum, which emphasizes student-centered learning, creativity, and flexibility in the learning process (Wahyuni et al., 2023) . This curriculum is designed to provide students the freedom to

explore their interests and talents through various methods and assessments. There are three types of assessments emphasized in this curriculum: diagnostic, formative, and summative assessments (Ardiansyah, 2023) . Among them, diagnostic assessment plays a critical role at the beginning of instruction to identify students' strengths, weaknesses, and learning needs.

Diagnostic assessments are typically categorized into cognitive and non-cognitive domains. Cognitive diagnostic assessment is used to measure students' prior knowledge and basic competencies related to the subject matter (Warni et al., 2023) . While non-cognitive diagnostic assessments focus on students' psychological, social, and emotional readiness. Effective implementation of these assessments requires appropriate learning models that align with the purpose of diagnosis and student engagement.

One such model is Project-Based Learning (PBL), a student-centered learning strategy that involves real-world projects to develop knowledge, skills, and values (Zhou, 2022) . PBL has been widely applied in STEM (Science, Technology, Engineering, Mathematics) education with proven benefits in fostering innovation, collaboration, and problem-solving skills (Ramadhana Sonjaya et al., 2022) . However, there is a noticeable research gap in the application of PBL within Physical Education (PJOK)—especially for diagnostic assessment purposes. Prior studies have not extensively explored how PBL can be used to assess foundational physical competencies such as motor accuracy, creativity in movement, or teamwork in sports settings.

This study addresses that gap by investigating the implementation of diagnostic assessment through PBL in the PJOK subject, focusing on three key assessment aspects: project outcomes, product creation, and practical performance. While PJOK is traditionally assessed through direct performance or skills tests, integrating PBL may offer richer, multidimensional insights into students' physical literacy, creativity, and collaborative abilities (Hadi Kosasih & Syamsul Taufik, 2023) .

Thus, the purpose of this research is to measure the effectiveness of PBL in conducting diagnostic assessment for CHD students, particularly in the topics of volleyball, hurdle running, and rhythmic movement. The outcomes are expected to inform more innovative, inclusive, and adaptive assessment strategies in physical education under the Merdeka curriculum framework.

Materials and Methods

Study Participants.

The population in this study comprised all students at MA Nuuru Zamzam , who served as the subjects possessing specific characteristics identified by the researcher for investigation and from whom conclusions would be drawn (Riskayani, 2022) . The sample was selected using a

purposive sampling technique, a non-random method in which the researcher deliberately chose individuals with characteristics aligned with the research objectives to obtain data relevant to the case being studied (Sri et al., 2022) .

The sampling criteria were based on the consideration that participants must have at least one year of experience in the Physical Education (PJOK) subject and no physical limitations that would hinder participation in physical activities. The researcher specifically selected female students in Grade 10, as preliminary observations indicated that female students at MA Nuuru Zamzam tended to show lower levels of engagement and participation in PJOK classes compared to their male counterparts. Moreover, the PJOK teacher at the school has not yet implemented diagnostic assessment methods comprehensively across all learning materials, making this group relevant for further investigation.

The research instrument consisted of a diagnostic assessment rubric developed by the researcher. Instrument validity was tested through expert judgment involving three lecturers with expertise in physical education and educational evaluation, all of whom confirmed that the rubric was appropriate for use. Furthermore, the reliability of the instrument was tested using Cronbach's Alpha, resulting in a score of $\alpha = 0.78$, indicating good internal consistency ($\alpha > 0.70$).

To control for external variables, students were instructed not to participate in any additional training sessions outside of regular PJOK class hours during the research period. Additionally, all learning activities were conducted under consistent conditions and time allocations to minimize variation in treatment.

Study organization.

The research method used in this study is the experimental method, which aims to determine the effect of a treatment on the respondents (sample). This study was conducted by applying a treatment in the form of learning using the Project-Based Learning (PBL) method to examine the impact of implementing diagnostic assessments in the PJOK subject. The research design used is a posttest design only, where there is no control group, and the subjects are randomly assigned. This design involves only one group. The subjects in this study were given a treatment in the form of PBL-based learning, and after the treatment, a posttest was conducted to measure the impact of this treatment, through diagnostic assessments. Therefore, this study aims to generate data showing the results of implementing diagnostic assessments through the PBL method in the PJOK subject.

$$X \ O_1$$

Explanation:

- X : Project Based Learning
- O₁ : Diagnostic Assessment

This study uses a non-test instrument because the research focuses on the assessment scale with the implementation of diagnostic assessments through the Project-Based Learning method. The instrument in this test only measures the students' abilities using the Project-Based Learning method in relation to cognitive diagnostic assessments. The test instruments include skill assessments for students. The assessment techniques in this skill aspect include practical assessments, product assessments, and project assessments (Ardiansyah, 2023) .

statistical analysis

The normality test using Shapiro- Wilk indicates that the data in this study is normally distributed because the significance value is > 0.05. Furthermore, the results of the ANOVA F test show a significant difference between the groups ($p \leq 0.05$), which is followed by a Post Hoc test to determine which groups show a significant difference.

Results

The implementation of assessment through the Project-Based Learning (PBL) method is an assessment based on projects. In the learning process, the teaching method is one of the most important aspects. The teaching method is the way the teacher delivers a learning material (Adolph, 2022) . It is also a technique used by the teacher in an organized and systematic manner to achieve the goals of the lesson. The method serves as a reference or plan for the learning process. The subjects in this study are female students from MA Nuuru Zamzam , totaling 18 participants, and the research was conducted in the MA Nuuru Zamzam school environment. The research process was carried out during the learning process with the treatment using the Project-Based Learning method, aimed at generating data that shows results in diagnostic assessment (Nuryadi & Rahmawati, 2023) . This research was conducted over 12 meetings with three topics: volleyball, hurdle running, and rhythmic movement/flow movement, which took place from July 15 to September 30. The purpose of this study is to analyze the results of the implementation of Diagnostic Assessment through the Project-Based Learning (PBL) method in the PJOK subject.

Table 1. Diagnostic Assessment Results in Volleyball

No	Name	Evaluation				Average
		Project	Product	Practice	Amount	
1	Agni Azhar Primary	100	91	81	272	91
2	Aulia Daughter	91	91	68	250	83
3	Beautiful June	100	83	62	245	82
4	Grandpa Winda Novianti	83	83	75	241	80
5	Devi Bagadanti	100	83	75	258	86
6	Dinda Maria	100	75	75	250	83
7	Kaila Qoerunnisa	100	83	56	239	80
8	Marisa Kayla	82	75	73	230	77
9	Miss Beautiful Nuraeni	100	83	75	258	86
10	Nisha Siti Saw Julian	75	75	74	224	75
11	Penty Risk Nurmawati	82	83	50	215	72
12	Risk Aslama	66	75	68	209	70
13	Rista Tri Yanda	85	91	70	246	82
14	Aprilia Salsa	91	91	81	263	88
15	Siti The Sharifatul Azizah	100	75	75	250	83
16	Sulis Ramadhan	100	75	68	243	81
17	The Sustainable	100	91	62	253	84
18	Yizza Naraya Marsya Laulia F.	100	91	75	266	89
Average		92	83	70	245	82

The table presents the results of the research conducted on the volleyball topic with the implementation of diagnostic assessment through the Project-Based Learning method. After the treatment was provided over 3 sessions, and 1 session was dedicated to testing the results of the project, the values recorded in the table were obtained. From the table, it can be seen that the average score achieved by students in the project aspect was 91, in the product aspect was 83, and in the practical aspect was 70. The average score obtained by each student in this topic was 82.

Table 2. Diagnostic Assessment Result Data For Hurdles

No	Name	Assessment				Average
		Project	Products	Practice	Total	
1	Agni Azhar Primary	91	86	87	264	88
2	Aulia Daughter	91	80	87	258	86
3	Beautiful June	100	86	81	267	89
4	Grandpa Winda Novianti	100	80	75	255	85

5	Devi Bagadanti	91	93	75	259	86
6	Dinda Maria	83	93	75	251	84
7	Kaila Qoerunnisa	91	80	81	252	84
8	Marisa Kayla	83	93	75	251	84
9	Miss Beautiful Nuraeni	91	93	81	265	88
10	Nisha Siti Salwa Julian	83	86	75	244	81
11	Penty Risk Nurmawati	100	93	81	274	91
12	Risk Asloma	83	93	75	251	84
13	Rista Tri Yanda	85	91	70	246	82
14	Aprilia Salsa	91	93	81	265	88
15	Siti The Sharifatul Azizah	100	86	75	261	87
16	Sulis Ramadhan	91	80	87	258	86
17	The Sustainable	100	86	81	267	89
18	Yizza Naraya Marsya Laulia H.	91	93	81	265	88
	Average	92	87	79	259	86

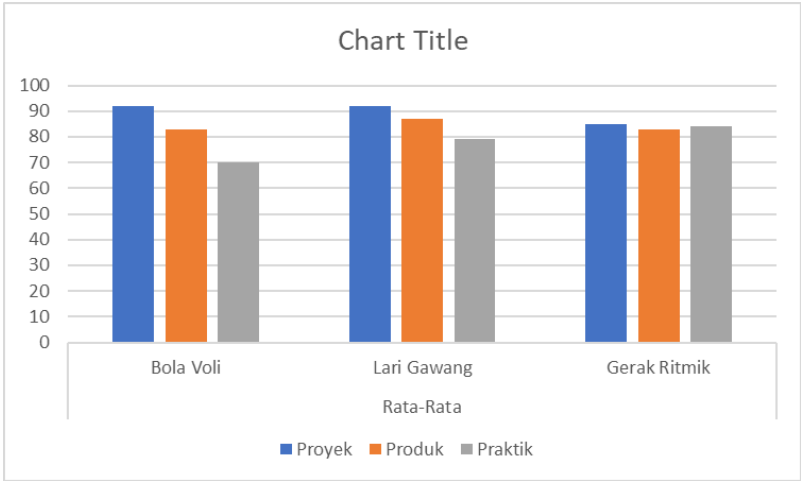
The table shows that the average score for all students in the project assessment is 92, in the product assessment is 87, in the practice assessment is 73, and the average score obtained by each student is 79.

Table 3. Diagnostic Assessment Results for Rhythmic Movement/Movement Rhythm

No	Name	Assessment				Average
		Project	Products	Practice	Total	
1	Agni Azhar Primary	100	83	93	276	92
2	Aulia Daughter	83	75	87	245	82
3	Beautiful June	83	83	81	247	82
4	Grandpa Winda Novianti	83	75	87	245	82
5	Devi Bagadanti	83	91	87	261	87
6	Dinda Maria	75	83	87	245	82
7	Kaila Qoerunnisa	83	75	83	241	80
8	Marisa Kayla	80	83	83	246	82
9	Miss Beautiful Nuraeni	83	91	87	261	87
10	Nisha Siti Salwa Julian	83	75	75	233	78
11	Penty Risk Nurmawati	100	91	75	266	89
12	Risk Asloma	66	75	75	216	72
13	Rista Tri Yanda	100	75	70	245	82
14	Aprilia Salsa	83	91	93	267	89
15	Siti The Sharifatul Azizah	75	83	75	233	78
16	Sulis Ramadhan	83	75	81	239	80
17	The Sustainable	91	83	93	267	89
18	Yizza Naraya Marsya Laulia H.	100	100	93	293	98
	Average	85	83	84	251	84

This table illustrates that the average score for all students in the project assessment is 85, in the product assessment is 83, in the practice assessment is 84, and the final average score obtained by students is 84.

Figure 1 . Average Results



Normality Test

The normality test stage is conducted to determine the distribution of the research data.

Table 4. Normality Test for Volleyball

Tests of Normality						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
VAR00001	.137	18	.200 [*]	.955	18	.516

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

a. Lilliefors Significance Correction

Data are considered normally distributed if the significance value (sig) is greater than 0.05. Conversely, if the significance value is less than 0.05, the data are considered not normally distributed. Based on the results of the normality test, it can be concluded that the data follow a normal distribution, as indicated by the Shapiro- Wilk significance values being greater than 0.05. The Shapiro- Wilk test was chosen because the sample size was fewer than 50 participants; if the sample size were more than 50, the Kolmogorov-Smirnov test would be used instead.

From the table above, the significance value obtained for the pretest is 0.516. Therefore, since the value is greater than 0.05, it can be concluded that the data are normally distributed.

ANOVA – F Test

ANOVA (Analysis of Variance) is a statistical analysis used to test the means between groups. The groups referred to can be either different groups or types of treatments.

Table 5. F Test (ANOVA)

ANOVA					
VAR00001					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1614.926	2	807.463	3.534	.037
Within Groups	11652.722	51	228.485		
Total	13267.648	53			

Each group is considered to differ in the dependent variable if the F test result is significant ($p \leq 0.05$). However, if it is unclear which group causes the difference, a Post Hoc Test is conducted to identify which group has the more significant difference. Conversely, if the F test result is not significant ($p > 0.05$), it is concluded that there is no difference between the groups in the dependent variable. Since the table above shows a significant F test result ($p < 0.05$), further testing through the Post Hoc Test is necessary to determine the differences between each dependent group.

Post Hoc Test

Table 6. Post Hoc Test Follow-Up Table

Multiple Comparisons						
Dependent Variable: VAR00001						
Games-Howell						
(I) VAR00002	(J) VAR00002	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1.00	2.00	-13.38889*	4.43850	.016	-24.4582	-2.3196
	3.00	-6.33333	5.86176	.533	-20.7004	8.0337
2.00	1.00	13.38889*	4.43850	.016	2.3196	24.4582
	3.00	7.05556	4.70118	.309	-4.6972	18.8083
3.00	1.00	6.33333	5.86176	.533	-8.0337	20.7004
	2.00	-7.05556	4.70118	.309	-18.8083	4.6972

*. The mean difference is significant at the 0.05 level.

Based on the table of Post Hoc Test results above, it can be concluded that each group of

dependent variables shows significant differences between group 2 and group 3, group 1 and group 3, as well as group 1 and group 2. and finally, group 1 (sig 0.533) and group 2 (sig 0.309). Thus, the test results indicate a significant difference between each group of variables.

Discussion

The findings of this study demonstrate that the implementation of diagnostic assessment through the Project-Based Learning (PBL) method can enhance student engagement and learning outcomes in the PJOK (Physical Education, Sports, and Health) subject. In the context of the Merdeka curriculum, which emphasizes student-centered and creative learning, PBL serves as a relevant pedagogical strategy that encourages learners to explore, create, and collaborate. This aligns with the curriculum's objectives to foster autonomy and holistic student development.

Implementation, in this study, refers to the structured application of project-based learning as a platform for diagnostic assessment. Through this approach, students engage in meaningful learning experiences that culminate in the creation of tangible outputs or projects. The results of these projects are then used to evaluate students' understanding and competencies across multiple dimensions.

The results indicate that project-based assessment consistently produced the highest scores across all three learning topics: volleyball (mean = 91), hurdle running (mean = 92), and rhythmic movement (mean = 85). In contrast, the lowest scores were observed in the practice assessments. This suggests that students performed better when assessed on creative and exploratory tasks than on practical execution. Which positives that PBL fosters innovation and student autonomy by allowing greater flexibility in how learning is expressed. In this context, creativity and idea generation may be more valued—and more accessible—than technical or motor precision (Zhou, 2022) .

However, this study also has several limitations. First, the sample consisted exclusively of female students from a single institution (MA Nuuru Zamzam), which introduces gender bias and limits the generalizability of the findings. Future studies should include a mixed-gender sample and be replicated in diverse educational contexts to enhance external validity. Second, while the PBL approach shows promise, the practical implementation may be constrained by financial considerations. Although this study recommends minimizing costs, the suggestion remains abstract.

A more concrete solution would be for schools to utilize recycled or locally available materials to reduce the financial burden associated with project creation. In addition, educators can collaborate with the community or leverage existing school resources to support material needs.

Despite these challenges, PBL remains a valuable strategy for implementing diagnostic assessments in PJOK. It offers several pedagogical benefits, including the development of student creativity, collaboration, problem-solving skills, and independent thinking. The multidimensional nature of diagnostic assessment—through project, product, and practice evaluation—provides a more comprehensive picture of student competence. Therefore, this study confirms that PBL is not only compatible with the goals of the Merdeka curriculum but also a practical tool for enriching the diagnostic assessment process in physical education.

Conclusion.

Based on the data collected in the field by the researcher over 12 sessions, in which the researcher applied a treatment using the Project-Based Learning method to the 10th-grade students of MA Nuuru Zamzam , the researcher concluded from the data analysis that diagnostic assessment can be implemented through the Project-Based Learning method in the PJOK (Physical Education, Sports, and Health) subject at MA Nuuru Zamzam .

The challenges in implementing diagnostic assessment through Project-Based Learning include the need for additional costs to purchase materials required for creating products, which would force students to spend their own money. A potential solution for implementing diagnostic assessment through the Project-Based Learning method is to minimize the costs incurred by using available materials and resources.

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