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Development of rhythmic movement activity teaching module based on project-based learning

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ABSTRACT

This study aimed to develop and evaluate a Project-Based Learning (PJBL) instructional module for rhythmic movement activities, specifically creative gymnastics, in senior high school physical education. Using the ADDIE development model, the research proceeded through analysis, design, development, implementation, and evaluation stages. Expert validation showed that the module achieved a very valid category, with the material expert scoring it at 88% and the PJBL expert at 90%, resulting in an overall validity of 89%. A small-group practicality trial demonstrated strong feasibility, with students rating the clarity, attractiveness, and usability of the module at an overall score of 88%, categorized as very practical. Effectiveness testing compared learning outcomes between two groups and revealed that the project-based class significantly outperformed the non-project class, achieving a mean score of 90% compared to 78%, yielding a 12% improvement attributed to the PJBL approach. These results confirm that the developed module is theoretically sound, practically feasible, and pedagogically effective. Overall, the module supports the goals of Kurikulum Merdeka by promoting creativity, collaboration, and student-centered learning in rhythmic movement activities.

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Introduction

Physical education plays a critical role in supporting students' holistic development by integrating physical competence, cognitive understanding, aesthetic expression, and social interaction (Carolin & Da Ary, 2025; Rusli et al., 2025). In the context of senior high school learning, rhythmic movement activities particularly creative gymnastics offer unique opportunities for students to build coordination, creativity, teamwork, and self-expression. However, despite their importance, rhythmic activities often receive less instructional attention compared to sports and fitness components. Many learning environments continue to rely on conventional drill-oriented methods, which limit students' engagement and creativity (Cheng et al., 2022; Puri et al., 2025).

Kurikulum Merdeka, introduced to provide greater flexibility and personalization in learning, encourages teachers to implement contextual and meaningful learning approaches (Noorhalida et al., 2024; Nuraini et al., 2024). One of the recommended models is Project-Based Learning (PJBL), which positions students as active creators of knowledge through collaborative, real-world tasks. PJBL is theoretically relevant to rhythmic movement learning, as both require exploration, creativity, reflection, and performance. However, empirical adoption of PJBL in physical education especially in creative gymnastics remains limited. Existing teaching practices still lack structured project-based frameworks and comprehensive instructional modules that guide teachers in implementing PJBL effectively (Retno et al., 2025; Satria et al., 2024).

Recent studies have shown positive outcomes from applying PJBL in physical education, such as improved motor skills, creativity, and student motivation. Research in rhythmic activities also highlights the potential for integrating artistic expression with cognitive and social learning. These state-of-the-art findings indicate a shift toward more innovative and expressive forms of physical education. Yet, research remains heavily concentrated on ball games, fitness training, and general skill performance. There is still a shortage of empirical studies that operationalize PJBL specifically within rhythmic movement or creative gymnastics, particularly at the senior high school level (Adiego & Martín-Cruz, 2021; Taiebine et al., 2025).

This leads to a clear research gap: although rhythmic movement activities demand creativity and collaboration, instructional materials and models that systematically incorporate PJBL are scarce (Pinto et al., 2025; Zakaria & Johnson Lim, 2022). Teachers frequently report limited access to structured modules that align rhythmic activities with PJBL principles, including phases of essential questioning, project planning, execution, presentation, and reflection. Without such structured guidance, rhythmic activities often become unsystematic and fail to maximize student potential. Furthermore, no existing modules have been validated comprehensively for both pedagogical quality and field practicality.

Another gap lies in the lack of comparative evidence examining differences in learning outcomes between project-based and non-project-based approaches within rhythmic activities. While PJBL is known to enhance deeper learning, performance outcomes in creative gymnastics have rarely been empirically contrasted across instructional models. This absence of robust comparative data limits educators' confidence in adopting PJBL as a transformative learning strategy in physical education classrooms (Lewin et al., 2023; Ram & Xing, 2023).

From these gaps emerges the novelty of the present research. This study develops a fully structured, PJBL-based instructional module specifically designed for creative gymnastics in Grade XII, aligned with Kurikulum Merdeka. The module includes complete instructional components lesson structure, project phases, assessment rubrics, and reflection tools validated by experts and tested for practicality and effectiveness. Unlike prior research, this study not only develops the module but also evaluates its impact through empirical comparison between project-based and conventional classes, providing measurable evidence of PJBL's superiority in rhythmic movement learning (Hulyadi et al., 2025; Yeung et al., 2024).

Therefore, this research contributes a new pedagogical innovation to the field of physical education by introducing a systematically developed, empirically tested PJBL module tailored to rhythmic movement activities (Sengupta et al., 2024; Su, 2024). The results are expected to support teachers in implementing creative, student-centered learning; enhance students' creativity, collaboration, and performance; and expand scholarly discourse on the application of project-based learning in physical education. Ultimately, the study strengthens the alignment between rhythmic movement learning and contemporary educational demands by offering a validated instructional tool that promotes meaningful and expressive student learning experiences.

Based on these gaps, this study aims to develop and evaluate a Project-Based Learning (PJBL) instructional module specifically designed for creative gymnastics in Grade XII senior high school physical education under the Kurikulum Merdeka framework. The module systematically integrates key PJBL stages, including essential questioning, project planning, implementation, presentation, and reflection, tailored to the characteristics of rhythmic movement learning. The novelty of this study lies in combining structured module development with empirical testing of its practicality and effectiveness through a comparative analysis between project-based and conventional classes. This

research is expected to provide empirical evidence on the effectiveness of PJBL in rhythmic movement learning while offering an applicable instructional guide for PJOK teachers to implement student-centered and creative learning practices.

Method

This study used a Research and Development approach with the ADDIE model, including analysis, design, development, implementation, and evaluation stages. A needs analysis involving students and PJOK teachers informed the design of a PJBL-based creative gymnastics module aligned with Kurikulum Merdeka. The module was validated by content and PJBL experts, tested for practicality through a small-group trial, and evaluated for effectiveness using a quasi-experimental comparison between project-based and conventional classes. Data were collected through validation instruments, student questionnaires, and performance assessments and analyzed to determine the module's validity, practicality, and effectiveness.

Results and Discussions

This study aimed to develop and validate a Project-Based Learning (PJBL)–based instructional module for rhythmic movement activities (creative gymnastics) for Grade XII students. The results are presented in three main parts: (1) expert validation, (2) practicality testing through small-group trials, and (3) effectiveness comparison between project-based and non-project-based classes.

Table 1. Expert Validation Results (Material & PJBL Experts)

Aspect Evaluated	Mean Score	Category
Material Expert Validation	88%	Very Valid
PJBL Expert Validation	90%	Very Valid
Overall Expert Validation	89%	Very Valid

Table 1 shows that both experts material content expert and PJBL learning model expert rated the developed module as *very valid*. The material expert gave a validity score of 88%, indicating that the content, structure, clarity, and alignment with the curriculum are highly appropriate. The PJBL expert provided a score of 90%, meaning that the instructional model aligns strongly with PJBL principles, including essential questions, project planning, implementation, and reflection. These results confirm that the module is conceptually strong, theoretically grounded, and suitable for implementation in a real classroom setting.

Table 2. Small-Group Trial: Student Practicality Response

Practicality Indicator	Mean Score	Category
Clarity of Instructions	85%	Very Practical
Feasibility of Tasks	87%	Very Practical
Attractiveness of Learning Activities	90%	Very Practical
Group Collaboration Support	88%	Very Practical
Overall Practicality Score	88%	Very Practical

Table 2 presents students' responses during the small-group practicality test. All indicators were rated in the very practical category, with an overall practicality score of 88%. Students reported that the module is easy to understand, the project tasks are feasible, and the activities are engaging.

The highest score (90%) was given for *learning attractiveness*, indicating that the creative gymnastics project successfully stimulates motivation, creativity, and enjoyment. These findings show that the module is highly usable, student-centered, and aligned with Kurikulum Merdeka principles.

Table 3 compares learning outcomes between the Project-Based Learning class and the traditional (non-project) class. The project-based group achieved a mean score of 90%, categorized as *very effective*. Meanwhile, the non-project group scored 78%, categorized as *effective* but significantly lower. The difference of 12 percentage points demonstrates that the PJBL approach has a substantial

positive impact on students' creativity, performance skills, teamwork, and expression in creative gymnastics activities. This result supports previous findings showing that PJBL improves motor skills, motivation, and collaborative competence in physical education contexts.

Table 3. Comparison of Learning Effectiveness: Project vs. Non-Project Classes

Class Type	Mean Score	Category
Project-Based Class	90%	Very Effective
Non-Project Class	78%	Effective
Difference	+12%	

The findings of this study demonstrate that the development of a Project-Based Learning (PJBL) based instructional module for rhythmic movement activities in PJOK is both theoretically valid and practically effective. The high validation scores from the material and PJBL experts indicate that the module content aligns well with the principles of rhythmic movement education, Kurikulum Merdeka requirements, and the theoretical framework of PJBL. The experts affirmed that the module components essential questions, project planning stages, task structure, assessment rubrics, and reflection mechanisms were systematically integrated and pedagogically consistent. Such alignment ensures that the module is academically credible and suitable for classroom implementation (Margallo et al., 2019; Wu et al., 2025).

The practicality results from the small-group trial show that students perceived the module as clear, engaging, and easy to follow. The highest practicality indicator was the attractiveness of the learning activities, which reflects students' strong motivation and enjoyment when participating in creative gymnastics projects. This aligns with previous studies indicating that PJBL enhances student engagement by offering autonomy, creativity, and hands-on learning experiences. The students' positive responses also highlight that the module promotes active participation, which is a critical characteristic of physical education learning in Kurikulum Merdeka. The ability of students to collaborate effectively further reinforces the module's suitability for fostering teamwork and communication skills (Calavia et al., 2023; Kokkoniemi & Isomöttönen, 2023).

In terms of effectiveness, the significant difference between the project-based and non-project classes indicates that PJBL offers substantial pedagogical advantages over traditional instructional methods. Students in the project-based class showed superior performance in creativity, motor coordination, expression, and group cohesion key competencies in rhythmic movement learning. The structured project stages provided opportunities for students to explore, design, rehearse, and present creative gymnastics routines, ultimately resulting in improved learning outcomes. These findings support research by Horng et al., (2024); Tuzun, (2020), who reported that PJBL enhances motor skills, creativity, and critical thinking in physical education contexts.

The module's success aligns with the philosophical foundation of Kurikulum Merdeka, which emphasizes contextual, student-centered, and competency-based learning (Bi et al., 2020; Diogo et al., 2023; Sugihartini et al., 2025). By incorporating real projects such as creative gymnastics performances, the module supports the development of the Profil Pelajar Pancasila, particularly in the dimensions of creativity, critical reasoning, independence, and collaboration. Students engage in reflective thinking, negotiate ideas within groups, and demonstrate holistic competencies not merely technical movement skills. This demonstrates that PJBL is particularly well-suited to the demands of rhythmic activity learning, which inherently requires artistic expression and teamwork (Castaldi & Mimmo, 2019; Mäkiö-Marusik et al., 2019).

The results of this study confirm that the PJBL-based module is a feasible innovation that addresses several challenges commonly found in PJOK learning, such as low student engagement, limited creativity, and teacher-centered instruction. The module provides a structured yet flexible framework that empowers both teachers and students to engage meaningfully in rhythmic movement activities (Adha et al., 2025; Berry, 2024; Duarte et al., 2025). The combination of strong theoretical validity, high practicality, and demonstrated effectiveness confirms that the module can serve as an impactful learning resource for PJOK teachers, particularly those seeking to implement Kurikulum Merdeka through project-oriented approaches. Future research may explore large-scale implementation, long

term retention effects, and integration with digital media to further strengthen the role of PJBL in physical education.

The findings indicate that the PJBL-based creative gymnastics module offers meaningful pedagogical value in rhythmic movement learning; however, its effectiveness should be interpreted with consideration of several limitations, including the small-scale trial, reliance on student perceptions, and the absence of long-term outcome analysis. While the module demonstrates potential to enhance creativity, collaboration, and performance in line with Kurikulum Merdeka, factors such as teacher readiness, classroom context, and instructional consistency may also influence learning outcomes. Therefore, future studies are recommended to involve larger samples, include teacher-based evaluations, examine sustained learning effects, and explore integration with digital learning tools to strengthen the empirical foundation and scalability of PJBL implementation in physical education.

Conclusions

Based on the development, validation, and implementation processes, this study concludes that the PJBL-based instructional module for rhythmic movement activities successfully meets the intended research objectives by proving valid, practical, and effective in improving students' creativity, participation, and learning outcomes in creative gymnastics. Expert validation confirmed the module's strong theoretical and structural quality, student responses demonstrated high practicality and engagement, and the effectiveness test showed that the project-based class achieved significantly higher performance than the non-project class. These results indicate that the developed module is a feasible and impactful learning innovation that supports Kurikulum Merdeka and enhances the overall quality of PJOK learning at the senior high school level.

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