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Application of the Project Based Learning Model to Improve Movement Coordination in Rhythmic Gymnastics

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ABSTRACT

Rhythmic gymnastics is an essential component of Physical Education, Sports, and Health (PJOK) that requires students to demonstrate coordinated movements involving the synchronization of hands, feet, head, and body in harmony with musical rhythm. However, preliminary observations in Grade X-4 of SMA Negeri 2 Martapura revealed that students experienced difficulties in movement coordination, resulting in low learning achievement. This study aimed to improve movement coordination and learning outcomes in rhythmic gymnastics through the application of the Project Based Learning (PjBL) model. This research employed a collaborative Classroom Action Research (CAR) design based on the Kemmis and McTaggart model, consisting of two cycles: planning, action, observation, and reflection. The participants were 35 Grade X-4 students, comprising 17 males and 18 females. Data were collected through observation sheets, psychomotor performance tests, and documentation. The data were analyzed using comparative descriptive analysis to compare learning outcomes and student participation across cycles. The results demonstrated a significant improvement in students' movement coordination and learning achievement. In the pre-cycle phase, only 20.00% (7 students) achieved mastery learning with a mean score of 60.35. Following the implementation of PjBL in Cycle I, mastery learning increased to 71.43% (25 students) with a mean score of 78.69. Further improvement was observed in Cycle II, where mastery learning reached 88.57% (31 students) with a mean score of 84.28. Student activity scores also improved from 2.50 (Satisfactory) in Cycle I to 3.67 (Excellent) in Cycle II. In conclusion, the Project Based Learning model effectively improved movement coordination, learning outcomes, creativity, collaboration, and self-confidence by transforming the learning process from teacher-centered to student-centered instruction in rhythmic gymnastics learning.

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INTRODUCTION

Physical Education, Sports, and Health (PJOK) constitutes an essential component of the Indonesian education system, aimed at fostering students' physical, cognitive, psychomotor, and affective development through structured physical activity and sports

participation. Contemporary physical education is no longer limited to improving physical fitness but also emphasizes the development of critical thinking, creativity, collaboration, communication, and character values that support lifelong learning (Casey & Goodyear, 2015; Kirk, 2019). Within this context, rhythmic gymnastics serves as an important learning content in senior high school because it integrates motor skills, artistic expression, body awareness, rhythm perception, and movement coordination into a unified learning experience (Suriani, 2025).

Movement coordination is one of the most fundamental competencies required in rhythmic gymnastics. It refers to the ability to synchronize various body segments, including the hands, feet, head, and trunk, in harmony with musical rhythm while maintaining movement continuity and flexibility. Effective coordination enables students to perform movement sequences smoothly, efficiently, and aesthetically. Conversely, poor coordination often results in fragmented movements, rhythm inconsistencies, and reduced performance quality (Pranoto et al., 2024). Research has demonstrated that coordination skills significantly influence students' success in performing complex motor tasks and contribute to broader physical literacy development (Barnett et al., 2016; Hulteen et al., 2018).

Despite its importance, movement coordination remains a significant challenge for many students. Preliminary observations conducted in Grade X-4 of SMAN 2 Martapura revealed that only 7 out of 35 students (20.00%) achieved the Minimum Competency Achievement Criteria (KKTP) score of ≥80. Most students experienced difficulties synchronizing footwork with arm movements and maintaining rhythm consistency throughout movement sequences. Classroom observations further indicated that students were generally passive during learning activities and relied heavily on teacher demonstrations. Such teacher-centered instructional approaches often limit students' opportunities to explore movement patterns, solve movement-related problems, and develop creativity independently (Maulana et al., 2025).

The challenges associated with rhythmic gymnastics learning are also influenced by individual differences in motor abilities, concentration levels, prior movement experiences, and motivation (Pranoto et al., 2024). Students with lower motor competence frequently require more opportunities for active practice, feedback, and collaborative learning experiences to achieve expected performance standards. Consequently, there is a pressing need for innovative pedagogical approaches capable of promoting active participation while simultaneously enhancing movement coordination and student engagement (Siregar et al., 2024).

Furthermore, the implementation of the Merdeka Curriculum emphasizes student-centered learning, project-based activities, and the development of competencies aligned with the Pancasila Student Profile. Therefore, instructional models that encourage autonomy, collaboration, creativity, and problem-solving are increasingly necessary within PJOK learning environments (Merdeka et al., 2023). One promising approach that aligns with these educational priorities is the Project Based Learning (PjBL) model.

Project Based Learning (PjBL) has emerged as one of the most widely recommended student-centered instructional models in contemporary education. PjBL positions students as active learners who investigate problems, design projects, collaborate with peers, and produce meaningful learning outcomes through authentic experiences (Thomas, 2020). Unlike conventional teacher-centered instruction, PjBL encourages students to take ownership of their learning process, thereby fostering deeper understanding and long-term skill development (Bell, 2020).

The theoretical foundation of PjBL is rooted in constructivist learning theory, which emphasizes that knowledge is actively constructed through experience, social interaction, and reflection (Vygotsky, 1978; Krajcik & Blumenfeld, 2021). In physical education settings, PjBL provides opportunities for students to engage in meaningful movement projects that integrate physical skills, cognitive processes, and collaborative problem-solving. Such experiences support the development of both motor competence and higher-order thinking skills (Casey & MacPhail, 2018).

The implementation of PjBL generally follows six systematic stages: (1) determining a fundamental question; (2) designing the project plan; (3) arranging a project schedule; (4) monitoring project implementation; (5) testing project outcomes; and (6) evaluating the learning experience (Anak et al., n.d.). These stages enable students to participate actively throughout the learning process while fostering responsibility, teamwork, communication, and self-regulation.

Recent studies have demonstrated the effectiveness of PjBL across various educational contexts. Research by Merdeka et al. (2023) reported that PjBL significantly improves learning motivation and enhances students' communication, collaboration, critical thinking, and creativity (4C) competencies. Similarly, Belajar et al. (2023) found that PjBL effectively increased student participation and psychomotor achievement in physical education learning. Other studies revealed that project-based activities contribute positively to students' engagement, self-confidence, and learning outcomes across multiple disciplines (Guo et al., 2020; Kokotsaki et al., 2016).

Within rhythmic gymnastics learning specifically, active and collaborative instructional approaches have been associated with significant improvements in movement coordination, rhythm accuracy, balance, flexibility, and performance quality (Manani et al., 2025). Rhythmic gymnastics requires students to integrate sensory information, motor planning, timing mechanisms, and movement execution simultaneously. Therefore, learning environments that provide opportunities for exploration, peer interaction, and reflective practice are particularly beneficial for developing coordination skills (Siregar et al., 2024).

Moreover, studies in motor learning indicate that project-oriented activities facilitate the development of neuromuscular coordination through repeated practice, feedback mechanisms, and contextual learning experiences (Logan et al., 2018; Robinson et al., 2015). Consequently, PjBL represents a potentially effective strategy for addressing coordination difficulties in rhythmic gymnastics while simultaneously supporting broader educational objectives.

Although numerous studies have examined the effectiveness of PjBL in improving learning outcomes, motivation, creativity, and collaboration, relatively few investigations have specifically focused on its application in rhythmic gymnastics learning within Indonesian senior high school settings. Most existing studies have concentrated on science education, mathematics, language learning, or general physical education contexts (Guo et al., 2020; Merdeka et al., 2023).

Furthermore, previous physical education studies predominantly assessed cognitive achievement, learning motivation, or general psychomotor performance without specifically examining movement coordination as the primary outcome variable (Belajar et al., 2023). Movement coordination in rhythmic gymnastics involves unique challenges because it requires synchronization among multiple body segments while maintaining rhythm and movement continuity. These characteristics distinguish rhythmic gymnastics from many other physical education activities and warrant dedicated investigation. Another limitation of previous research is the lack of classroom action research examining how PjBL can address real-world instructional problems faced by teachers in Indonesian schools. Existing studies rarely report intervention outcomes within the context of the Merdeka Curriculum and the Pancasila Student Profile framework, particularly among high school students experiencing coordination difficulties (Manani et al., 2025).

Moreover, the preliminary findings from SMAN 2 Martapura indicate a substantial discrepancy between expected competency standards and actual student performance, with only 20.00% of students achieving KKTP mastery. This situation highlights the necessity of identifying effective pedagogical interventions capable of improving movement coordination and increasing student learning achievement. Therefore, this study addresses three major research gaps: (1) the limited evidence regarding PjBL implementation in rhythmic gymnastics learning; (2) the scarcity of studies focusing specifically on movement coordination outcomes; and (3) the lack of empirical investigations conducted within Indonesian senior high school contexts under the Merdeka Curriculum framework.

Based on the identified problems and research gaps, this study aims to examine the application of the Project Based Learning model to improve movement coordination in rhythmic gymnastics among Grade X-4 students of SMAN 2 Martapura. Specifically, the study seeks to determine whether PjBL can enhance students' ability to synchronize hand, foot, head, and body movements in accordance with rhythmic patterns and improve overall learning achievement.

The novelty of this research lies in several aspects. First, it focuses specifically on movement coordination in rhythmic gymnastics, an area that remains underexplored within PjBL research. Second, it integrates the PjBL framework with rhythmic gymnastics instruction under the Merdeka Curriculum and Pancasila Student Profile paradigm. Third, it provides empirical evidence from a real classroom setting where students demonstrate substantial coordination difficulties and low learning achievement. Finally, the study contributes practical recommendations for physical

education teachers seeking innovative strategies to improve psychomotor learning outcomes through active and project-oriented pedagogy.

In conclusion, the increasing demand for student-centered learning approaches in Indonesian education necessitates innovative instructional models capable of enhancing both motor competence and twenty-first-century skills. Given the low level of rhythmic gymnastics mastery observed among Grade X-4 students of SMAN 2 Martapura and the theoretical advantages of Project Based Learning, investigating the effectiveness of PjBL in improving movement coordination is both relevant and necessary. The findings of this study are expected to contribute to the development of effective PJOK instructional practices and provide empirical support for the implementation of project-based learning in rhythmic gymnastics education.

METHODS

This study is a collaborative and participatory Classroom Action Research (CAR) employing an integrated qualitative and quantitative approach (mixed method). lassroom Action Research (CAR) that combines observation and tests in two cycles is the most effective design to significantly and measurably improve PJOK learning outcomes (Irham et al., 2024).The CAR was implemented following the spiral model of Kemmis and McTaggart across two cycles, each consisting of four stages: planning, acting, observing, and reflecting (Pendidikan et al., 2025).

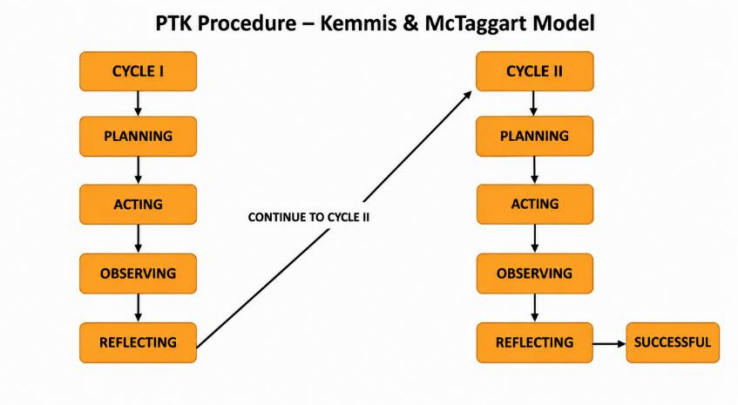

Figure 1.
Classroom Action Research Procedure (Kemmis & McTaggart Model)

Data collection techniques included observation, psychomotor performance tests, and documentation. Research instruments comprised a PjBL-based Teaching Module, teacher and student activity Observation Sheets, and a Movement Coordination Assessment Rubric covering 6 aspects. Data were analyzed using comparative descriptive analysis by comparing pre-cycle, Cycle I, and Cycle II results.

The research success indicators were established as follows: (1) a minimum of 80% of students achieve a KKTP score of ≥ 80 on the movement coordination test; and (2) the mean student activity score reaches the "Good" category (≥ 75%) on the observation sheet (Maulana et al., 2025).

RESULTS AND DISCUSSION

Result

Prior to the intervention, a preliminary observation revealed that the learning process remained conventional and teacher-centered. Students tended to be passive and were unable to synchronize footwork with arm swings. Of the 35 Grade X-4 students, only 7 (20.00%) achieved a KKTP score of ≥ 80, with a class mean of only 60.3. Complete data are presented in Table 1.

Table 1.
Pre-Cycle Data Results

Description	Result
Students Completed	7 (20%)
Students Not Completed	28 (80%)
Average	60.3
Highest Score	87,5
Lowest Score	25

Cycle I

In Cycle I, the researcher developed PjBL-based learning materials, including a Teaching Module, Student Activity Worksheets (LKPD), Observation Sheets, assessment rubrics, and heterogeneous group divisions (5 groups of 7 students each). Implementation took place over 2 meetings following the 6 PjBL syntax stages. The first meeting focused on establishing the fundamental question and project planning, while the second meeting focused on performance and reflection.

The mean teacher activity score reached 2.67 (Good category), while the mean student activity score was 2.50 (Satisfactory category). Movement coordination test results showed significant improvement as presented in Table 2.

Table 2.
Cycle I Results Data

Description	Result
Students Completed	25 (71,43%)
Students Not Completed	10 (28,57%)
Average	78.6
Highest Score	91,7
Lowest Score	37,5

Of the 35 students, 25 (71.43%) had achieved a KKTP score of ≥ 80 with a mean of 78.6. Although a significant improvement from the pre-cycle was observed, the success indicator had not yet been met as the minimum target of 80% mastery was not fulfilled. Cycle I reflection identified the following weaknesses: some students still exhibited low coordination, movement creativity was limited, time management was suboptimal, and students had not fully understood the assessment rubric.

Cycle II

Based on Cycle I reflections, improvements were made including: (1) revising the Teaching Module with more detailed movement guides; (2) strengthening scaffolding through direct demonstration; (3) optimizing time allocation; (4) communicating the assessment rubric transparently; and (5) increasing project complexity to a 16-count

movement sequence. The mean teacher activity score improved to 3.83 (Excellent) and student activity to 3.67 (Excellent). Test data are presented in Table 3.

Table 3.
Cycle II Results Data

Description	Result
Students Completed	31 (88,57%)
Students Not Completed	4 (11,43%)
Average	84,2
Highest Score	95,8
Lowest Score	54,2

Of the 35 students, 31 (88.57%) achieved a KKTP score of ≥ 80 with a mean of 84.28. Both success indicators were fulfilled in Cycle II, and the research was therefore declared successful.

Table 4.
Recapitulation of Learning Outcome Comparison: Pre-Cycle, Cycle I, and Cycle II

Stage	Students Completed	Students Not Completed	Percentage	Mastery Percentage
Pre-Cycle	7 students	28 students	11%	**20,00%**
Cycle I	25 students	10 students	46%	**71,43%**
Cycle II	31 students	4 students	43%	**88,57%**
Total Increase	**↑ 24 students**	**↓ 24 students**	**0%**	**↑ 68,57%**

Discussion

The findings of this study demonstrate that the implementation of the Project Based Learning (PjBL) model successfully improved movement coordination in rhythmic gymnastics among Grade X-4 students of SMAN 2 Martapura. The improvement was reflected in the increasing number of students who achieved the Minimum Competency Achievement Criteria (KKTP), as well as in the enhancement of students' ability to synchronize hand, foot, head, and body movements according to rhythmic patterns. These findings indicate that PjBL serves not only as an instructional strategy for improving cognitive achievement but also as an effective pedagogical approach for enhancing psychomotor competencies, particularly movement coordination in physical education settings.

The primary factor contributing to the improvement in learning outcomes was the paradigm shift from teacher-centered instruction to student-centered learning facilitated by the PjBL model. In traditional physical education classes, students often function as passive recipients of information, relying heavily on teacher demonstrations and instructions. Such an approach frequently limits opportunities for active exploration, problem-solving, and collaborative learning experiences, which are essential for motor skill acquisition and coordination development (Casey & Goodyear, 2015; Kirk, 2019). Through PjBL, students became active participants who collaboratively designed, practiced, refined, and presented rhythmic gymnastics projects. This active engagement promoted deeper learning and greater ownership of the learning process.

The findings support the argument that Project Based Learning effectively enhances learning outcomes, learning motivation, and twenty-first-century competencies, including collaboration, communication, critical thinking, and creativity (4C) skills (Merdeka et al., 2023). Students were required to communicate movement ideas, solve performance-related challenges, collaborate in project completion, and creatively develop rhythmic movement sequences. These learning experiences fostered meaningful engagement that ultimately contributed to improved movement performance. Similar findings have been reported in previous studies indicating that student-centered learning environments significantly enhance psychomotor achievement and learning engagement in physical education contexts (Casey & MacPhail, 2018; Guo et al., 2020; Kokotsaki et al., 2016).

The results of this study are consistent with the findings of Maulana et al. (2025), who reported that the implementation of PjBL in rhythmic gymnastics learning increased student mastery from 71% in Cycle I to 91% in Cycle II. The consistency of these findings suggests that PjBL provides a robust instructional framework capable of facilitating motor learning through active participation and collaborative problem-solving. From a constructivist perspective, knowledge and skills are more effectively acquired when learners actively construct understanding through experience rather than passively receiving information (Vygotsky, 1978; Krajcik & Blumenfeld, 2021). Therefore, the significant improvement observed in this study can be attributed to students' direct involvement in planning, practicing, and evaluating rhythmic gymnastics performances.

Another important finding concerns the improvement of movement coordination resulting from increased opportunities for intensive practice within collaborative groups. Rhythmic gymnastics requires the harmonious integration of multiple body segments and movement elements performed in synchronization with musical rhythm. Such complex motor tasks demand repetitive practice, continuous feedback, and opportunities for correction (Pranoto et al., 2024). The group-based activities embedded within the PjBL framework enabled students to engage in repeated movement rehearsals while receiving feedback from both peers and teachers. This collaborative practice environment facilitated motor adaptation and refinement, leading to improved coordination performance.

The findings corroborate the study conducted by Manani et al. (2025), which demonstrated that PjBL significantly enhances student participation, creativity, and learning outcomes in rhythmic gymnastics instruction. Increased participation is particularly important because motor learning effectiveness is strongly associated with practice volume and active engagement. Students who participate more frequently in movement activities tend to develop superior coordination, balance, rhythm perception, and movement control compared with students who engage less actively (Robinson et al., 2015; Logan et al., 2018). Consequently, the enhanced participation observed during the implementation of PjBL likely contributed substantially to the improvement in movement coordination.

From a motor learning perspective, the observed improvement can also be explained through the theory of deliberate practice. Deliberate practice emphasizes focused repetition, feedback utilization, and progressive refinement of performance (Ericsson et al.,

2018). During the project implementation process, students repeatedly practiced rhythmic movement sequences while evaluating and revising their performances. Such repeated practice facilitated neuromuscular adaptation, improved motor planning, and strengthened movement synchronization mechanisms. Previous studies have shown that repeated and structured movement experiences significantly improve motor competence and coordination abilities among adolescents (Barnett et al., 2016; Hulteen et al., 2018).

A notable factor contributing to the success of Cycle II was the strengthened scaffolding provided by the teacher through direct demonstrations of difficult movements. While PjBL emphasizes student autonomy, effective facilitation remains essential, particularly when students encounter challenging motor tasks. Direct demonstrations helped students visualize correct movement execution, understand movement timing, and identify critical coordination elements. As a result, students were able to imitate and internalize proper movement patterns more effectively.

This finding supports the conclusions of Belajar et al. (2023), who reported that direct teacher demonstrations positively influence movement coordination improvement. In physical education, observational learning plays a crucial role in skill acquisition because students often learn movement patterns through visual modeling before attempting independent execution (Bandura, 1986). Demonstration-based scaffolding provides learners with a clear reference for movement performance, reducing uncertainty and enhancing confidence during practice. Similar findings have been reported by studies indicating that demonstration methods significantly improve motor skill acquisition, movement accuracy, and psychomotor achievement (Ward & Lee, 2020; Rink, 2018).

Furthermore, the implementation of transparent assessment criteria emerged as another significant contributor to improved learning outcomes. Students were informed about assessment indicators, performance expectations, and evaluation standards before undertaking project activities. This transparency enabled learners to better understand learning objectives and self-monitor their progress throughout the project cycle.

The findings align with Ahwan and Basuki (2023), who argued that authentic and transparent assessment practices improve student responsibility, motivation, and academic achievement. In the context of rhythmic gymnastics, rubric transparency helped students focus on essential performance aspects, including rhythm synchronization, movement continuity, body alignment, and creativity. Research in educational assessment suggests that clearly communicated assessment criteria enhance learner autonomy, self-regulation, and goal-directed behavior (Panadero et al., 2018; Andrade & Brookhart, 2020). Consequently, students became more accountable for their learning progress and demonstrated greater commitment to achieving performance standards.

The improvement observed during Cycle II also reflects the importance of reflective learning processes within the PjBL framework. Reflection enables students to evaluate their strengths and weaknesses, identify performance gaps, and develop strategies for improvement. Through project presentations, peer evaluations, and teacher feedback sessions, students engaged in continuous reflection that facilitated deeper understanding and more effective movement correction. Previous research has consistently shown that

reflective practice enhances learning quality, self-awareness, and skill development in physical education settings (Dyson et al., 2021; Casey et al., 2020).

Overall, the findings indicate that PjBL successfully transformed students from passive and unconfident learners into active, creative, and collaborative participants in the learning process. This transformation is consistent with the findings of Irvansyah et al. (2023), who reported that project-based learning promotes learner autonomy, social interaction, and active participation. Students demonstrated increased confidence when performing rhythmic gymnastics movements, greater willingness to collaborate with peers, and stronger motivation to complete learning tasks. Such behavioral changes are particularly important because positive learning attitudes often contribute to sustained academic and psychomotor achievement (Deci & Ryan, 2020; Ntoumanis et al., 2021).

From the perspective of the Merdeka Curriculum and the Pancasila Student Profile, the implementation of PjBL effectively fostered essential competencies such as creativity, collaboration, independence, critical reasoning, and communication. These competencies are increasingly recognized as fundamental educational outcomes in the twenty-first century (Merdeka et al., 2023; OECD, 2021). Consequently, the success of PjBL in improving movement coordination extends beyond psychomotor development and contributes to broader educational objectives related to holistic student development.

In summary, the improvement in movement coordination observed in this study resulted from multiple interconnected factors, including student-centered learning, increased participation, intensive collaborative practice, teacher scaffolding through demonstrations, transparent assessment procedures, and reflective learning experiences. The integration of these elements within the PjBL framework created a supportive learning environment that facilitated both motor skill development and broader educational competencies. Therefore, Project Based Learning can be considered an effective and innovative instructional model for enhancing movement coordination in rhythmic gymnastics and improving overall learning quality in physical education.

CONCLUSION

Based on the results of the CAR conducted over two cycles in Grade X-4 of SMAN 2 Martapura, the following conclusions are drawn: (1) The application of the PjBL model improved student learning activity, evidenced by an increase in the mean activity score from 2.50 (Satisfactory) in Cycle I to 3.67 (Excellent) in Cycle II, with an achievement percentage of 91.75%. (2) The PjBL model successfully and consistently improved rhythmic gymnastics movement coordination learning outcomes: the class mean increased from 60.35 (pre-cycle) → 78.69 (Cycle I) → 84.28 (Cycle II); and the mastery percentage rose from 20.00% → 71.43% → 88.57%. The success indicator (minimum 80% mastery) was fulfilled in Cycle II.

Physical Education teachers are advised to: ensure assessment rubrics are communicated transparently, strengthen scaffolding through direct demonstration, and provide additional support for students with low motor ability. Schools are advised to

promote the implementation of the PjBL model across subjects and facilitate innovative learning training based on the Curriculum.

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