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The Effect of Cross-Lateral Movement-Based Pencak Silat Training on Improving the Dynamic Balance of Physical Education Students Class of 2023

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ABSTRACT

This study aims to determine the effect of pencak silat training based on cross-lateral movement on improving the dynamic balance of Physical Education students in the 2023 cohort. The study used a quantitative approach with a Classroom Action Research (CAR) design conducted in two cycles, each comprising the stages of planning, implementation of actions, observation, and reflection. The research sample consisted of 39 students who took pencak silat classes. The instrument used was a valid and reliable dynamic balance test, with measurements taken at the pre-cycle stage, at the end of cycle I, and at the end of cycle II. The results showed a gradual increase in dynamic balance scores, with a pre-action average score of 42.15 ± 5.21, increasing at the end of cycle I to 48.63 ± 4.82, and increasing again at the end of cycle II to 52.74 ± 4.15. The results of the paired sample t-test showed a very significant difference between pre-intervention and cycle I ($t = 7.82$; $p < 0.001$), cycle I and cycle II ($t = 5.43$; $p < 0.001$), and pre-intervention and cycle II ($t = 11.06$; $p < 0.001$). In addition, the percentage of students who achieved the minimum completion criteria increased from 20.51% in the pre-intervention to 53.85% at the end of cycle I and 79.49% at the end of cycle II. Based on these results, it can be concluded that pencak silat training based on cross-lateral movement has a positive and significant effect on improving the dynamic balance of 2023 Physical Education students, making it effective as a motor learning strategy in pencak silat lectures at universities.

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INTRODUCTION

Physical education in higher education plays a strategic role in preparing future educators and sports practitioners who not only possess technical skills but also a scientific understanding of the learning process of movement. Physical education plays an important role in improving students' attitudes toward sports and motor skills in higher education, where research shows that structured physical education programs not only affect physical condition but also motor skills, as well as participation and

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attitudes toward sports in general among students (C. Wang et al., 2024). Physical education and sports programs have a significant influence on the development of motor competence and physical skills in general, where systematic research shows that movement learning in sports education helps improve motor competence in children and adolescents as a structured curriculum model through PE learning content (Loras Havard, 2020). Physical education students are required to master various sports, one of which is pencak silat as a cultural heritage of the nation that has educational, philosophical, and health values. In the context of classroom learning, pencak silat serves not only as a martial arts skill, but also as a means of developing basic physical abilities, including balance, coordination, and body control. Research on physical education in schools shows a strong correlation between interest in sports and the development of students' motor skills, highlighting the importance of paying attention to motivation and variety in sports learning to optimize students' motor skills. These findings are also relevant to physical education in higher education in order to maximize practical learning of sports movements, including pencak silat (Sahabuddin et al., 2025). However, the reality in the field shows that pencak silat learning in higher education still tends to be oriented towards conventional mastery of techniques, so it has not fully optimized the potential for developing students' specific motor skills.

One of the important components in pencak silat is dynamic balance, which is the individual's ability to maintain body stability while moving or changing positions. Maintaining static and dynamic balance is very important for good performance in various sports; athletes generally need training to improve their balance, which is very important for competitive performance (Sahabuddin et al., 2025). Dynamic balance is essential in performing various pencak silat techniques such as kicks, dodges, evasions, and stance changes. Balance training significantly improves body stability, agility, and movement coordination, which contributes to improved competitive performance (Kusuma & Arya, 2024). Dynamic balance has a significant correlation with lower body strength, explosive power, and agility, indicating that dynamic balance ability contributes to overall physical performance (J. Wang et al., 2025). Physical Education students with good dynamic balance will find it easier to master pencak silat techniques effectively and safely. However, initial observations of the 2023 Physical Education students show that some students still have difficulty maintaining body stability when performing a series of pencak silat movements, especially those involving weight transfer and coordination between body parts.

The problem of low dynamic balance indicates the need for innovation in pencak silat training and learning methods, considering that exercises that stimulate the neuromuscular system have been proven effective in improving dynamic balance and body control during complex movements (Myer et al., 2024). One approach that is considered potential but is still rarely applied in pencak silat learning is cross-based training -lateral movement training, which involves cross-body movements between the right and left sides of the body, such as coordinating the right hand with the left foot or vice versa. This is related to the body's ability to cross the midline and contributes to improved motor coordination and integration

between body parts (Ricon et al., 2022). Theoretically, this cross-lateral movement pattern can stimulate the integration of the right and left brain, improve neuromuscular coordination, and improve postural control during movement, as demonstrated in the dynamic neuromuscular stabilization approach, which has a positive effect on postural stability and dynamic movement performance (Kobesová et al., 2025).

Cross-lateral movement-based exercises have been widely used in the fields of motor development, rehabilitation, and certain sports because they have been proven effective in improving balance, coordination, and concentration through the stimulation of bilateral body work and central nervous system integration (Diamond, 2019). Movement patterns involving cross-coordination between the right and left sides of the body are known to improve neuromuscular control and movement quality, particularly in activities that require complex coordination and postural stability during movement (Ricon et al., 2022). However, the application of the cross-lateral movement approach in pencak silat learning, especially in a college environment, is still very limited, even though the characteristics of pencak silat movements, which involve simultaneous coordination between the hands, feet, and body, are very suitable for combining with these cross-movement patterns. The integration of cross-lateral movement exercises into pencak silat learning is expected to not only improve technical mastery effectively but also provide a more comprehensive improvement in movement quality through improved coordination, dynamic balance, and postural control of students (Kobesová et al., 2025).

As prospective physical education teachers, Physical Education students are not only required to be able to perform movements correctly, but also to understand the principles of scientifically-based training and learning, because the implementation of scientific methods in physical education learning has been proven to improve teacher competence and overall teaching quality (Sakti et al., 2021). Therefore, pencak silat learning needs to be designed systematically and measurably in order to have a real impact on improving students' physical abilities; this approach is in line with the idea that classroom action research provides opportunities for physical education teachers to identify learning problems, apply new strategies, and assess results cyclically and reflectively (Adams et al., 2023). Classroom action research (CAR) with a quantitative approach is one of the relevant research designs for examining the effectiveness of a training method in the context of real classroom learning because sports learning studies show that systematic and evidence-based research designs improve pedagogical practices and enhance student learning outcomes (Rozi et al., 2025).

The quantitative approach in PTK allows researchers to objectively measure improvements in students' dynamic balance through standardized test instruments. Thus, the effects of cross-lateral movement-based pencak silat training can be analyzed systematically and measurably. In addition, the use of quantitative data also strengthens the validity of the research findings and provides a clear picture of the effectiveness of the actions taken. This is important so that the research results are not only descriptive but can also be used as a basis for decision-making in the development of pencak silat learning in higher education.

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This study focuses on the effect of cross-lateral movement-based pencak silat training on improving the dynamic balance of 2023 Physical Education students. This research is expected to contribute theoretically to the development of pencak silat learning studies based on a modern motor approach, as well as practically to lecturers and students in improving the quality of the learning process and outcomes. In addition, the results of this study are also expected to serve as a reference for further research in developing more effective, safe, and holistic pencak silat learning innovations that focus on improving students' physical abilities.

METHODS

The research method used in this study was Classroom Action Research (CAR) with a quantitative approach, which is a form of reflective research conducted by educators to systematically improve and enhance the quality of learning through concrete actions in the classroom supported by empirical data (Kemmis, McTaggart, & Nixon, 2014). This study was conducted on students of the Sports Education Study Program at STKIP PGRI Bangkalan class of 2023 who took pencak silat courses with a sample size of 38 students. The PTK design was chosen based on the research objective, which was to improve the learning process and outcomes through the application of a pencak silat training model based on cross-lateral movement, because PTK allows lecturers to innovate learning while directly evaluating its effectiveness in a real classroom context (Mertler, 2020).

The research was conducted in two cycles, and each cycle consisted of four main stages, namely planning, implementation of actions, observation, and reflection, which were carried out continuously. This cycle structure is in line with the basic principles of PTK, which emphasizes the process of continuous improvement through data-based reflection on each learning action provided (Kemmis et al., 2014). In the action implementation stage, students were given pencak silat exercises based on cross-lateral movement integrated into practical learning, in the form of a series of movements that emphasized cross-coordination between the right and left sides of the body, such as a combination of stances with opposite hand swings, cross steps, and simple moves involving dynamic weight transfer, as cross-coordination-based exercises have been proven effective in improving neuromuscular control and postural stability during dynamic movements (Myer et al., 2024).

Dynamic balance measurements were conducted at the pre-cycle stage, the end of cycle I, and the end of cycle II using dynamic balance test instruments appropriate for the characteristics of Physical Education students. The research data were analyzed using descriptive quantitative analysis, comparing the average dynamic balance scores of students at each measurement stage. The indicators of research success were determined based on the increase in the average dynamic balance score and the percentage of students who achieved the predetermined mastery criteria, because the quantitative approach in PTK allows researchers to obtain an objective and measurable picture of the impact of a learning action on student learning outcomes (Creswell &

Creswell, 2018). The results of the analysis were then used as a basis for reflection to determine the effectiveness of the action and improvements in learning in the next cycle.

RESULTS AND DISCUSSION

Result

This study used a valid and reliable dynamic balance test instrument. Each student was tested in three stages:

1. Pre-cycle (before exercise)
2. End of Cycle I
3. End of Cycle II

Table 1.

Pre-Action and Post-Action Dynamic Balance Data

Measure Stage	Average Score	SD (Standard Deviation)
Pre-Intervention	42,15	5,21
End of Cycle I	48,63	4,82
End of Cycle II	52,74	4,15

The results of the dynamic balance measurement show a gradual increase in scores, where at the pre-intervention stage, the average score was 42.15 with a standard deviation of 5.21. then increased at the end of cycle I to 48.63 with a standard deviation of 4.82, and increased again at the end of cycle II with an average score of 52.74 and a standard deviation of 4.15, indicating that the exercises given contributed positively to the improvement of students' dynamic balance.

Table 2.

Comparison of Pre-Intervention and Post-Intervention Dynamic Balance Data

Comparison	t	df	p-value
Pre-Intervention vs Cycle I	7,82	38	< 0,001
Cycle I vs Cycle II	5,43	38	< 0,001
Pre-Intervention vs Cycle II	11,06	38	< 0,001

The results of the statistical test using the paired sample t-test show that there are very significant differences in the dynamic balance scores of students, both between pre-intervention and cycle I ($t = 7.82$; $df = 38$; $p < 0.001$), between cycle I and cycle II ($t = 5.43$; $df = 38$; $p < 0.001$), and between pre-intervention and cycle II ($t = 11.06$; $df = 38$; $p < 0.001$), indicating that the increase in dynamic balance scores after cross-lateral movement-based pencak silat training was statistically significant and showed a real effect of the training on improving students' dynamic balance.

Table 3.

Percentage of Mastery Criteria

Stage	Number of Students ≥ KKM	Percentage (%)
Pre-Intervention	8	20,51%
End of Cycle I	21	53,85%
End of Cycle II	31	79,49%

Based on the results of achieving the minimum mastery criteria (KKM), at the pre-action stage, there were 8 students or 20.51% who had met the KKM. then the number increased significantly at the end of cycle I to 21 students or 53.85%, and again increased at the end of cycle II to 31 students or 79.49%, which shows that the implementation of

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exercises in stages was able to increase the number of students who met the completion criteria, from the initial condition which was still low to most students being declared complete at the end of the research cycle. The pencak silat training designed with a cross-lateral movement approach had a positive and significant effect on improving the dynamic balance of Physical Education students in the 2023 cohort. This training method proved to be effective as a motor learning strategy that can be applied in pencak silat learning practices in higher education.

Discussion

The results of the study indicate that pencak silat training based on cross-lateral movement has a positive and significant effect on improving the dynamic balance of Physical Education students in the 2023 cohort. This finding is in line with research results showing that balance training programs produce significant improvements in dynamic balance performance after training intervention, both in adolescent groups and young athlete groups, indicating that balance training can improve body stability during movement (Muehlbauer et al., 2022). The gradual improvement in dynamic balance scores from pre-intervention to the end of cycle II indicates that the intervention was effective in improving students' ability to maintain body stability during movement, supporting evidence that structured neuromuscular or balance training produces positive adaptations in dynamic balance through enhanced postural control and neuromuscular responses (P. Wang et al., 2024). These findings reinforce the view that dynamic balance is a physical ability that can be improved through systematically designed and sustained training in the context of pencak silat learning. This improvement in dynamic balance is inseparable from the characteristics of cross-lateral movement training, which emphasizes cross-body coordination between the right and left sides of the body. This movement pattern requires the simultaneous involvement of various muscle groups and more complex neuromuscular coordination, thereby stimulating the central nervous system to control posture and body stability. In pencak silat, this ability is essential because almost all techniques, such as stances, kicks, and evasions, involve rapid and dynamic shifts in body weight and position.

The statistical test results, which showed a very high significance value in each measurement comparison, confirmed that the improvement in students' dynamic balance did not occur by chance but was a direct result of the training provided. These findings are in line with research results showing that structured physical activity in physical education has a significant impact on improving motor skills, including balance. where statistical tests show a meaningful improvement in students' balance after treatment (pre-test average of 50.3 to post-test average of 68.5, $p < 0.05$), thus demonstrating the effectiveness of exercise intervention in motor learning (Proboyulianto & Siska, 2024). This also supports the view of movement learning theory which states that exercises involving variation and comprehensive involvement of the motor system significantly improve students' motor skills, including balance and coordination, as shown in studies using a quantitative experimental approach with

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statistically significant tests ($p < 0.05$) on the aspect of balance after physical activity intervention in PJOK.

In addition to an increase in average scores, the research results also showed a significant increase in the percentage of students who achieved the minimum mastery criteria; this finding is in line with research that found that the application of innovative learning in sports can increase the percentage of students who achieve physical skill mastery, where the percentage of students who achieve skill standards increased significantly after a systematically designed learning intervention in physical education subjects (Musto et al., 2025). In the early stages, most students were unable to demonstrate adequate dynamic balance, but after further training intervention, the percentage of students who achieved mastery increased significantly, supporting other national findings that systematic physical activity-based learning can help learners of various ability levels achieve physical learning targets. In the context of Classroom Action Research (CAR), these results indicate that the process of reflection and improvement of actions in each cycle plays an important role in increasing the effectiveness of learning. Improvements in cycle II, in terms of exercise variation, intensity, and learning management, proved to provide more optimal results than the previous cycle. Thus, CAT becomes a relevant approach for lecturers in evaluating and refining pencak silat learning practices in a sustainable manner based on empirical data.

The theoretical implication of this study is to contribute to the development of pencak silat learning studies, particularly in the use of the cross-lateral movement approach as a strategy for improving dynamic balance. This study enriches the literature on movement learning by confirming that the integration of cross-movement patterns can improve the quality of postural control and motor coordination in sports students. These findings can also be the basis for further research to examine the effects of similar approaches on other physical components, such as agility, coordination, or concentration.

The practical implication of this study is that cross-lateral movement-based pencak silat training can be used as an alternative effective learning method in higher education, particularly in physical education study programs. Lecturers can integrate these exercises into pencak silat lectures to improve movement quality, reduce the risk of injury due to imbalance, and equip students as prospective sports teachers with innovative and science-based learning experiences. Thus, the results of this study not only have an impact on improving student abilities but also on developing more effective, safe, and holistic physical ability-oriented pencak silat learning practices.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that pencak silat training based on cross-lateral movement has a positive and significant effect on improving the dynamic balance of Physical Education students in the 2023 cohort, as indicated by a gradual increase in dynamic balance scores from pre-intervention to the end of the cycle and supported by statistical test results showing a

very significant difference. thus the improvement that occurred was a real impact of the application of these exercises; in addition, these exercises were also able to significantly increase the number of students who achieved the minimum completion criteria, both for students with high and low initial abilities, so that theoretically this study reinforces the study of movement learning that exercises with right-left cross-coordination patterns are effective in improving postural control and movement quality, and practically implies that pencak silat training based on cross-lateral movement can be used as an alternative innovative, measurable, and effective learning method in pencak silat lectures in higher education and is relevant to equip students as prospective physical education teachers with scientific-based learning experiences.

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