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Embedding Mindfulness into Sport Specific Training: Effects on Attentional Control in Adolescent Wushu Athletes

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Abstract
Attentional control is a critical cognitive component in precision-based sports such as wushu, where athletes must coordinate complex motor actions with sustained focus. While mindfulness training has been widely studied in sport psychology, its integration into sport-specific training contexts remains limited, particularly in martial arts. This study aimed to examine the effect of embedding mindfulness practices into regular wushu training on athletes' attentional control. Methods: A pre-experimental one-group pretest–posttest design was employed involving 23 adolescent wushu athletes (aged 16–20 years) with at least two years of training experience. Participants underwent a four-week mindfulness-integrated training program (3 sessions/week, 30 minutes/session). Attentional control was measured using the Attention Control Scale (ACS). Data were analyzed using descriptive statistics, normality tests, paired sample t-tests, and effect size (Cohen's d). Result: The results showed a significant improvement in attentional control scores ($p < 0.001$), with mean scores increasing from 60.30 to 75.91. The effect size was large ($d = 3.92$), indicating substantial practical impact. Conclusion: Embedding mindfulness into sport-specific training may effectively enhance attentional control in wushu athletes. However, due to the absence of a control group, findings should be interpreted cautiously. Future studies using stronger experimental designs are recommended.

Keywords: attentional control; mental training; mindfulness; sport psychology; wushu

1. Introduction

Attentional control is essential for athletic performance, especially in sports that demand precision, coordination, and timing (Rahimi et al., 2022). In wushu, athletes perform complex movements that combine speed, balance, rhythm, and expression. To meet these demands, they need both technical skill and steady focus, especially under pressure (Mei & Yuan, 2024). Even small lapses in attention can affect accuracy and performance, highlighting the importance of stable attention in wushu (Li, 2020). Attentional Control Theory explains that cognitive performance relies on balancing goal-focused and stimulus-driven attention (Wills et al., 2017). When athletes feel anxious or overloaded, this balance can shift, leading to less efficient attention and inconsistent performance (Q. Wang, 2025). Self-regulation theory also highlights the need for internal monitoring and control to perform well. Together, these theories suggest that attentional control is not just a natural ability but a skill that can be improved with training (Latinjak, 2025).

Although attentional control is important, most martial arts training focuses on physical conditioning and technical drills, with little attention to psychological training (Moore et al., 2019). This creates a gap between what athletes need mentally and how they are trained. As a result, athletes may have strong physical skills but lack the mental tools to perform well under pressure (Hufton et al., 2024). Mindfulness is a promising way to improve attentional control by helping athletes stay present and reduce mental distractions (Y. Wang et al., 2023). Practices like mindful breathing and observing thoughts without judgment can help athletes focus better and avoid distractions during performance (Qi, 2025). Research shows that mindfulness training can boost concentration, emotional control, and consistent performance in many sports. However, most studies have used mindfulness separately from regular training (Röthlin et al., 2020).

This separation limits the ecological validity of mindfulness training, as athletes may find it difficult to transfer psychological skills acquired in isolated settings to real competitions (Papadakis et al., 2025). Keeping mindfulness training separate from regular practice makes it harder for athletes to use these skills in real competitions (Rooks et al., 2017). To address this, recent sports science research supports training models that combine mental, emotional, and physical skills within the sport itself (Rogowska, 2024). This is especially important in complex sports like wushu, where athletes need to coordinate mental focus with physical performance (Chao & Siriphan, 2024). Athletes who are unable to maintain stable attention are more likely to experience performance breakdowns, particularly during sequences that demand precise timing and coordination (Huang et al., 2024). In competitive settings, even small attentional disruptions can lead to significant scoring penalties, further underscoring the need for training approaches that explicitly target cognitive control (Furley et al., 2016).

Despite growing recognition of the importance of mental skills in sport, the implementation of structured psychological interventions in daily training. Even though mental skills are becoming more recognized in sports, structured psychological training is still rare in daily practice (Riyanto et al., 2025). Often, mental training occurs in separate sessions, making it hard for athletes to use these skills during actual performance. There is a clear need for training methods that build mental skills directly into sport-specific activities (Firănescu et al., 2020). st simultaneously manage body coordination, spatial awareness, rhythm, and emotional expression, placing substantial demands on attentional control (Tu et al., 2025). However, empirical evidence investigating the integration of mindfulness within wushu training remains scarce, particularly in ecologically valid training settings that reflect real practice conditions (Du, 2024).

This study will examine how adding mindfulness practices to regular wushu training affects athletes' attentional control (Si, Xing Wei, 2024). Instead of treating mindfulness as a separate activity, the study includes it in actual sport movements, so athletes can build attention skills while performing (C & Komala, 2025). This approach aims to help create more practical and complete training models that match the real needs of athletes (Nien et al., 2020).

2. Method

Research Design

The study used a pre-experimental design of a pretest–posttest group to examine the initial effect of exercise-specific training integrated with mindfulness on attention control among adolescent wushu athletes. This design was chosen because it is suitable for exploratory intervention studies that aim to evaluate initial feasibility, practicality, and effectiveness before implementing larger-scale controlled trials. The study assessed changes in attention control by comparing participants' scores before and after the intervention period.

Participants

Participants consisted of 23 teenage wushu athletes from East Java, Indonesia, aged between 16 and 20 years. All participants have at least two years of formal training experience and have participated in regional or national-level competitions. Participants were recruited using purposive sampling methods to ensure homogeneity of training backgrounds and competitive experience. The inclusion criteria are: (1) actively participating in regular wushu training sessions, (2) having at least two years of formal wushu training experience, (3) being physically fit and free from injury during the intervention period, and (4) having no prior formal mindfulness training experience. Athletes who missed more than two intervention sessions or failed to complete both assessments were excluded from the final analysis. Participation in this study was voluntary, and informed consent was obtained from all participants prior to data collection.

Intervention Procedure

The intervention was a four-week mindfulness training program built into the athletes' regular wushu practice sessions. It took place three times a week, with each session lasting about 30 minutes. Instead of offering mindfulness as a separate module, the practices were included in sport-specific training to make them more relevant and help athletes apply attentional control directly during their movements.

The mindfulness program included several practices that aligned with the mental and physical needs of wushu. These included mindful breathing to encourage present-moment awareness, body scans to help athletes notice physical sensations, and movement-based mindfulness built into wushu techniques to support focus during complex routines. Participants were also taught to notice their thoughts and feelings without judgment, so they could spot distractions and bring their attention back to the task.

All training sessions were led by a certified mindfulness instructor with experience in sport settings to ensure consistency. A certified mindfulness instructor with experience in sports led all training sessions to keep the program consistent. Each session followed a set of guidelines to make sure the timing, frequency, and delivery of mindfulness practices were the same for everyone. This helped keep the program reliable and reduced differences between participants. By incorporating mindfulness in regular wushu practice, the program aimed to help athletes combine mental and physical skills in a way that aligns with real performance.

Measurement of Attentional Control

Attention control is assessed using the Attention Control Scale (ACS), a widely used and psychometrically validated instrument designed to measure an individual's capacity to focus attention and divert attention resources when needed. ACS evaluates two main dimensions of attention control: attention focusing and distraction. Higher scores indicate better regulation of attention and resistance to distractions.

ACS was administered twice during the study period: before the intervention (pretest) and immediately after the completion of the four-week mindfulness program (posttest). The use of standardized and validated instruments increases keandalan dan perbandingan temuan di seluruh peserta dan fase intervensi.

Data Analysis

The data were analyzed using statistical software through a systematic sequence of analytical procedures. Initially, descriptive statistics were calculated to summarize the characteristics of the data, including the mean, standard deviation, minimum, and maximum values of attentional control scores obtained from the pre-test and post-test. These descriptive measures provided an overview of the distribution and central tendency of the data.

Prior to conducting inferential analysis, normality testing was performed to determine whether the data met the assumptions required for parametric statistical testing. Both the Kolmogorov–Smirnov test and the Shapiro–Wilk test was applied to assess the distribution of the data. The results indicated that the data were normally distributed ($p > 0.05$), thereby justifying the use of parametric tests for further analysis.

To evaluate the effect of the intervention, a paired sample t-test was conducted to compare the pre-test and post-test attentional control scores. This analysis allowed for the examination of within-subject differences following the mindfulness-integrated training program. Statistical significance was determined at an alpha level of 0.05. In addition to hypothesis testing, the magnitude of the intervention effect was assessed using Cohen's d effect size. This measure provided a practical interpretation of the observed changes beyond statistical significance, enabling a more comprehensive understanding of the impact of the intervention on attentional control.

Ethical Considerations

This study followed ethical guidelines for research with human participants. Everyone gave informed consent before data collection began. Participation was voluntary, and we kept all personal information confidential. The intervention was low risk, using only non-invasive psychological training as part of regular athletic practice.

3. Result

Descriptive Statistics of Attentional Control

This study looked at how athletes' attentional control changed after adding mindfulness practices to their regular wushu training. The results showed that focus scores improved clearly after the intervention.

Table 1. Descriptive Statistics of Attentional Control Scores (Pre-test and Post-test)

Statistics	Pre-Test Focus Score	Post-Test Focus Score
N	23	23
Mean	60.30	75.91
Median	60.00	76.00
Standard Deviation	3.28	4.58
Minimum	54	68
Maximum	66	84
Skewness	-0.12	-0.04
Kurtosis	-0.70	-0.89

The average attentional control score rose from 60.30 before the intervention to 75.91 after it, showing a clear improvement. Median scores also went up, from 60.00 to 76.00. The scores stayed symmetrical, with skewness values near zero, and kurtosis values showed no major departure from a normal distribution.

The rise in both the lowest and highest scores shows that most participants improved, pointing to a steady pattern of change instead of just a few individual gains.

Assumption Testing (Normality)

Before running inferential analysis, normality tests were used to check if the data met the assumptions needed for parametric tests.

Table 2. Normality test results

Variabel	Kolmogorov-Smirnov (Sig.)	Shapiro-Wilk (Sig.)
Pre-Test Focus	0,200	0,899
Post-Test Focus	0,200	0,778

The Kolmogorov-Smirnov and Shapiro-Wilk tests showed that the data were normally distributed ($p > 0.05$). This means the assumption of normality was met, so using parametric statistical analysis was appropriate.

Inferential Analysis: Pre–Post Comparison

A paired sample t-test was used to compare attentional control scores before and after the mindfulness-integrated training program.

Table 3. Paired sample t-test results

Variable	Mean Difference	SD	SE	t	df	Sig. (2-tailed)
Post-Test – Pre-Test Focus	15.61	1.50	0.313	-49.915	22	0.000

The paired sample t-test showed a significant increase in attentional control scores after the intervention ($t(22) = -49.915$, $p < 0.001$). On average, athletes' focus improved by 15.61 points after taking part in the mindfulness-integrated training program.

Effect Size Interpretation

The analysis showed a very large effect size ($d = 3.92$). This means the improvement was not just statistically significant but also meaningful in practice. It suggests that adding mindfulness practices to training was closely linked to better attentional control.

However, this unusually large effect size should be viewed carefully. Because the sample was quite similar and there was no control group, the size of the change might show both the effect of the intervention and the influence of the controlled training environment, where participants had similar backgrounds and routines.

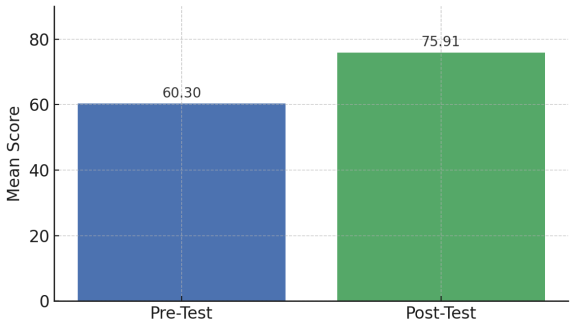

Figure 1. Comparison of Mean Focus Scores Before and After Treatment

4. Discussion

This study looked at how adding mindfulness practices to regular wushu training affects athletes' attentional control. Results showed that attentional control improved after the intervention, suggesting that mindfulness can help athletes focus better during performance (Baltar & Filgueiras, 2018). However, these results are preliminary due to limitations in the study design. The results support Attentional Control Theory, which says that cognitive performance depends on balancing goal-directed and stimulus-driven attention (Ding et al., 2025). Mindfulness training may help athletes stay focused on important cues and block out distractions. In wushu, where athletes perform complex movements in changing situations, better attentional stability can lead to more precise and consistent performance (Teng et al., 2024).

These findings also align with self-regulation theory, which emphasizes the importance of awareness and control of thoughts and emotions. Mindfulness practices like focused breathing and non-judgmental awareness can help athletes notice when their attention drifts and bring it back (Yang et al., 2025). This is especially important in wushu, where mental focus and physical movement must work together for the best results. A key contribution of this study lies in integrating mindfulness into sport-specific training activities rather than delivering it as a separate intervention (Peng et al., 2025). A main strength of this study is that mindfulness was integrated into regular wushu training rather than taught separately (Si et al., 2024). This way, athletes practiced focusing their attention while actually moving, not just in isolation. Practicing skills in real training settings helps athletes use them better in competition, since the environment is similar to what they will face during actual performance, with relatively limited empirical attention (Josefsson et al., 2017). While earlier studies have primarily focused on sports such as archery, tennis, and endurance activities, the present study highlights the applicability of mindfulness in a complex, dynamic sport that requires simultaneous cognitive, physical, and expressive control. This suggests that the effectiveness of mindfulness may not be restricted to specific types of sports but may generalize across diverse performance contexts when appropriately adapted (Faude et al., 2017).

Despite these positive results, there are some important limitations. First, the study used a one-group pretest–posttest design without a control group, so it is hard to say for sure that mindfulness caused the improvements. Other factors, like regular training, getting used to the tests, or natural changes over time, could have played a role. Second, the sample was small and similar, which means the results might not apply to everyone. While having a similar group can reduce differences, it can also make the effects look bigger than they really are.

The exceptionally large effect size observed in this study (Cohen's d = 3.92) should therefore The very large effect size found in this study (Cohen's d = 3.92) should be viewed carefully. While it suggests a strong practical effect, such a big result is rare in behavioral and sports science and might be due to how the study was done, not just the intervention itself. Future research with larger, more diverse groups is needed to yield more reliable results. program produced significant improvements, it remains unclear whether these effects are sustained over time or transferable to actual competitive performance. Longitudinal research is needed to examine the durability of attentional improvements and their impact on performance outcomes in real competition settings. From a practical standpoint, the findings of this study offer important implications for coaches and sport practitioners. The integration of brief, structured mindfulness exercises into regular training routines may serve as an efficient and scalable strategy to enhance athletes' attentional control without requiring major modifications to existing training programs. This approach supports the development. Practically, these findings are useful for coaches and sports practitioners. Adding short, structured mindfulness exercises to regular training could be an efficient way to help athletes improve their focus without significantly altering training programs (Song et al., 2026). This supports a more comprehensive training approach that integrates insights into the physical, technical, and mental skills underlying cognitive enhancement in sport contexts (Xie et al., 2025).

5. Conclusion and Recommendation

This study demonstrates that embedding mindfulness practices into sport-specific training has the potential to enhance attentional control in adolescent wushu athletes. The findings highlight the importance of integrating psychological training within physical practice to support holistic athlete development.

However, due to methodological limitations, particularly the absence of a control group, these results should be interpreted with caution. Future studies are recommended to adopt more rigorous experimental designs to strengthen the evidence base.

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Conflict of interest

The authors declare no conflicts of interest about this study.

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