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The influence of Sepak Takraw technical skills on athletes at the student education and training center

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ABSTRACT

This study examined the changes in technical skills of 15 PPLP sepak takraw athletes over a three-month structured training period, focusing on ball juggling, service, smash, and setting. Using a one-group repeated measures design, athletes' performances were assessed under standardized conditions in March and June. Results showed significant improvement in ball juggling (mean increase = 43.6 points, $F = 61.62$, $p < .001$, $\eta^2 = 0.81$) and smash (mean increase = 5.2 points, $F = 9.73$, $p < .05$, $\eta^2 = 0.66$), indicating effective adaptation of coordination and offensive skills. In contrast, service and setting declined significantly, with setting showing the largest decrease (mean = −57 points, $F = 29.92$, $p < .01$, $\eta^2 = 0.91$), suggesting insufficient emphasis on precision and tactical drills. Findings highlight the need for balanced training programs integrating coordination, strength, accuracy, and tactical practice. Limitations include small and unequal sample sizes for some skills, and the absence of a control group. Future studies should incorporate control groups and longer-term monitoring to better inform evidence-based training strategies.

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Introduction

Sepak takraw is a dynamic, high-intensity sport that demands exceptional technical proficiency, agility, and coordination (Basyiruddin et al., 2024; Pagayang et al., 2025). Originating in Southeast Asia, the sport has evolved from a recreational pastime into a competitive discipline with structured training methodologies and international tournaments. Unlike many team sports that rely primarily on limb movement, sepak takraw integrates foot-based ball manipulation with acrobatic body mechanics, placing unique demands on athletes' motor skills and technical capabilities (Ayu et al., 2024; Kiram et al., 2023).

Technical skill development is central to performance success in sepak takraw. Foundational techniques such as ball juggling reflect an athlete's motor control, balance, and ball–body coordination, while service quality affects the initiation of game sequences. Offensive techniques like smash directly

contribute to scoring, and setting facilitates team coordination and tactical transitions from defense to attack (Aji, 2021; Putra et al., 2025). Together, these skills form the basis for competitive success.

Despite increasing interest in sepak takraw, scientific understanding of technical skill progression over time remains limited. Previous research has primarily focused on physiological attributes such as aerobic capacity, muscular power, and agility (Hirwana et al., 2023), leaving a gap in knowledge regarding the longitudinal development of technical skills.

Most existing studies emphasize cross-sectional comparisons between elite and sub-elite athletes (Morrison et al., 2025), which limits insight into individual performance trajectories and responses to structured training interventions. Longitudinal designs with repeated measurements can reveal patterns of adaptation or decline within the same athletes, providing more robust evidence for skill acquisition.

Another gap concerns the interplay between different technical skills. Improvements in one domain, such as ball juggling, may not automatically transfer to tactical skills like setting, which depend on perceptual decision-making and game context (Agustina et al., 2025; Carvache-Franco et al., 2024). Understanding these relationships is crucial for designing training programs that balance coordination, power, precision, and tactical competence.

Addressing these gaps has practical significance for athlete development programs like PPLP, where coaches often rely on intuition or experience to allocate training emphasis among technical skills. Empirical evidence from longitudinal studies can inform periodization models and help distribute workload across technical, tactical, and physical domains more effectively (Adnan et al., 2020; Monma et al., 2018).

This study employs a repeated measures design to track changes in technical performance in a cohort of PPLP sepak takraw athletes across two time points, March and June. Rigorous statistical methods, including repeated measures ANOVA and effect size estimation, were applied to evaluate skill progression (Porter & Schon, 2020; Vadivel et al., 2026).

The novelty of this study lies in its longitudinal assessment of multiple technical skill domains ball juggling, service, smash, and setting within the same cohort. Unlike prior research that focuses on isolated skills or cross-sectional comparisons, this approach captures within-athlete changes across fundamental control, offensive execution, precision, and tactical skills.

By integrating multiple technical domains and employing a longitudinal design, this study aims to provide evidence-based guidance for coaches and practitioners to optimize training strategies, balance skill development, and enhance overall performance in sepak takraw athletes (Del Rosario, 2019; Suwarno et al., 2022).

Method

This study employed a quantitative pre-experimental design with a one-group repeated measures approach to examine changes in technical skills of PPLP sepak takraw athletes over a three-month structured training period. The design focused on within-subject comparisons, with March serving as the pre-test and June as the post-test, to evaluate temporal changes potentially attributable to the training program. The absence of a control group is acknowledged as a limitation in interpreting causal effects.

Fifteen athletes participated in the study, but complete paired datasets varied across technical skills due to availability and compliance: ball juggling (n = 15), service (n = 6), smash (n = 6), and setting (n = 4). This unequal sample size reflects challenges in assessing some skills consistently during routine training sessions, and it is considered a limitation for statistical power and generalizability.

The study evaluated four technical components: ball juggling, service, smash, and setting. Ball juggling was assessed through repetition-based control tests, service through accuracy scoring, smash via attack execution scoring, and setting through passing accuracy evaluation. All assessments were conducted under standardized and consistent testing conditions to enhance reliability.

Data were summarized using descriptive statistics (mean ± standard deviation) and analyzed for temporal changes using repeated measures ANOVA. Since only two time points were included, the ANOVA results are mathematically equivalent to paired-sample t-tests. Partial eta squared (η^2) was calculated to evaluate effect sizes, and 95% confidence intervals (CI) were reported to estimate the precision of mean differences. Statistical significance was set at $p < .05$.

Given the small and unequal sample sizes for service, smash, and setting, the results for these variables were interpreted cautiously, acknowledging potential variability and limited statistical power. Future studies are recommended to include control groups and larger sample sizes to strengthen the validity of findings.

Results and Discussions

Descriptive Statistics of Technical Skills

The analysis of technical performance data revealed notable changes in sepak takraw skills among PPLP athletes between March and June. Overall, the athletes demonstrated substantial improvement in fundamental control and offensive skills, particularly ball juggling and smash, indicating effective adaptation to the training program. In contrast, precision-based skills, including service and setting, showed a significant decline over the same period. These contrasting trends highlight differential responses of technical domains to the implemented training regimen and provide a clear foundation for further statistical analysis, including repeated measures ANOVA, effect size estimation, and confidence interval assessment.

Table 1. Descriptive Statistics of Technical Skills (March–June)

Variable	n	March (Mean ± SD)	June (Mean ± SD)	Mean Difference (June–March)
Ball Juggling	15	47.60 ± 32.84	91.20 ± 32.59	+43.60
Service	6	21.00 ± 3.85	13.40 ± 3.78	−7.60
Smash	6	20.83 ± 4.26	26.00 ± 6.16	+5.17
Setting	4	75.75 ± 11.38	18.75 ± 5.68	−57.00

Explanation: A marked increase was observed in ball juggling performance, with the mean nearly doubling from March to June. Smash performance also demonstrated improvement, albeit of smaller magnitude. In contrast, service and setting performances declined, with setting showing the most pronounced reduction.

Repeated Measures ANOVA Results

To determine whether the observed changes were statistically significant, repeated measures ANOVA was conducted for each technical variable.

Table 2. Repeated Measures ANOVA (Effect of Time: March vs June)

Variable	F(1, df)	p-value	Partial η^2	Interpretation
Ball Juggling	61.62 (1,14)	< .001	0.81	Very large increase
Service	8.47 (1,5)	< .05	0.63	Significant decrease
Smash	9.73 (1,5)	< .05	0.66	Significant increase
Setting	29.92 (1,3)	< .01	0.91	Very large decrease

A significant main effect of time was found across all variables. Ball juggling showed a highly significant improvement with a very large effect size (partial $\eta^2 = 0.81$), indicating that 81% of the variance in performance was attributable to the time factor. Smash performance also improved significantly with a large effect size. Conversely, service and setting performances significantly decreased over time, with setting exhibiting an extremely large effect size (partial $\eta^2 = 0.91$), suggesting substantial performance deterioration.

Confidence Intervals of Mean Differences

To further interpret the magnitude and precision of changes, 95% confidence intervals (CI) were calculated for each mean difference.

Table 3. Mean Differences with 95% Confidence Intervals

Variable	Mean Difference	95% CI	Direction of Change
Ball Juggling	+43.60	[31.67, 55.53]	Significant increase
Service	−7.60	[−14.31, −0.89]	Significant decrease
Smash	+5.17	[0.91, 9.43]	Significant increase
Setting	−57.00	[−90.10, −23.90]	Significant decrease

All confidence intervals did not cross zero, confirming statistically reliable changes between March and June. The interval for ball juggling indicates a robust and consistent improvement across athletes. Smash performance also improved with a positive and stable confidence range. In contrast, service and setting displayed negative confidence intervals, confirming genuine declines rather than random variation. The extremely wide interval in setting reflects substantial variability combined with a pronounced drop in performance.

The results demonstrate differential adaptation patterns in sepak takraw technical skills. Fundamental coordination skills (ball juggling) and offensive execution (smash) improved significantly over time. However, precision-based and tactical components (service and setting) showed significant declines. These findings suggest that while physical and coordination-based training adaptations were successful, technical accuracy and playmaking components may require more targeted and balanced training interventions.

The present study examined longitudinal changes in technical skills of PPLP sepak takraw athletes over a three-month structured training period using a one-group repeated measures design. Overall, results indicated significant improvement in fundamental control skills, specifically ball juggling, and offensive skills such as smash, while precision-based skills, including service and setting, declined (Del Rosario, 2019; Suwarno et al., 2022). These findings highlight differential adaptation patterns in response to targeted training and provide insight into optimizing skill development.

The significant increase in ball juggling performance suggests that coordination, balance, and fine motor control respond quickly to repetitive and structured exercises. Ball juggling reflects neuromuscular control and contributes to better ball handling during gameplay. The large effect size (partial $\eta^2 = 0.81$) underscores the substantial impact of the training intervention. However, the design does not include a control group, so improvements cannot be fully attributed to the training alone (Gao et al., 2026; Li, 2020).

Smash performance also improved, reflecting enhanced lower-limb power, timing, and accuracy (Adhitya et al., 2023; Peth et al., 2018). Nevertheless, the small sample size for smash (n = 6) limits generalizability, and individual variability may have influenced results. While improvements align with previous studies linking explosive power and offensive performance, caution is needed in extrapolating findings.

In contrast, service and setting skills declined, indicating that precision and tactical components may have received insufficient emphasis in the training program. Setting showed the most pronounced decrease (partial $\eta^2 = 0.91$), highlighting potential gaps in situational practice, decision-making training, or cognitive engagement (Agustina et al., 2025; Carvache-Franco et al., 2024). The unequal sample sizes (service n = 6, setting n = 4) further limit interpretation.

These divergent trends underscore the importance of a multidimensional training approach. While coordination and offensive skills benefit from high-volume repetition and strength-oriented exercises, precision-based and tactical skills require specific drills, game simulation, and cognitive engagement to maintain performance (Guinto & Ang, 2025; Park et al., 2018).

From an educational perspective, systematic monitoring of technical performance allows coaches to identify areas needing targeted interventions. Integrating coordination, strength, accuracy, and tactical exercises can foster holistic athlete development, including perceptual and decision-making skills (Furtado da Fonseca et al., 2020; Siong & John, 2021).

Limitations of this study include the absence of a control group, small and unequal sample sizes, and assessment at only two time points, which restricts understanding of gradual skill development.

Additionally, external factors such as fatigue, competition schedule, or individual differences were not controlled, which may have influenced performance outcomes.

Despite these limitations, the findings provide practical guidance for designing balanced training programs in PPLP settings. Coaches should consider allocating sufficient time for precision and tactical drills alongside coordination and strength exercises to ensure comprehensive skill development.

In conclusion, a focused three-month training period can enhance fundamental control and offensive skills in sepak takraw athletes, but precision and tactical skills may decline without targeted intervention. Future research should include control groups, larger sample sizes, and multiple measurement points to better understand interactions between physical conditioning and technical skill acquisition (Brady et al., 2021).

Conclusions

This study concludes that a three-month training period significantly enhanced fundamental control and offensive skills specifically ball juggling and smash in PPLP sepak takraw athletes, while precision-based skills such as service and setting decreased. These findings indicate that technical skill development is domain-specific and responsive to focused training, emphasizing the need for balanced programs that integrate coordination, strength, accuracy, and tactical exercises. Implementing such balanced training strategies can simultaneously improve athletic performance and support educational development, aligning with the dual goals of achievement and holistic skill learning in young athletes.

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