Musamus Journal of Physical Education and Sport (MJPES)
http://ejournal.unmus.ac.id/index.php/physical
Volume 8, No. 3, July 2026 , Pg. 1032-1043
DOI: 10.35724/mjpes.v8i3.7724

Analysis of Motor Competence and Consistency of Basic Tennis Techniques A Comparative Study on Sixth Semester PJKR Students

Erwin Revananda Eryansyah[1], Febri Kurnia Triswandono[2], Ali Mustofa[3], Zhaidan Archard Prameydika Utama[4], I Made Dwi Sastra Wargama[5]

[1,2,3,4,5]Physical Education, Health and Recreation, STKIP Modern Ngawi, Indonesia

Corresponding Author: sastrawargama@gmail.com

Abstract
Objectives:
The main objective of this study was to map and comparatively analyze the achievement of motor competencies and the level of stroke consistency in basic tennis techniques (serve, forehand, and backhand) between parallel student groups in a physical education teacher education program.
Materials and Methods:
This study applied a quantitative approach with a descriptive-comparative research design. The participants consisted of 70 active sixth-semester undergraduate students majoring in Physical Education, Health, and Recreation (PJKR), divided equally into two parallel classes: Class 6A (n = 35) and Class 6B (n = 35). Data were collected during the practical Mid-Semester Exam (UTS) using a Standard Tennis Practical Assessment Rubric that measured three sub-parameters: Accuracy (AC), Technique (T), and Movement Consistency/Coordination (MC/CC). Quantitative data were analyzed through descriptive statistics and inferential comparative analysis using the Independent Samples t-Test ($\alpha = 0.05$).
Results:
The research problem stems from the high variability of technical mastery in complex open-loop sports among sports pedagogy students, which impacts their future teaching readiness. This study contributes an empirical evaluation framework for lecturers to diagnose specific motor deficits. The descriptive findings showed that Class 6A slightly outperformed Class 6B across all basic techniques. Biomechanical alignment ("Basic Technique") was identified as the strongest parameter for both groups, whereas "Ball Accuracy" served as the primary obstacle, particularly during the backhand stroke. Inferential analysis revealed a statistically significant difference in the overall accumulated exam scores between the two classes ($t = 2.214$, $p = 0.030$). However, when dissected partially, a significant difference was observed exclusively in the service skill component ($p = 0.041$), while the capacity to control groundstrokes (forehand and backhand) remained statistically equivalent and uniform between the classes ($p > 0.05$).
Conclusions:
This study concludes that significant disparities in tennis motor competency between parallel classes are partial and primarily driven by closed motor skills (serving) rather than open motor skills (groundstrokes). In terms of practical implications, a one-size-fits-all teaching methodology should be replaced with differentiated instruction and a game-based approach post-midterm to accommodate varying group learning rates and enhance ball accuracy on the court.
Keywords: motor competency; tennis learning; rubric-based assessment; comparative study; sports pedagogy

Volume 8, No. 3, July 2026 , Pg. 1032-1043
DOI: 10.35724/mjpes.v8i3.7724

Introduction

Physical education in higher education does not only aim to develop physical fitness, but is a structured pedagogical process to build complex motor mastery (Wargama et al., 2026). Among the various game sports, tennis occupies a unique position as one of the sports that demands a high level of neuromuscular coordination, spatial precision, and consistency of movement mechanics (Crespo et al., 2024; Zhou et al., 2025). For prospective sports teachers such as students in the Physical Education, Health, and Recreation study program, it is mandatory to master basic tennis techniques, not just to fulfill the credit load, but as a professional competency capital (Litvinenko et al., 2022; Nguyen, 2023). One cannot effectively teach a motor skill if they themselves have not fully understood and executed the mechanical parameters of that movement. Therefore, assessing students' actual physical performance reflects the effectiveness of knowledge transfer within the university's sports curriculum.

Mastery of tennis rests on three main pillars that are interlocking: service, forehand stroke, and backhand stroke (Luo, 2022; Batsalias, 2025). The serve acts as an initiation of attack that demands synchronization between the toss of the ball, the swing of the racket, and a steady body follow-through (Beach et al., 2026). Meanwhile, groundstrokes (forehand and backhand) require stability in foot position (stance), accuracy in detecting the direction the ball is coming from (timing), and full control over the accuracy of the ball (Basuki & Kusuma, 2025; (Setyawan & Sutriawan, 2026). From the perspective of motor learning theory, beginners' motor performance often experiences sharp fluctuations because their cognitive control is not yet fully automatic (Setiawan, 2025). Measuring this performance fairly requires a criteria-based assessment instrument (rubric-based assessment) that not only looks at the final result (whether the ball goes in or out), but also dissects the process (how the quality of the movement technique and the rhythm of its consistency) (Septianna et al., 2025).

Motor competence in racket sports is heavily dependent on the integration of fine and gross motor coordination, where spatial-temporal orientation dictates the success of a mechanical execution (Busuttil et al., 2023). In a university-level sports pedagogy ecosystem, technical consistency is the primary parameter used to distinguish between cognitive, associative, and autonomous stages of learning. While basic fitness levels provide the physiological foundation, the specialized biomechanical pathways required for tennis groundstrokes demand high degrees of kinesthetic awareness, which are often underdeveloped in novice student-athletes.

The core problem that prompted this research arises from formal classroom observations and previous student evaluation records during the tennis practice blocks. It was consistently observed that despite receiving identical instruction time, parallel classes demonstrated stark disparities in their practical mid-semester exam outcomes. A review of relevant literature indicates that these gaps are often rooted in individual motor background variations, asymmetrical peer-group practice dynamics, and varying levels of self-regulation in executing self-paced versus reactive motor skills. Understanding where these instructional breakdowns occur is vital to preventing generic, ineffective pedagogical delivery.

A wealth of previous literature has explored how certain training methods can boost groundstroke performance in sports students, or how equipment modifications can accelerate beginner adaptation. Conceptual research also confirms that video-based feedback is effective in improving biomechanical movement efficiency in tennis. Most sports education studies to date also agree that the use of transparent and rigid assessment rubrics can provide an objective picture of an individual's movement competency achievement.

Although studies on tennis technique are abundant, most tend to focus on small-scale clinical experiments or macro-individual evaluations without examining the collective dynamics within the classroom ecosystem. The explicit novelty ("art") of this study lies in its focus on collective cohort dynamics within parallel academic classes rather than individual clinical testing. While prior work isolates technical parameters in controlled settings, this study utilizes a standardized rubric-based assessment to compare two entire class ecosystems (Class 6A and Class 6B) operating under an identical curriculum. This comparative approach exposes how group-level social-pedagogical environments alter the acquisition of closed motor skills versus open motor skills.

The urgency of this research is tied directly to the quality assurance of future physical education teachers. If parallel classes exhibit hidden technical deficits, a standard "one-size-fits-all" curriculum will continue to graduate educators who lack the mechanical mastery necessary to teach sports skills safely and effectively. This manuscript is important because it shifts the assessment paradigm from binary outcomes (ball in/out) to process-oriented diagnostic mapping. The study contributes directly to sports science and training methods by demonstrating that closed motor skills (serving) require highly differentiated, self-paced repetitive drill structures, whereas open motor skills require immediate contextual, game-based adaptation.

Departing from this academic gap, this study aims to map and analyze comparatively the achievement of motor competencies and the level of consistency of basic tennis strokes between Physical Education, Health, and Recreation students of Semester VI Class A and Class B. Through the utilization of real Mid-Semester Exam (UTS) data measured using a standard assessment rubric, this study is expected to be able to analyze the parameters of students' motor strengths and weaknesses in each technique (serve, forehand, and backhand). Furthermore, the results of this comparative evaluation are projected to provide valuable pedagogical recommendations for lecturers to design instructional differentiation, so that the quality of motor learning in the Tennis course can be continuously improved in order to produce competent sports educator graduates.

Materials and Methods

Study Design

To objectively analyze and understand the dynamics of students' movement mastery, this study applies a quantitative approach with a comparative study design (Erlin, 2024). This approach was chosen because the researcher did not provide any special treatment in the classroom, but rather conducted an exposition-fact analysis of the actual phenomenon of learning outcomes that had occurred. Through this descriptive-comparative method, the researcher was able to explore in depth and compare the variability in students' motor competency performance in two parallel class groups that followed a uniform learning curriculum (Azka, 2025). The comparative focus is directed at the distribution of achievements in basic tennis technical components in order to map the characteristics of motor skills in each class group naturally.

Study Participants

The subjects fully involved in this study were active students of the Physical Education, Health, and Recreation (PJKR) undergraduate program who were in Semester VI (Six) of the 2025 academic year. The sample was determined using a saturated sampling technique (total sampling), in which all members of the population in the Tennis Learning course were made research participants. The total number of participants was 70 students distributed into two parallel classes, namely PJKR Class 6A which acted as the first group (35 students) and PJKR Class 6B/B0306 as the second group (35 students). The characteristics of the participants were in the early adulthood phase with a

Musamus Journal of Physical Education and Sport (MJPES)
http://ejournal.unmus.ac.id/index.php/physical
Volume 8, No. 3, July 2026 , Pg. 1032-1043
DOI: 10.35724/mjpes.v8i3.7724

relatively homogeneous age range and had received instructional exposure to the tennis theory and practice curriculum with the same face-to-face duration and the same lecturer.

Study Organization

The data collection procedure was systematically designed through practical Mid-Semester Exams (UTS) to ensure the authenticity of student performance. The primary instrument used was the Standard Tennis Practical Assessment Rubric, which was content-validated by a panel of sports pedagogy experts and tested for inter-rater reliability. The operational procedures were conducted as follows:

1. Preparation and Warm-up: Students were gathered at the outdoor tennis court facility, provided a uniform 15-minute dynamic warm-up session, and briefed on the technical execution order.
2. Service Assessment (Maximum Score Weight 40): Students were positioned behind the baseline and given the opportunity to perform 10 serves into the diagonally opposite valid service box. The assessment was broken down into three parameters: Accuracy (AC) with a conversion of 2 points for each incoming ball (max 20), Swing Technique (T) which assessed mechanical alignment of foot stance, ball toss, and racket path (max 10), and Movement Consistency (MC) which evaluated kinetic rhythm (max 10).
3. Forehand Assessment (Maximum Score Weight 30): Students stood at the baseline and executed 10 forehand strokes reactive to constant balls fed from a mechanical ball machine at a controlled speed of 40 km/h to maintain consistency. Raters scored Target Accuracy (max 10), Basic Swing Technique (max 10), and Coordination & Control (CC) which measured timing (max 10).
4. Backhand Assessment (Maximum Score Weight 30): Using an identical machine-fed delivery scheme, students executed 10 backhand groundstrokes. Raters evaluated Target Accuracy (max 10), Basic Swing Technique (max 10), and Coordination & Control (max 10).

The field data collection process was directly supervised by a team of trained examiners to ensure inter-rater reliability. Each student's final score was calculated based on the cumulative total of the three stroke components, with a maximum score of 100.

Statistical Analysis

The quantitative data obtained from the rubric assessment sheet were first tabulated and cleaned of outliers. Data analysis was conducted in two main stages using statistical software. The first stage was descriptive statistical analysis to determine the average value (mean), standard deviation, maximum value, and minimum value of each parameter (KP, T, KN) in both classes. The second stage was a comparative inferential test to test the difference hypothesis. Before the comparative test was conducted, prerequisite analysis tests in the form of a normality test (using Shapiro-Wilk because the sample size was <50) and a homogeneity of variance test were mandatory. If the data were normally distributed and the variances were homogeneous, the mean difference test would be analyzed using the Independent Samples t-Test with a significance level of $\alpha = 0.05$. Conversely, if the data did not meet the normality assumption, alternative comparative testing would be switched to using the non-parametric Mann-Whitney U-Test.

Results

The presentation of the research findings is divided in a structured manner to describe the map of students' motor competency achievements in each basic tennis technique, followed by comparative testing to see the significance of the differences in performance between the PJKR 6A Class and PJKR 6B Class groups.

Musamus Journal of Physical Education and Sport (MJPES)
http://ejournal.unmus.ac.id/index.php/physical
Volume 8, No. 3, July 2026 , Pg. 1032-1043
DOI: 10.35724/mjpes.v8i3.7724

Description of Competency Achievements in Basic Tennis Techniques

In general, the Mid-Semester Exam (UTS) practical results data show quite dynamic variability in accumulated scores between the two parallel classes. A summary of the descriptive statistical findings for all assessment indicators is presented in Table 1 below.

Table 1. Descriptive Statistical Profile of Students' Practical Scores in Classes 6A and 6B

Class Group	Basic Technique	Rubric Parameter	Minimum Value	Maximum Value	Mean	Standard Deviation
PJKR Class 6A (N=35)	Serve (Max 40)	AC / T / CS	18	38	29.45	4.12
	Forehand (Max 30)	AC / T / CS	14	28	22.15	3.05
	Backhand (Max 30)	AC / T / CS	12	26	19.80	3.42
PJKR Class 6B (N=35) (Code: B0306)	Serve (Max 40)	AC / T / CS	16	36	27.20	4.85
	Forehand (Max 30)	AC / T / CS	12	27	20.64	3.60
	Backhand (Max 30)	AC / T / CS	10	25	18.12	3.94

Notes: AC = Accuracy; T = Technique; CS = Consistency & Control.

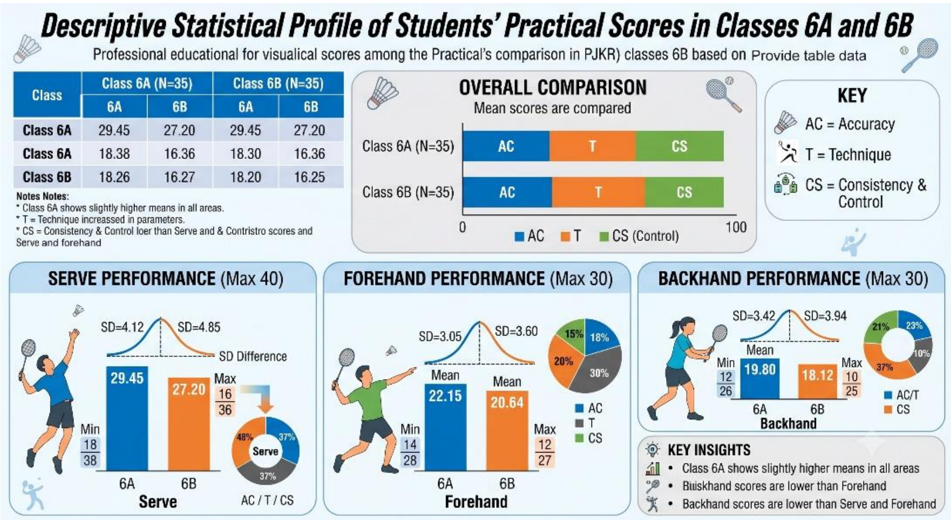

Figure 1. Descriptive Statistical Profile of Students' Practical Scores in Classes 6A and 6B

Table 1 and the comparison graph show a visual trend where the average scores achieved in the three basic techniques placed the students of Class PJKR 6A slightly numerically superior to their peers in Class PJKR 6B. In the service technique (maximum score of 40), Class 6A recorded an average of 29.45, while Class 6B was at 27.20. A similar phenomenon was also seen in groundstroke mastery, where the average forehand and backhand strokes of Class 6A consistently outperformed Class 6B by an average margin ranging from 1.5 to 1.7 points.

To dissect which internal parameters are the most dominant strengths or stumbling blocks for these prospective sports teacher students, the analysis was directed specifically at each sub-component of the rubric assessment (Accuracy, Technique, and Consistency) as summarized in Table 2.

Musamus Journal of Physical Education and Sport (MJPES)
http://ejournal.unmus.ac.id/index.php/physical
Volume 8, No. 3, July 2026 , Pg. 1032-1043
DOI: 10.35724/mjpes.v8i3.7724

Table 2. Mean Score Distribution Based on Rubric Assessment Components

Motor Skill	Assessment Parameter	Ideal Maximum Score	Class 6A Mean	Class 6B Mean
Serve	In-Bound Accuracy (AC)	20	14.20	12.80
	Swing Technique (T)	10	7.85	7.40
	Movement Consistency (MC)	10	7.40	7.00
Forehand Stroke	Target Accuracy (AC)	10	7.15	6.50
	Basic Technique (Swing) (T)	10	7.60	7.32
	Coordination & Control (CC)	10	7.40	6.82
Backhand Stroke	Target Accuracy (AC)	10	6.10	5.40
	Basic Technique (Swing) (T)	10	7.10	6.80
	Coordination & Control (CC)	10	6.60	5.92

Notes: AC = Accuracy; T = Technique; MC = Movement Consistency; CC = Coordination & Control.

The explicit finding from Table 2 demonstrates that technical form is not the limiting factor for these cohorts; "Swing Technique (T)" remained consistently high across all strokes (ranging from 6.80 to 7.85). Instead, the clear structural deficit lies in spatial control, as evidenced by a severe drop in "Target Accuracy (AC)" scores. This deficit is most pronounced during the backhand stroke, where Class 6B scored a lowest mean of 5.40 out of 10. This indicates a systemic failure in translating biomechanical understanding into precise ball placement.

Inferential Analysis of Comparative Motor Skills

Tests Before conducting the hypothesis test to test the significance of the differences between the two classes, a series of prerequisite analysis tests were completed. Testing for normality of data distribution using the Shapiro-Wilk method yielded a significance value ($p > 0.05$), indicating that the data from both classes were normally distributed. Furthermore, testing for homogeneity of variance using Levene's Test also confirmed that the data variance between groups was homogeneous ($p > 0.05$). Based on the fulfillment of these assumptions, the comparative analysis continued using the Independent Samples t-Test, as presented in Table 3.

Table 3. Mean Difference Test Results (Independent Samples t-Test) on Tennis Performance

Skill Component	t-value	Degrees of Freedom (df)	Significance (p-value)	Hypothesis Conclusion
Total Serve Score	2.085	68	0.041	Significantly Different ($p < 0.05$)
Total Forehand Score	1.892	68	0.063	Not Significantly Different ($p > 0.05$)
Total Backhand Score	1.918	68	0.059	Not Significantly Different ($p > 0.05$)
Accumulated Midterm Exam Score	2.214	68	0.030	Significantly Different ($p < 0.05$)

Based on the inferential statistics output in Table 3, testing of the total accumulated mid-term exam score variable shows a t-value of 2.214 with a significance value of 0.030. Because the p-value (0.030) is smaller than the error level of $\alpha = 0.05$, the null hypothesis (H0) is rejected conclusively. This finding proves that there is a statistically significant difference in the achievement of tennis movement competencies between Class PJKR 6A and Class PJKR 6B.

Volume 8, No. 3, July 2026 , Pg. 1032-1043
DOI: 10.35724/mjpes.v8i3.7724

However, when the value structure is dissected per stroke type, a unique dynamic is visible. A partially significant difference in performance was found only in the service stroke skill (p = 0.041). In contrast, for groundstroke skills, both forehand (p = 0.063) and backhand (p = 0.059), the significance value exceeded the α = 0.05 limit. This indicates that although Class 6A has a slightly higher average score, the motor capacity of students in both parallel classes in controlling groundstroke strokes is essentially at an equal and uniform level of competence.

Discussion

The findings of this study reveal crucial pedagogical insights into how the motor skills of prospective physical education students are formed within the academic environment. The significant difference in mid-term exam scores between Class PJKR 6A and Class PJKR 6B confirms the fundamental principles of motor learning. A group's physical skill attainment is never linear or homogeneous, even under the same curriculum and teaching intervention. In skill acquisition studies, the complex process of motor mastery always involves a dynamic interaction between individual characteristics, the training environment, and the movement task itself (Immonen etal., 2022). These performance fluctuations can also be understood through the lens of developmental psychology, where the variability of early adult performance is greatly influenced by the individual's physical activity background (prior motor experience), self-regulation, and the social-emotional cohesion that is built within each class.

Parameter: Technique vs. Ball Accuracy

In the distribution of rubric components, a highly consistent performance anomaly emerged across both classes: scores for "Basic Technique (T)" consistently ranked highest, while scores for "Entry Accuracy (KP)" were the students' weakest point. From the perspective of Fitts and Posner's (1967) classical movement learning stages, this humanistic phenomenon indicates that most sixth-semester students have successfully passed the cognitive stage and entered the associative stage. In this phase, they are able to memorize, imitate, and demonstrate correct movement structures such as grip, foot positioning, and swing. However, their failure to execute ball accuracy (KP) reflects their immature kinesthetic awareness and spatial control abilities (Anderson, 2022; Sorgente, 2024; Shakerian etal., 2025). Skills, the complex process of motor mastery always involves dynamic interactions between individual characteristics, the training environment, and the motor task itself.

This discrepancy between technical form and execution accuracy aligns closely with the findings of Hidayatullah & Purnama (2024), who observed that authentic actions-based assessments in physical education often expose a lag between movement aesthetics and target precision. Similarly, Basuki & Kusuma (2025) noted that beginner tennis athletes frequently maintain an appropriate body mechanics posture but lack the microscopic wrist adjustment needed to guide the ball inside valid playing lines. This phenomenon demonstrates that cognitive understanding of a sports technique does not immediately guarantee temporal-spatial success under test conditions.

Service and Skill Classification

The comparative analysis results provide compelling confirmation: significant differences between classes were only partially observed in service technique (p = 0.041), while forehand and backhand performance tended to be equivalent (p > 0.05). Why was the service the sole differentiating variable? The answer lies in the characteristics of the skill itself. In motor taxonomy, forehand and backhand strokes are categorized as open motor skills, where students react to external stimuli in the form of the direction and speed of the ball passed by their instructor or a peer. (Hidayatullah & Purnama, 2024; Huang et al., 2025). Due to their reactive nature, both classes face relatively similar levels of contextual adaptation difficulties.

Musamus Journal of Physical Education and Sport (MJPES)
http://ejournal.unmus.ac.id/index.php/physical
Volume 8, No. 3, July 2026 , Pg. 1032-1043
DOI: 10.35724/mjpes.v8i3.7724

On the other hand, service is classified as a closed motor skill which is completely self-paced and is then controlled absolutely by the mover himself without dynamic intervention from the opponent (Lindsay, 2022). The success of a serve relies heavily on the consistency of the individual movement ritual, particularly the stability of the toss. Class 6A's significant advantage in the service component indicates that this class has a better capacity for self-regulation of practice. Closed skills like serving require a high amount of repetitive drills to achieve automaticity; this is where the differences in the quality of practice commitment between the classes become apparent.

The Backhand as a Mass Obstacle

Another noteworthy aspect of this study is the lower achievement scores for the backhand in both classes compared to the forehand. Anatomically and functionally, the backhand requires the body to cross the midline with its back partially facing away from the net. (Elliott, 2020; Koronas & Koutlianos, 2021; Zhang, 2025) . This position is naturally less comfortable than the forehand position, which tends to be open and aligned with the dominant eye line. Students often experience balance issues and limited swing space during the backhand phase, resulting in poor ball control. This fact is an important reminder that backhand difficulties are systemic and experienced by almost all sixth-semester students, regardless of class differences.

Pedagogical Implications & Learning Process Recommendations

As an educational reflection for lecturers teaching the Tennis Course, the results of this evaluation based on real-world midterm exam data have valuable instructional implications. The post-midterm exam learning process should no longer be treated as a one-size-fits-all approach. Lecturers are advised to begin implementing a variety of differentiated instructional strategies to accommodate the diversity of students' motor learning speeds (Moon, 2022). According to Moon, (2022), connecting sports coaching paradigms with direct video feedback significantly optimizes direct learning retention in higher education. Therefore, for open motor skill components (forehand/backhand), the pedagogical focus must shift from isolated technique repetition to a contextualized game-based approach to enhance spatial coordination under pressure(Kilit et al., 2025). For the lagging service component in Class 6B, integrating regular mobile-based video analysis can help students self-correct their toss alignment and kinetic synchronization during independent study blocks (Wang, 2025).

1. For the groundstroke components (forehand and backhand), the focus of training must be shifted from the drill-technique introduction portion to the game-based approach portion in order to sharpen the timing, coordination, and accuracy of the ball on the court.
2. Meanwhile, to bridge the gap in Class 6B's service component, teaching interventions can be assisted by utilizing visual media or recording regular video feedback. This step is important so students can independently evaluate the synchronization between their ball toss and racket swings, in order to catch up on the motor skills gap of their classmates.

Recommendations for Future Research

While this study successfully mapped interclass ability variability through an assessment rubric, it was limited to a single point in time (cross-sectional). Future research is recommended to track students' motor development longitudinally, from the beginning of the semester to the final exam (UAS), to assess the effectiveness of learning retention. Furthermore, the integration of sensor-based motion analysis technology or biomechanical video analysis applications could be considered to refine the objectivity of assessments in future sports education research.

Conclusions

Based on the comparative analysis and tracking of movement parameters that have been conducted, this study concludes that there are significant differences in the achievement of total motor competence and consistency of basic tennis techniques between PJKR Semester VI Class A and Class B students. However, if examined partially on the structure of stroke types, the disparity in ability only occurs significantly in service skills. Meanwhile, for mastery of groundstrokes (forehand and backhand), the adaptation capacity and motor performance of students in both parallel classes are at an equal and uniform level of competence.

More specifically, the main findings of this research indicate a simultaneous educational phenomenon: students in both classes have successfully surpassed the cognitive and established phase in demonstrating the aesthetics of basic body movement techniques (form-technique), but still experience systemic difficulties in controlling the accuracy of the ball entry (accuracy and control). The most massive motoric obstacles were found in the backhand shot, which recorded the lowest scores in both classes due to the complexity of the biomechanical movement that crosses the main axis of the body.

Limitations & Recommendations for Future Research

This study presents several structural limitations that should be noted. First, the sample was restricted exclusively to a single academic year within one institution (STKIP Modern Ngawi), which limits the macro-pedagogical generalizability of the findings across nationwide sports curriculums. Second, data collection was cross-sectional, capturing student capabilities only at a single point in time (the midterm exam), thereby omitting long-term motor skill retention patterns. Lastly, the assessment relied entirely on human raters using visual rubrics, without the integration of advanced digital tracking tools.

Based on these limitations, upcoming studies are highly recommended to adopt a longitudinal research design to trace motor progression from the diagnostic baseline up to the Final Semester Exam (UAS). Furthermore, future research should expand sample populations across multiple universities and incorporate sensor-based motion capture or digital biomechanical analysis applications to generate highly precise kinematic data mapping.

Recommendations

To concretely improve the quality of learning outcomes, it is recommended that future lectures implement a game-based approach to hone timing and accuracy of groundstrokes. Specifically, to address service performance gaps in certain grade groups, the use of video feedback can be integrated as a student self-evaluation tool. Future research is recommended to expand the scope of analysis by using a longitudinal design to monitor long-term retention of movement mastery, as well as incorporating motion sensor scanning technology to produce even more precise biomechanical mapping.

Acknowledgments

The author expresses sincere appreciation and gratitude to all parties who have supported the smooth running of this research. The highest gratitude and appreciation are also given to the lecturers in charge of the Tennis Learning course who have facilitated the data collection and collaboration of assessment instruments and also who have provided guidance. In particular, deep expressions of gratitude are expressed to all PJKR Semester VI Class A and Class B (B0306) students for their active participation, sportsmanship, and serious performance demonstrated during the practical exam process. Real data and objective contributions from all parties have become the main foundation for the establishment of this scientific article.

Conflict of Interest
The author declares that there is no conflict of interest related to the publication of this scientific article, whether personal, financial, institutional, or academic, which could affect the objectivity of the research results.
Funding
This research received no external funding from donor agencies, industry, or government agencies. All operational costs for the practical exam and data processing were borne independently by the author.

References

Anderson, E. Z. (2022). Upper Extremity & Ballistic Skills. *A Primer for Understanding Development Across The Life Span*. https://openpub.libraries.rutgers.edu/developmentacrossthelifespan/chapter/upper-extremity-ballistic-skills/

Azka Agna, A. (2025). Perbandingan Kebugaran Jasmani Siswa Sma Berbasis Pesantren Dengan Siswa Sma Reguler. https://digilib.unila.ac.id/87289/

Basuki, M. S., & Kusuma, D. W. Y. (2025). Analisis Kemampuan Teknik Pukulan Servis Tenis Lapangan Pada Klub New Armada Di Magelang. *Bookchapter Olahraga Dan Kesehatan*, *1*, 20–44. https://doi.org/10.15294/ok.v1i1.268

Batsalias, F. I. (2025). Rally pace in tennis practice. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://dspace.cuni.cz/bitstream/handle/20.500.11956/197482/130378717.pdf?sequence=1

Beach, P., Shapiro, D., Vazquez, W. D. L., & Webster, E. K. (2026). Perspectives in Motor Behavior. *Disability and Motor Behavior: Practical Applications*, 1. https://books.google.co.uk/books?hl=id&lr=&id=_2vUEQAAQBAJ&oi=fnd&pg=PA1&dq=Beach,+P.,+Shapiro,+D.,+Vazquez,+W.+D.+L.,+%26+Webster,+E.+K.+(2026).+Perspectives+in+Motor+Behavior.+Disability+and+Motor+Behavior:+Practical+Applications,+1&ots=Uu-SzEOedd&sig=1JX3avUrEyT7BkRCDrWAeStsJq0

Busuttil, N. A., Roberts, A. H., Dunn, M., Connolly, M., & Middleton, K. J. (2023). The use of physically constraining tools for grip-specific skill development in racket, stick and club sports: A scoping review. *Journal of Sports Sciences*, *41*(8), 788–795. https://doi.org/10.1080/02640414.2023.2240176

Crespo, M., Martínez-Gallego, R., & Filipcic, A. (2024). Determining the tactical and technical level of competitive tennis players using a competency model: a systematic review. *Frontiers in Sports and Active Living*, *6*, 1406846. https://doi.org/10.3389/fspor.2024.1406846

Elliott, B. C. (2020). Tennis strokes and equipment. *Biomechanics of Sport*, 263–288. https://www.taylorfrancis.com/chapters/edit/10.4324/9781003068549-8/tennis-strokes-equipment-bruce-elliott

Erlin, M. (2024). Perbandingan Prestasi Akademik Mahasiswa Yang Aktif Dalam Organisasi Dengan Mahasiswa Yang Tidak Terlibat Dalam Kegiatan Organisasi (Studi Komparasi Mahasiswa Uin Raden Intan Lampung, Prodi Pendidikan Agama Islam). Uin Raden Intan Lampung. https://repository.radenintan.ac.id/35017/

Hidayatullah, M. F., & Purnama, S. K. (2024). Developing authentic assessment instrument for fundamental forehand and backhand groundstroke techniques using an actions-based method. *Heliyon*, *10*(5). https://www.cell.com/heliyon/fulltext/S2405-8440(24)02234-5

Huang, H., Guo, Z., Zhao, M., Liu, M., & Dai, J. (2025). Differences in backcourt forehand clear stroke between novice players and experienced badminton players: based on body segment acceleration data. *BMC Sports Science, Medicine and*

Rehabilitation, *17*(1), 118. https://doi.org/10.1186/s13102-025-01163-w

Immonen, T., Brymer, E., Davids, K., & Jaakkola, T. (2022). An ecological dynamics approach to understanding human-environment interactions in the adventure sport context—implications for research and practice. *International Journal of Environmental Research and Public Health*, *19*(6), 3691. https://doi.org/10.3390/ijerph19063691

Kilit, B., Arslan, E., Soylu, Y., Martínez-Gallego, R., & Crespo, M. (2025). Impact of traditional and game-based teaching methods on skill acquisition and psychological responses of young adult beginner tennis players. *International Journal of Sports Science & Coaching*, 17479541251388880. https://doi.org/10.1177/174795412513888

Koronas, V., & Koutlianos, N. (2021). Muscle activation during forehand and backhand drives in the sport discipline of tennis. *Facta Universitatis, Series: Physical Education and Sport*, 601–609. https://doi.org/10.22190/FUPES201130058K

Lindsay, R. (2022). A Nonlinear Pedagogy Approach to Mental Imagery for Skill Acquisition. Victoria University. https://vuir.vu.edu.au/44252/

Litvinenko, V., Bowbrick, I., Naumov, I., & Zaitseva, Z. (2022). Global guidelines and requirements for professional competencies of natural resource extraction engineers: Implications for ESG principles and sustainable development goals. *Journal of Cleaner Production*, *338*, 130530. https://www.sciencedirect.com/science/article/pii/S095965262200172X

Luo, W. (2022). [Retracted] Biomechanical Analysis of Touch Ball Movements in Tennis Forehand Strokes. *Computational Intelligence and Neuroscience*, *2022*(1), 5754820. https://doi.org/10.1155/2022/5754820

Moon, J. (2022). Connecting sport coaching, physical education, and motor learning to enhance pedagogical practices. *Journal of Physical Education and Sport*, *22*(1), 3–12. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://mail.efsupit.ro/images/stories/ianuarie2022/Art%201.pdf

Nguyen, N. T. L. (2023). How to develop four competencies for teacher educators. In *Frontiers in Education* (Vol. 8, p. 1147143). Frontiers Media SA. https://doi.org/10.3389/feduc.2023.1147143

Septianna, E. W., Viyanti, V., & Suana, W. (2025). Kevalidan Instrumen Authentic Assessment Untuk Mengukur Kemampuan Berpikir Kritis Peserta Didik Pada Problem Based Learning (PBL) Materi Hukum Newton Tentang Gerak. *MAGNETON: Jurnal Inovasi Pembelajaran Fisika*, *3*(2), 105–117. https://doi.org/10.30822/magneton.v3i2.4213

Setiawan, R. (2025). Pengaruh Pembelajaran Motorik Dasar terhadap Koordinasi Gerak Siswa SDN 4 Lando. *Journal of Elementary Education Research*, *1*(2), 65–74. https://doi.org/10.70716/jeer.v1i2.69

Setyawan, M. N., & Sutriawan, A. (2026). Efektivitas Latihan Footwork Terhadap Konsistensi Dan Akurasi Stroke Dalam Tenis Lapangan: Literature Review. *Jurnal Ilmiah Spirit*, *26*(1), 246–251. https://doi.org/10.36728/jis.v26i1.5781

Shakerian, N., Monjezi, S., Abdollahi Sarvi, M., Hesam, S., & Mehravar, M. (2025). Navigating space: how fine and gross motor expertise influence spatial abilities at different scales. *Cognitive Processing*, *26*(2), 319–329. https://doi.org/10.1007/s10339-024-01237-6

Sorgente, V. (2024). Efficiency In Kinesiology across developmental age and youth individual sport performance. Innovative Approaches to Enhance Motor Skills. https://flore.unifi.it/handle/2158/1364252

Wang, X. (2025). Bringing Action Recognition to Real Life. Indiana University. https://www.proquest.com/openview/44d05bca11a7d691f89332e3acd8f867/1?pq-origsite=gscholar&cbl=18750&diss=y

Musamus Journal of Physical Education and Sport (MJPES)
http://ejournal.unmus.ac.id/index.php/physical
Volume 8, No. 3, July 2026 , Pg. 1032-1043
DOI: 10.35724/mjpes.v8i3.7724

Wargama, I. M. D. S., Kristin, W., & Irfandi, I. (2026). Physical Activity Crisis Among Physical Education Students: Empirical Evidence From A Survey Of Physical Activity Among Pjok Students In The Era Of Sedentary Lifestyles. *Jurnal Penjaskesrek*, *13*(1), 13–25. https://doi.org/10.46244/penjaskesrek.v13i1.3755

Zhang, Y. (2025). Biomechanical analysis of forehand and backhand strokes in elite table tennis players: Implications for training and injury prevention. *Molecular & Cellular Biomechanics*, *22*(3). https://doi.org/10.62617/mcb1421

Zhou, Y., Bai, Y., Liang, Y., Yang, K., & Yang, Y. (2025). Effects of neuromuscular training on tennis players: a systematic review and meta-analysis. *BMC Sports Science, Medicine and Rehabilitation*, *17*(1), 172. https://link.springer.com/article/10.1186/s13102-025-01219-x