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Coaching to Improve the Accuracy and Effectiveness of Junior Tennis Players' Shots in the Special Region of Yogyakarta Through the Integration of Training Using a Ball-Launcher and Conventional Training

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Abstract

Junior tennis development requires coaching that integrates technical precision with tactical adaptability under controlled and variable playing conditions. This descriptive-evaluative community engagement program involved 20 junior tennis athletes aged 10–16 years in the Special Region of Yogyakarta, Indonesia, during July 2026. Eight sessions were organized into adaptation, formation, improvement, and consolidation phases. Ball-machine exercises provided repeatable feeds for forehand and backhand practice, while coach- or partner-fed drills, footwork, shadow swings, and restricted games supported movement preparation and tactical application. Training loads progressed from 4 × 8 to 6 × 12 repetitions, with rest intervals decreasing from 60 to 40 seconds and relative intensity ranging from 50% to 70%. All eight scheduled sessions were completed, yielding 100% program implementation. Technical observations addressed ready position, contact point, follow-through, directional placement, positional recovery, attacking variation, and point completion during simulated play. The program documented structured integration of mechanical repetition and interactive practice and produced training guidelines and monitoring instruments for coaching. Individual pretest and posttest scores were not validated, preventing quantitative estimates of improvement or causal conclusions about effectiveness. The integrated model offers a practical framework for junior coaching, although validated athlete-level assessments remain necessary to establish changes in accuracy and attacking effectiveness.

Keywords: *Attack Effectiveness, Ball-Machine Training, Conventional Training, Junior Tennis, Shot Accuracy.*

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INTRODUCTION

Junior tennis development increasingly requires coaching approaches that integrate technical accuracy, movement coordination, and tactical adaptability within structured training environments. Groundstroke proficiency involves coordinated preparation, body positioning, racket control, and stroke execution, indicating that technical assessment cannot rely exclusively on the frequency or power of ball contact (Diler et al., 2024). Research on precision-oriented groundstroke exercises has established shot placement as a relevant training objective that requires systematic technical development (Sunaryo et al., 2025). Technological innovations in tennis coaching have expanded opportunities for individualized instruction and structured skill acquisition among young athletes (Liu et al., 2024). Research involving junior tennis players in the Special Region of Yogyakarta has also addressed groundstroke consistency through structured training, demonstrating the relevance of technical repetition to regional athlete development (Ma'ruf et al., 2024). The present community engagement program involved junior tennis athletes aged approximately 10–16 years who participated in coaching activities through clubs, academies, and regional tennis development organizations in Yogyakarta. Preliminary needs identification revealed inconsistent forehand and backhand placement, limitations in attacking-pattern execution, and insufficient integration between ball-launcher exercises and conventional practice, indicating the need for a coordinated training approach that addresses technical accuracy and practical shot effectiveness.

Contemporary research on tennis training has developed along interconnected directions involving repetitive technical practice, movement variability, technological assistance, and the application of learned skills under changing playing conditions. Conventional training approaches

employing thrown-ball drills and deep-drive exercises have demonstrated their relevance to backhand skill development through structured hitting practice (Fauzan et al., 2024). Variability-oriented training has been investigated in relation to forehand precision and stroke velocity, indicating that modifications in practice conditions represent an important consideration in technical development (Negro et al., 2023). Investigations combining induced variability and specific practice have further examined how different instructional arrangements influence forehand approach performance (Oliveira et al., 2024). Machine-assisted training has also been examined as an approach to improving forehand and backhand execution through repeated ball delivery and organized technical exercises (Gemilang et al., 2025). These research directions suggest complementary instructional functions, with controlled repetition supporting movement consistency and variable practice addressing adaptation to changing task requirements, although their coordinated application requires more specific examination.

Despite these developments, existing research has not sufficiently explained how automated ball delivery and conventional coaching exercises can be systematically integrated within a single junior tennis development program. Research concerning the design and manufacture of tennis ball-launching machines provides a technological foundation for controlled ball delivery but does not directly establish how equipment-assisted exercises should be combined with interactive coaching activities (Noguera Cundar et al., 2022). Studies examining machine-assisted forehand and backhand training have addressed technical skill development without fully establishing the contribution of integrated practice involving mechanical feeds, partner rallies, footwork exercises, and restricted games (Gemilang et al., 2025). A systematic review of technological and non-technological tennis learning aids identifies different instructional resources but does not provide a specific implementation framework for combining these approaches among junior athletes in Yogyakarta (Zakaria et al., 2025). Existing research involving junior tennis athletes in the region has examined superdrill exercises and groundstroke consistency rather than the coordinated implementation of ball-launcher training and conventional practice (Ma'ruf et al., 2024). The resulting research gap concerns the limited applied evidence regarding how controlled technical repetition can be organized alongside interactive drills to address stroke accuracy and attacking effectiveness within a structured coaching intervention. This limitation also raises methodological questions concerning the distinction between successful program implementation, observed technical development, and performance improvements that require validated individual measurements.

The unresolved integration of technological and conventional coaching approaches has practical implications for the organization and evaluation of junior tennis development programs. Technical assessment research demonstrates that groundstroke proficiency involves multiple movement characteristics, making repetitive ball contact an insufficient basis for evaluating stroke quality independently of preparation, execution, and recovery (Diler et al., 2024). Evidence concerning variable tennis practice indicates that precision must also be considered under changing task conditions rather than exclusively through standardized repetitions (Negro et al., 2023). Research on targeted groundstroke exercises further establishes the relevance of directional accuracy as a specific technical objective requiring appropriate instructional procedures and performance assessment (Sunaryo et al., 2025). Without a coordinated training structure, machine-assisted repetition and conventional tactical exercises may remain separate instructional activities, limiting opportunities to connect technical control with adaptive shot execution. Applied research is consequently needed to document the organization, implementation, and evaluation of integrated training activities while distinguishing observable coaching processes from performance outcomes that have not been established through validated measurements.

The present study introduces an applied coaching approach that integrates ball-launcher exercises with conventional tennis training through a structured progression of technical and tactical activities. Its technological component incorporates repeated mechanical ball delivery to support forehand and backhand execution, extending the practical application of tennis ball-launching equipment beyond considerations of mechanical design alone (Noguera Cundar et al., 2022). Unlike investigations concentrating on machine-assisted stroke training, the intervention includes coach- or partner-fed drills, footwork exercises, shadow swings, and restricted games within the same instructional arrangement (Gemilang et al., 2025). These conventional components complement repetitive technical practice through movement adjustment and interactive hitting activities, reflecting the instructional relevance of structured backhand training exercises (Fauzan et al., 2024). The

intervention also differs from studies focused on practice variability as an independent training approach by incorporating variable exercises into a broader sequence that includes standardized ball delivery and supervised technical correction (Oliveira et al., 2024). Its proposed novelty lies in the operational integration of technological and conventional training components for junior athletes in Yogyakarta, with attention to both stroke-placement accuracy and the practical execution of attacking patterns. The contribution is positioned as an applied coaching framework whose implementation can be documented and evaluated without treating completion of training activities as conclusive evidence of measurable performance improvement.

This study aims to implement and evaluate an integrated coaching program combining ball-launcher training with conventional exercises for junior tennis athletes in the Special Region of Yogyakarta. The program is designed to address forehand and backhand placement accuracy and attacking-shot effectiveness through eight training sessions organized into adaptation, formation, improvement, and consolidation phases. Its instructional activities combine standardized ball feeding, supervised technical correction, footwork exercises, partner-based drills, and restricted games to connect repeated stroke execution with interactive playing situations. The evaluation examines program implementation, training-load progression, technical observations, and documented instructional activities to establish the operational characteristics of the integrated approach. The principal applied contribution is a structured coaching framework supported by training guidelines and monitoring procedures that can inform subsequent junior tennis development activities. The study also distinguishes documented implementation outcomes from quantitative changes in athlete performance, recognizing that validated individual pretest and posttest measurements are necessary before conclusions concerning improvements in shot accuracy and attacking effectiveness can be established.

RESEARCH METHODS

The program employed a descriptive-evaluative approach and was conducted in July 2026 with 20 junior tennis athletes aged 10–16 years in the Special Region of Yogyakarta over eight training sessions. The intervention followed four progressive phases consisting of adaptation, formation, improvement, and consolidation, with adaptation scheduled for sessions 1–2, formation for sessions 3–4, and improvement for sessions 5–6. Participants were organized into small groups using a rotation system, allowing athletes to undertake supervised exercises while receiving technical guidance and corrections from coaches or assistants. Ball-machine exercises provided repeated forehand and backhand feeds, consistent with the application of machine-assisted training for developing fundamental tennis stroke performance (Gemilang et al., 2025). Conventional training incorporated coach- or partner-fed balls, footwork exercises, shadow swings, and restricted games to support technical execution and movement adaptation through structured practice (Fauzan et al., 2024). The integration of technological and conventional exercises reflected complementary instructional approaches to tennis skill acquisition, connecting controlled technical repetition with interactive training activities (Zakaria et al., 2025).

Training loads progressed from 4 × 8 to 6 × 12 repetitions, with rest intervals ranging from 60 to 40 seconds and relative exercise intensity maintained within the reported range of 50–70%. Before training sessions, ball-machine settings involving feed direction, interval, elevation, speed, and spin were adjusted according to athletes' abilities and the equipment's available functions. Technical observations covered forehand and backhand execution, ready position, contact point, follow-through, and positional recovery, corresponding to the movement characteristics considered in groundstroke assessment among young tennis players (Diler et al., 2024). Tactical observations addressed shot direction, ball placement, cross-court and down-the-line attacks, approach shots, volleys, and point completion during restricted games, reflecting the distinction between controlled stroke execution and variable practice conditions (Oliveira et al., 2024). Evaluation data were obtained from program implementation records, training-load information, technical observations, and activity documentation, with descriptive assessment distinguishing prescribed exercises from documented training activities (Perri et al., 2023). Data analysis involved descriptive comparisons between planned and implemented activities and examination of documented technical observations, without inferential statistical testing because individual pretest and posttest scores had not been validated.

RESULTS AND DISCUSSION

Implementation and Evaluation of the Junior Tennis Mentoring Program

The junior tennis mentoring program was implemented in July 2026 in the Special Region of Yogyakarta, involving 20 athletes aged 10–16 years. The program consisted of eight training sessions designed to integrate ball-machine exercises with conventional coaching activities through a progressive instructional arrangement. All eight scheduled sessions were completed, corresponding to a program implementation rate of 100% based on the planned activities. The mentoring process emphasized fundamental stroke execution, directional control, movement coordination, and the application of attacking patterns during structured tennis exercises. The development of junior tennis athletes requires organized coaching activities that accommodate technical proficiency, training continuity, and the developmental characteristics of participants (Aini et al., 2025). Research concerning technological innovation in tennis training also identifies structured instructional environments as relevant to technical skill acquisition among young athletes (Liu et al., 2024). The documented implementation indicates that the integrated training program was delivered according to its scheduled duration, although completion of the planned activities does not independently establish improvements in individual stroke accuracy or attacking effectiveness.

Participants were organized into small training groups using a rotation system intended to maintain orderly practice and distribute opportunities for technical instruction. Each group undertook supervised exercises involving forehand and backhand execution, movement preparation, and progressive application of fundamental tennis techniques. Coaches or assistants provided technical guidance and corrections during practice, allowing participants to receive instruction while performing the assigned activities. This organizational arrangement supported the implementation of different training activities without requiring all participants to perform identical exercises simultaneously. Assessment research involving young tennis players emphasizes the importance of coordinated movement characteristics, including preparation and stroke execution, when examining fundamental groundstroke proficiency (Diler et al., 2024). Previous research involving junior tennis athletes in Yogyakarta has similarly identified structured training as relevant to developing groundstroke consistency within regional athlete development programs (Ma'ruf et al., 2024).



Figure 1. Junior Tennis Training Mentoring Through Technical Corrections and On-Court Group Organization

Figure 1 documents the organization of junior tennis mentoring through small-group training and technical correction provided by coaches or assistants. The instructional arrangement enabled participants to undertake supervised activities while receiving guidance concerning movement preparation and stroke execution. Direct coaching was incorporated into the training process to connect technical explanations with the practical performance of forehand and backhand exercises. Research examining verbal instruction and motor learning in tennis indicates that instructional guidance can influence the development of movement representations and technical performance (Meier et al., 2020). Evidence concerning drill-based tennis coaching also supports the relevance of repeated technical

exercises for developing fundamental forehand ability (Setyawan, 2025). The mentoring arrangement provided opportunities for athletes to identify movement errors and practice technical corrections within the scheduled training activities. Nevertheless, the available documentation does not quantify individual coaching interactions, correction frequencies, or technical changes associated with the guidance provided during each session.

Program implementation was organized into four progressive phases consisting of adaptation, formation, improvement, and consolidation. The adaptation phase was scheduled for sessions 1–2 and emphasized familiarization with training equipment and fundamental tennis techniques. The formation phase occupied sessions 3–4 and incorporated formative evaluation alongside activities directed toward developing stroke consistency and directional control. The improvement phase was implemented during sessions 5–6, while consolidation formed part of the documented training progression without a separately specified session allocation in the implementation records. Progressive organization of training activities is consistent with periodization principles that emphasize the systematic arrangement of training stages and exercise demands (Bompa & Buzzichelli, 2019). The correspondence between planned activities and documented implementation, including participant involvement, session completion, training guidelines, and performance evaluation arrangements, is presented in Table 1.

Table 1. Implementation of the Junior Tennis Athlete Mentoring Program in Yogyakarta

Component	Plan	Implementation
Participants	20 junior athletes	20 athletes participated
Meetings	8 sessions	8 sessions completed (100%)
Adaptation phase	Sessions 1–2	Completed
Formation phase	Sessions 3–4	Completed, including formative evaluation
Improvement phase	Sessions 5–6	Completed
Training guidelines	8-session program	Training guidelines available
Performance evaluation	Pretest and posttest	Individual scores require validation before analysis

Source: Research findings, 2026

Table 1 demonstrates the correspondence between the planned mentoring activities and their documented implementation during the July 2026 program. The number of participating athletes matched the planned target of 20, while all eight scheduled meetings were completed, producing an implementation rate of 100%. The adaptation, formation, and improvement phases were recorded as completed, with formative evaluation specifically incorporated into the formation stage. Training guidelines were available for the eight-session program, providing documented instructional material for organizing the coaching activities. Research concerning structured on-court training among young tennis players highlights the relevance of clearly organized interventions when examining athletic and technical development (Morais et al., 2024). The planned performance evaluation included pretest and posttest assessments, but individual scores required validation before quantitative analysis could be conducted. The implementation results therefore demonstrate procedural completion and program delivery rather than statistically established changes in shot accuracy, stroke consistency, or attacking effectiveness.

Training progression also involved adjustments to the prescribed repetition volume, rest intervals, and relative intensity across the mentoring program. Exercise loads increased from 4 × 8 to 6 × 12 repetitions, indicating a planned progression from 32 to 72 repetitions within the documented training arrangements. Rest intervals ranged from 60 to 40 seconds, while relative training intensity was maintained within the reported range of 50–70%. These parameters describe the prescribed exercise progression, although session-specific workloads and individual training responses were not presented in the available implementation records. Research on tennis drill prescription emphasizes the importance of distinguishing training configurations from the actual movement and stroke demands experienced by athletes (Perri et al., 2023). Studies reviewing exercise interventions among young tennis players also demonstrate the relevance of structured physical training for athletic development, while emphasizing the need for appropriate performance measurements when evaluating training outcomes (Xiao et al., 2022).

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The mentoring arrangement combined progressive training stages, supervised technical practice, and instructional activities adapted to the operational requirements of junior tennis development. Small-group organization and rotation procedures enabled coaches or assistants to supervise different exercises while maintaining the continuity of scheduled training activities. The integration of mechanical ball delivery with conventional coaching provided an instructional arrangement in which controlled technical repetition could be connected with movement adaptation and practical shot execution. Research on groundstroke training equipment identifies technological aids as potentially relevant resources for supporting fundamental tennis skill development among beginning players (Fauzan et al., 2024). Investigations of machine-assisted tennis training also provide evidence concerning the application of automated ball delivery to forehand and backhand practice, although their reported performance effects cannot be directly attributed to the present program (Gemilang et al., 2025). The combination of technological and conventional training resources is consistent with contemporary approaches that distinguish equipment-supported practice from interactive instructional activities (Zakaria et al., 2025). The applied contribution of the mentoring program lies in the documented coordination of these training components within a progressive coaching framework rather than in demonstrating the independent superiority of either training approach.

The implementation findings establish that the junior tennis mentoring program was conducted with the planned number of participants and that all eight scheduled sessions were completed. The documented activities incorporated progressive training phases, technical guidance, training-load adjustments, and the integration of ball-machine exercises with conventional practice. This implementation structure provides a practical reference for organizing supervised junior tennis training through complementary technological and instructional resources. Research examining the development of young tennis players emphasizes the relevance of systematic training organization and technological integration in technical skill acquisition (Liu et al., 2024). The descriptive-evaluative approach was sufficient to document program delivery but did not establish causal relationships between the intervention and changes in individual athletic performance. Further validation of individual pretest and posttest measurements remains necessary before conclusions can be drawn regarding improvements in shot accuracy, attacking effectiveness, or the comparative contribution of the integrated training components.

Integration of Ball-Machine and Conventional Training in Technical Skill Development

Integration of Ball-Machine and Conventional Training in Technical Skill Development The integrated mentoring program incorporated four training formats: ball-machine drills, coach- or partner-fed practice, footwork and shadow-swing exercises, and restricted games. These activities were delivered within the eight-session schedule to connect repeated stroke production with increasingly variable on-court tasks. Machine-generated feeds supported relatively consistent opportunities to rehearse forehand and backhand movements, while live feeds exposed athletes to changes in ball arrival and subsequent positioning. Footwork and shadow swings provided movement preparation exercises without requiring every repetition to involve direct ball contact. Restricted games introduced directional choices, attacking transitions, and responses to changing situations during tennis play. Research on tennis learning aids distinguishes the instructional functions of technological and conventional resources, supporting their consideration as complementary practice modalities (Zakaria et al., 2025). The documented combination of these formats established an integrated instructional arrangement, although the relative contribution of each training component to stroke accuracy and attacking effectiveness could not be determined from the available observations.

Ball-machine practice used repeated feeds intended to support consistent racket preparation, contact points, and directional control. Before each training session, machine settings involving feed direction, interval, elevation, speed, and spin were adjusted according to athletes' abilities and the functions available on the equipment. These adjustments provided an adaptable practice arrangement, although the records did not specify numerical machine settings or individual feeding sequences. Research concerning tennis ball-launching equipment identifies controlled ball delivery as a technological capability that can support the organization of repeated training activities (Noguera Cundar et al., 2022). Investigations involving machine-assisted tennis training have also examined the contribution of repeated ball delivery to forehand and backhand practice, providing a relevant

comparison for this instructional arrangement (Gemilang et al., 2025). The documented application of the ball machine to repetitive stroke practice and directional control is presented in Figure 2.



Figure 2. Use of a Ball Machine for Repetitive Stroke Practice and Directional Control

The repetitive feeding patterns illustrated in Figure 2 provided training conditions in which athletes could concentrate on movement execution while incoming balls remained comparatively predictable. Forehand and backhand exercises emphasized contact-point positioning, coordinated racket movement, and the placement of strokes toward intended directions. The instructional purpose of this arrangement was to establish opportunities for controlled technical repetition before athletes encountered more variable playing conditions. Structured technical assessment among young tennis players requires consideration of stroke preparation and execution rather than evaluating proficiency exclusively through successful ball contact (Diler et al., 2024). Research on technological approaches to junior tennis development also identifies equipment-supported practice as a component of systematic technical learning and individualized coaching (Liu et al., 2024). The available documentation did not provide individual successful-shot counts, target-zone scores, or detailed machine-feeding records that could establish the magnitude of technical improvement. The findings consequently demonstrate the implementation of an organized approach to repetitive technical training rather than a quantified performance gain attributable to automated ball delivery.

Basic-technique training stations complemented machine-assisted exercises through forehand and backhand practice, ready-position drills, footwork activities, and shadow swings. These activities addressed body positioning, movement preparation, racket coordination, and recovery following stroke execution. Footwork and positional adjustment exercises extended technical preparation beyond the instant of ball contact to include readiness for subsequent movements. Research examining physical function and baseline stroke ability identifies movement capability as a relevant consideration in the development of tennis techniques (Lu et al., 2025). Investigations involving young tennis players further demonstrate the relevance of integrating physical and technical exercises within organized on-court training programs (Morais et al., 2024). Figure 3 documents the fundamental technique and movement-coordination exercises incorporated into the training stations.

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Figure 3. Basic Technique and Movement Coordination Training at Practice Stations

The training arrangement illustrated in Figure 3 positioned technical rehearsal alongside movement preparation rather than treating forehand and backhand execution as isolated racket actions. Ready-position exercises emphasized preparation for incoming balls, whereas shadow swings enabled athletes to rehearse movement sequences without the immediate demands of ball contact. Footwork activities addressed positional adjustment and recovery as integral components of repeated stroke execution. Coaches and assistants provided technical guidance during these activities to support coordination between body positioning, racket preparation, and follow-through. Research investigating verbal instruction and motor learning in tennis emphasizes the relevance of instructional guidance to the development of movement representations and technical performance (Meier et al., 2020). Studies examining footwork and forehand accuracy among junior tennis athletes similarly identify movement organization and shot placement as related areas of technical development (Randau et al., 2026). The documented activities establish the instructional components delivered during mentoring, although individual coordination scores, recovery times, and technical improvements were not quantitatively reported.

Conventional training incorporated balls delivered by coaches or partners and simulated rallies designed to expose athletes to variable interactions during practice. Athletes performed exercises requiring positional adjustment, responses to changing ball directions, and selection of appropriate strokes during successive exchanges. Restricted games connected these responses with cross-court and down-the-line shots, attacking transitions, and the practical application of previously rehearsed techniques. Research examining thrown-ball drills and deep-drive exercises demonstrates the relevance of conventional training approaches to developing backhand hitting ability in tennis (Fauzan et al., 2024). Studies involving situation-based forehand training also support incorporating playing conditions into technical development activities rather than relying exclusively on repetitive stroke execution (Jatra et al., 2024). The implementation of coach- or partner-fed exercises and rally simulations is presented in Figure 4.

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Figure 4. Conventional Training Through Coach or Partner Feeds and Rally Simulations

Figure 4 illustrates the transition from mechanically generated repetitions toward training activities involving live ball feeds and simulated tennis exchanges. Under these conditions, incoming-ball variation required athletes to adjust their positioning, organize movement responses, and select appropriate stroke directions. This distinction was relevant because the ability to reproduce a stroke under relatively predictable feeding conditions does not necessarily establish effective attacking decisions during variable rallies. Research on variability-based tennis training has examined the relationship between changing practice conditions, forehand approach precision, and stroke velocity, identifying task variation as a relevant dimension of technical development (Negro et al., 2023). Investigations involving induced variability and specific practice have similarly evaluated the influence of different training arrangements on forehand approach performance (Oliveira et al., 2024). The mentoring documentation confirmed the incorporation of interactive exercises but did not provide validated measurements of decision accuracy, successful attacking strokes, or point-completion outcomes. The tactical contribution of conventional practice must consequently be interpreted through the opportunities for adaptive skill application rather than as evidence of measurable improvements in competitive effectiveness.

The integration of ball-machine and conventional exercises established a training arrangement connecting controlled repetition, supervised technical correction, movement coordination, and interactive tennis practice. Mechanical feeds supported the organization of repeated technical exercises, while conventional drills introduced changing ball conditions and decisions concerning directional placement and attacking execution. Research differentiating stroke and movement characteristics across tennis training drills demonstrates that distinct exercise formats impose different technical and physical demands on participating athletes (Perri et al., 2023). Literature concerning technological and non-technological tennis learning aids likewise emphasizes the relevance of examining their complementary instructional functions rather than treating different training resources as interchangeable (Zakaria et al., 2025). The descriptive-evaluative records establish the practical integration of both approaches within the eight-session mentoring program but do not determine their comparative effectiveness or individual contributions to performance development. Validated pretest and posttest measurements remain necessary to establish whether this integrated training arrangement produces measurable improvements in stroke accuracy, technical consistency, and attacking effectiveness among junior tennis athletes.

Technical and Tactical Observations of Shot Accuracy and Attacking Effectiveness

Technical and tactical observations during the mentoring program focused on how junior athletes executed and applied strokes under the training conditions documented in July 2026. The 20 participants practiced forehand and backhand movements while coaches observed ready position, contact point, follow-through, and positional recovery. These features represented the technical components monitored during ball-machine practice and conventional exercises rather than scores obtained from a standardized test. Groundstroke assessment among young tennis players requires

attention to the coordination of preparatory and execution phases, not merely the final flight of the ball (Diler et al., 2024). Instructional corrections during the sessions addressed visible elements of stroke execution as athletes repeated the assigned tasks. Evidence from tennis motor-learning research provides a basis for considering guided feedback relevant to the organization of stroke movements (Meier et al., 2020). The documentation establishes the technical scope of mentoring but does not quantify changes in execution quality for individual athletes.

Target accuracy was observed through shot direction and ball placement during forehand and backhand practice. The ball machine offered relatively predictable feeds, while coach- and partner-fed exercises required adjustment to different incoming balls. This combination placed directional control within both repeated practice and situations involving greater variation in ball arrival. Precision-oriented groundstroke training has treated placement accuracy as an assessable component of technical performance (Sunaryo et al., 2025). Variability-based training research additionally suggests that accuracy should be examined in relation to the conditions under which the stroke is executed (Negro et al., 2023). Because target-hit counts, error distributions, and validated individual pretest and posttest scores were unavailable, directional improvement cannot be expressed numerically.

Observations of movement emphasized the ready position, footwork, and recovery after each stroke. Footwork and shadow swings were used to rehearse positional adjustments without requiring every repetition to involve ball contact. During live-ball exercises, athletes were expected to prepare for the next stroke after completing the preceding movement. These demands differ from assessing the accuracy of a single stationary shot because court coverage and recovery influence opportunities to execute subsequent strokes. Research on footwork and forehand accuracy in junior tennis identifies movement preparation as a relevant area of technical development (Randau et al., 2026). Work on physical-function training has likewise examined baseline movement as part of tennis stroke ability (Lu et al., 2025). The mentoring records describe the movement dimensions addressed but provide no individual reaction-time, movement-speed, or recovery-efficiency measurements.

Attacking variation was practiced through cross-court, down-the-line, and approach shots. Restricted games also introduced volleys and the use of open court space as components of point completion. These activities required athletes to consider both where to direct a stroke and how to prepare for the next action within an exchange. Situation-based forehand training research supports examining skills through tasks that approximate playing demands (Jatra et al., 2024). Studies of specific and variable tennis practice similarly recognize approach-shot performance as an outcome shaped by practice conditions (Oliveira et al., 2024). The documented observation categories and their corresponding coaching focus are presented in Table 2.

Table 2. Technical and Tactical Observation Areas During Mentoring

Area	Observed Indicators	Mentoring Focus
Stroke technique	Forehand, backhand, contact point, and follow-through	Consistency of movement patterns
Target accuracy	Shot direction and ball placement	Directional and target control
Movement	Ready position, footwork, and positional recovery	Readiness for the next ball
Attacking variation	Cross-court, down-the-line, and approach shots	Selection of attacking direction
Point completion	Volleys and use of open space	Application of skills in play

Source: Research findings, 2026.

Table 2 distinguishes stroke technique, target accuracy, movement, attacking variation, and point completion as five separate but related areas of observation. The first area concerns execution of forehand and backhand strokes, whereas the second concerns direction and placement of the resulting shots. Movement adds readiness and positional recovery, which become relevant when successive balls demand changes in court position. Attacking variation and point completion extend the observation framework to directional choices and the use of volleys or available space. The distinction between stroke mechanics and applied playing actions is consistent with research that evaluates groundstroke technique through observable movement components (Diler et al., 2024). Research differentiating

tennis drill demands also suggests that performance characteristics should be interpreted in relation to the exercises performed (Perri et al., 2023). These categories describe what coaches monitored but do not provide graded ratings or observed frequencies sufficient to establish which dimension developed most.

The restricted games were intended to connect mechanical and conventional practice with decisions about shot placement during rallies. Cross-court and down-the-line options allowed the coaching activities to address directional variation, while approach shots and volleys introduced possible attacking transitions. The training records do not specify how often those options were attempted or how many actions led to successful point completion. Research concerning training variability suggests that applying a learned stroke under changing conditions is a distinct problem from reproducing it under predictable feeds (Negro et al., 2023). Technology-supported training studies address the potential of repeated practice for stroke development but do not substitute for observing decisions and outcomes during live play (Gemilang et al., 2025). The available evidence supports the documented inclusion of tactical activities rather than a claim of improved attacking effectiveness.

The observation framework reflects the applied objective of linking technical repetition to the functional use of forehand and backhand skills. Machine-generated feeds established opportunities for consistent practice, while conventional drills exposed athletes to more variable movement and ball-response requirements. This arrangement was implemented as one integrated program and cannot be interpreted as a comparison of two independently assigned training groups. A review of technology-based and non-technological tennis learning aids identifies these categories as complementary resources for skill instruction (Zakaria et al., 2025). Research on regional junior athletes has also examined groundstroke consistency through structured drills, providing a relevant but methodologically distinct reference for the Yogyakarta setting (Ma'ruf et al., 2024). Evidence from forehand precision training reinforces the value of specifying measurable outcomes before concluding that a particular training arrangement is effective (Sunaryo et al., 2025). The principal result of the present evaluation is a documented set of training and observation practices, not a verified performance effect.

The descriptive-evaluative design allowed the program to document the technical and tactical dimensions addressed across eight sessions. Its main limitation was the absence of validated individual pretest and posttest records for shot accuracy and attacking effectiveness. The documentation also did not include standardized target-zone scores, ratings for each technical indicator, or verified outcomes of attacking decisions during restricted games. Systematic approaches to groundstroke assessment illustrate why defined criteria and repeatable measurements are necessary for evaluating changes in tennis performance (Diler et al., 2024). Future evaluations should validate individual performance records and apply consistent indicators of stroke placement, movement execution, and point-completion success across assessment occasions. Until such data are available, the findings support a conclusion of implemented technical and tactical mentoring rather than measurable improvement in individual shot performance.

CONCLUSION

The community engagement program was implemented in July 2026 with 20 junior tennis athletes aged 10–16 years in the Special Region of Yogyakarta through eight structured training sessions. All scheduled sessions were completed, achieving a program implementation rate of 100%. The intervention integrated ball-machine exercises with conventional training involving coach- or partner-fed drills, footwork practice, shadow swings, and restricted games. Training activities progressed through adaptation, formation, improvement, and consolidation, connecting controlled stroke repetition with increasingly interactive playing conditions. Small-group rotations and direct technical corrections facilitated supervised practice while supporting the systematic implementation of forehand and backhand training. Technical observations covered stroke execution, directional accuracy, movement readiness, positional recovery, attacking variation, and point completion during simulated playing situations. These findings establish the successful implementation of an integrated coaching framework that combines technological innovation with conventional training, although measurable improvements in individual shot accuracy and attacking effectiveness have not been confirmed.

The principal contribution of this program is an applied coaching model that integrates repeatable ball delivery with conventional exercises requiring movement adaptation, technical coordination, and tactical decision-making. Eight-session training guidelines and monitoring

instruments were developed to support subsequent coaching implementation and systematic evaluation of junior tennis development. The integrated training arrangement provided structured opportunities to practice forehand and backhand placement, attacking transitions, and tactical shot selection under progressively varied training conditions. Descriptive evaluation documented the implementation process and instructional activities but did not establish a causal relationship between the integrated intervention and individual performance outcomes. The absence of validated individual pretest and posttest scores prevented quantitative conclusions regarding improvements in stroke accuracy, technical consistency, and attacking effectiveness. Future evaluations should incorporate validated athlete-level measurements, standardized shot-placement assessments, technical observation criteria, and indicators of attacking success to determine the effectiveness of the coaching intervention. Longitudinal monitoring and more rigorous comparative evaluation are also necessary to establish the sustainability, transferability, and practical effectiveness of this integrated training model in junior tennis development.

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