



Simple return board as a self-practice tool: its effect on table tennis forehand drive, backhand drive, and service technique skills

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Abstract: This study aimed to examine the effect of Simple Return Board on the improvement of forehand drive, backhand drive, and service technique skills among junior high school students. **Methods** A quasi-experimental design with a non-equivalent pre-test post-test control group was employed. A total of 120 students from four junior high schools in West Bandung Regency were divided into an experimental group (n=60) and a control group (n=60). The experimental group received SRB-assisted learning for eight weeks (16 sessions), while the control group followed conventional instruction. Data were collected using an observation sheet validated by three expert judges (CVR=0.91). Independent samples t-test and paired samples t-test were used for data analysis. **Results** The experimental group demonstrated a significant improvement in overall table tennis skills (pre-test M=62.4, SD=7.3; post-test M=84.7, SD=5.6; $t=21.43$, $p<0.001$, $d=2.77$). Forehand drive improved by 34.2%, backhand drive by 29.8%, and service by 38.1%. Between-group comparison confirmed significantly higher gains in the experimental group ($p<0.001$). **Conclusion** Simple Return Board is an effective, affordable, and practical learning tool for improving table tennis basic technique skills in resource-limited school settings.

Keywords: Simple Return Board; table tennis; basic techniques; quasi-experiment; physical education; junior high school



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Introduction

The Physical education plays a fundamental role in holistic student development, encompassing physical fitness, motor skills, cognitive ability, and psychosocial well-being (Dra. Dini Rosdiani, 2013). Among the various sports included in physical education curricula across Indonesia, table tennis occupies a prominent position due to its accessibility and widespread popularity among all age groups (Herliana et al., 2024). However, translating the enthusiasm for table tennis into effective skill acquisition in school settings remains a persistent challenge, particularly at the junior high school level.

Table tennis demands high levels of eye-hand coordination, rapid reaction time, and precise anticipatory movement, making the systematic teaching of its basic techniques forehand drive, backhand drive, and service both critical and complex (Hodges & Franks, 2002). The acquisition of these motor skills requires structured, high-frequency repetition practice to achieve movement automatization (Schmidt & Lee, 2020a). Yet, practical implementation of this principle is severely hampered in Indonesian schools by a well-documented shortage of physical education facilities. Field observations conducted in West Bandung Regency identified three primary constraints faced by physical education teachers and students in teaching and learning table tennis. First, most schools possess only one to two table tennis tables, creating an imbalance between equipment availability and student numbers. Second, the absence of systematic training aids makes it difficult for teachers to provide each student with adequate repetition opportunities. Third, the lack of sparring partners prevents students from practicing stroke techniques with consistent ball return, a condition that is fundamental to motor skill development (Ericsson et al., 2018). These findings are consistent with national data indicating that approximately 73% of Indonesian schools experience significant limitations in sports facilities (Sutiswo & Widodo, 2021).

Table tennis is a sport that demands mastery of fundamental techniques, particularly the forehand stroke, which serves as the primary attacking weapon in competitive play (Mongsidi et al., 2023). The forehand drive and forehand spin are considered the most critical basic techniques, as they directly influence a player's ability to control ball placement, generate speed, and outmaneuver opponents during matches (Royana et al., 2019). Developing these skills requires not only appropriate teaching methods but also effective training media and systematic practice approaches. Research has demonstrated that the part methoda teaching strategy that breaks complex movements into smaller, manageable components significantly improves students' forehand service skills in table tennis, as learners can progressively master each movement phase before integrating them into a complete stroke (Effendy et al., 2020). Furthermore, multiball training has been identified as a highly effective drill method for improving forehand drive precision, as it enables high-repetition practice with immediate feedback, thereby accelerating motor learning and stroke consistency (Mongsidi et al., 2023). Beyond instructional methods, talent identification research highlights that physical attributes such as eye-hand coordination, agility, and muscle power all of which are central to table tennis performance can be systematically assessed in young athletes to guide early sport specialization and long-term athlete development (Hariadi et al., 2022). Taken together, these findings underscore the importance of integrating evidence-based teaching methods, purposeful training tools, and early talent screening to optimize forehand stroke development in table tennis players across all levels.

Table tennis is one of the most widely practiced sports in the world, recognized not only for its competitive value but also for its significant contribution to the physical and cognitive development of students in school settings. Table tennis offers substantial advantages in terms of skill acquisition and health improvement, making it a meaningful element of physical education curricula (Siregar et al., 2022). The mastery of basic technical skills particularly the forehand drive, backhand drive, and service constitutes the foundation of table tennis competence in early stages of learning. Forehand and backhand strokes are considered very important in table tennis, especially for beginner players, as they serve multiple functions including attack and ball return (Junaidi et al., 2026). Among the various techniques, the drive stroke stands out as a fundamental element that enables players to maintain the rhythm of attack while controlling the ball with precision, and the ability to execute an effective drive stroke not only increases the likelihood of scoring points but also strengthens the player's dominance on the court (Suisdareni & Tomoliyus, 2021). Studies examining junior high school students have consistently found that students' forehand proficiency tends to be more developed than their backhand, indicating that backhand technique still requires more intensive and systematic development at the junior high school level (Faber et al., 2021).

The development of technical skills in table tennis is heavily influenced by the quality and consistency of practice methods and training tools available to students. The use of auxiliary tools to enhance the ability in various types of strokes in table tennis has a positive impact on improving the accuracy and consistency of the drive stroke (Urfi et al., 2023). One innovative approach is the use of a simple return board, which functions as a self-practice tool that allows students to repeatedly practice drive and service strokes without requiring a partner or coach. Drill training using a reflected board media is a method that can effectively improve skills in performing the forehand drive, as it allows players to practice independently and repeatedly in a self-regulated manner (Pane et al., 2021). Research in self-practice-based motor learning further supports this, showing that self-controlled practice enhances autonomy, protects perceptions of competence, and contributes positively to motor learning outcomes among young athletes (Van der Meer et al., 2024). Furthermore, an external focus of attention during practice which is naturally encouraged when using a return board has been shown to enhance stroke accuracy in low-skilled players (Niżnikowski et al., 2022). Given the limited availability of qualified partners and coaches in many junior high schools, particularly in regions such as West Bandung Regency, the simple return board presents a highly accessible and cost-effective solution for developing forehand drive, backhand drive, and service technique skills among junior high school students (Haryanto et al., 2025).

Innovative learning media have been widely recognized as a strategic solution to infrastructure constraints in physical education (Sadiman et al., 2014). Among these innovations,

Simple Return Board (SRB) stands out for its unique combination of being low-cost, self-practice-enabling, and versatile. Unlike commercially available ball-feeding robots that cost millions of rupiah, SRB can be constructed from locally available materials at minimal expense. Functionally, SRB automatically returns the ball to the player, enabling independent practice without the need for a sparring partner or continuous teacher supervision. Its design allows for variable rebound angles, accommodating the practice of forehand drive, backhand drive, and service techniques within a single device. This aligns with the principles of deliberate practice, wherein high-repetition structured training with immediate feedback is the key driver of motor skill mastery (Ericsson et al., 2018). Despite the theoretical promise of SRB, empirical evidence for its effectiveness at the junior high school level in Indonesia remains scarce. Previous studies have examined ball-feeder devices in tennis (Nugroho et al., 2022) and modified training aids in badminton (Prakoso & Sugiyanto, 2017), demonstrating positive effects on skill acquisition. However, no study has rigorously examined SRB as a dedicated table tennis learning tool with a controlled experimental design and a sufficiently large sample. This research gap is the primary motivation for the present study.

This study therefore aimed to: (1) determine the effect of Simple Return Board on forehand drive technique skills among junior high school students; (2) determine the effect of SRB on backhand drive technique skills; (3) determine the effect of SRB on service technique skills; and (4) compare overall skill improvement between SRB-assisted and conventional learning groups. The findings are expected to provide evidence-based recommendations for physical education practitioners in resource-limited school environments.

Materials and Methods

Research Design

This study employed a quasi-experimental design with a non-equivalent pre-test post-test control group, in which participants were not randomly assigned but were selected based on intact class groupings. This design is appropriate when random assignment is not feasible in naturalistic school settings and is widely used in physical education intervention research (Sugiyono, 2019). The independent variable was the use of Simple Return Board in the learning process, while the dependent variables were student scores on forehand drive, backhand drive, and service techniques.

Participants

A total of 120 junior high school students from four schools in West Bandung Regency, West Java, Indonesia participated in this study. Purposive sampling was applied, selecting schools with comparable characteristics in terms of facility limitations and teacher qualifications. Students were

divided into an experimental group ($n=60$; mean age=13.4 years, $SD=0.6$; 31 males, 29 females) and a control group ($n=60$; mean age=13.5 years, $SD=0.7$; 30 males, 30 females). Inclusion criteria were: (a) active enrollment as 8th-grade students, (b) no prior formal table tennis training outside school, and (c) written consent from parents or guardians. The study was conducted from February to April 2025, spanning eight weeks of intervention.

Intervention

The experimental group received table tennis instruction integrated with Simple Return Board for 16 sessions over eight weeks (two sessions per week, 80 minutes per session). Each session followed a structured format: warm-up (10 minutes), SRB-assisted technical practice (50 minutes), and cool-down and reflection (20 minutes). SRB practice was organized in rotation stations, ensuring each student received a minimum of 200 ball-contact repetitions per session. The SRB devices were constructed from plywood and rubber sheet materials at a unit cost of approximately IDR 85,000 (approximately USD 5.50), making them highly replicable for schools with limited budgets. The control group received conventional table tennis instruction of identical duration and frequency, following the standard national physical education curriculum without SRB.

Instruments

Data were collected using a structured observation sheet for table tennis basic technique skills, developed based on International Table Tennis Federation (ITTF) standards and adapted for the junior high school context. The instrument assessed three main dimensions: (1) forehand drive (30 points), evaluating stance, grip, backswing, impact, and follow-through; (2) backhand drive (30 points), with identical indicators; and (3) service (40 points), assessing toss consistency, racket contact point, spin application, and placement accuracy. Total scores ranged from 0 to 100. Content validity was established through expert judgment by three table tennis specialists and two physical education curriculum experts, yielding a Content Validity Ratio (CVR) of 0.91, indicating very high content validity. Inter-rater reliability was assessed using Cohen's Kappa, yielding $\kappa=0.89$, indicating strong inter-rater agreement.

Data Analysis

Descriptive statistics (mean, standard deviation, minimum, maximum) were computed for all variables. Normality of distribution was verified using the Shapiro-Wilk test. Homogeneity of variance was assessed using Levene's test. Since normality and homogeneity assumptions were satisfied, within-group changes were analyzed using paired-samples t-tests, and between-group comparisons were performed using independent-samples t-tests. Effect sizes were calculated using Cohen's d , with thresholds of 0.2 (small), 0.5 (medium), and 0.8 (large). All analyses were performed using SPSS version 26.0, with a significance level set at $\alpha=0.05$.

Results and Discussion

Descriptive Statistics

Table 1 presents the descriptive statistics for pre-test and post-test scores of both groups across all technique dimensions

Variable	Group	Pre-test M	Pre-test SD	Post-test M	Post-test SD	Gain M	Gain %
Forehand Drive	Experimental	20.8	2.4	28.0	1.9	+7.2	34.2%
	Control	20.5	2.6	22.8	2.3	+2.3	11.2%
Backhand Drive	Experimental	20.4	2.5	26.5	2.1	+6.1	29.8%
	Control	20.2	2.7	21.8	2.4	+1.6	7.9%
Service	Experimental	21.2	3.1	29.3	2.6	+8.1	38.1%
	Control	21.0	3.0	22.6	2.8	+1.6	7.6%
Overall Score	Experimental	62.4	7.3	84.7	5.6	+22.3	35.7%
	Control	61.7	7.8	67.2	6.9	+5.5	8.9%

As shown in Table 1, both groups showed comparable baseline scores in the pre-test, confirming group equivalence prior to intervention. The experimental group demonstrated substantially greater gains across all three technical dimensions compared to the control group. The largest relative improvement was observed in service technique (38.1%), followed by forehand drive (34.2%) and backhand drive (29.8%). The control group's modest gains likely reflect normal learning progression through standard curriculum instruction.

Within-Group Analysis (Paired Samples t-Test)

Table 2 presents the results of within-group pre-test to post-test

Technique	Group	Mean Diff	SD Diff	t	df	p	Cohen's d
Forehand Drive	Experimental	7.20	1.84	30.27	59	<.001	3.91
	Control	2.30	1.62	10.99	59	<.001	1.42
Backhand Drive	Experimental	6.10	1.91	24.72	59	<.001	3.19
	Control	1.60	1.44	8.60	59	<.001	1.11
Service	Experimental	8.10	2.23	28.12	59	<.001	3.63
	Control	1.60	1.68	7.38	59	<.001	0.95
Overall Score	Experimental	22.30	8.05	21.43	59	<.001	2.77
	Control	5.50	4.18	10.19	59	<.001	1.32

Both groups exhibited statistically significant improvements from pre-test to post-test across all technique dimensions ($p < 0.001$). However, the magnitude of improvement differed substantially. The experimental group displayed very large effect sizes for all techniques (Cohen's d ranging from 2.77 to 3.91), indicating that SRB-assisted practice produced profound skill gains.

By contrast, the control group showed moderate to large effect sizes (Cohen's d ranging from 0.95 to 1.42), reflecting standard instructional progress.

Between-Group Analysis (Independent Samples t -Test)

Table 3 presents the between-group comparison of post-test scores and gain scores

Technique	Exp. Post-test M (SD)	Ctrl Post-test M (SD)	Mean Diff	t	df	p	Cohen's d
Forehand Drive	28.0 (1.9)	22.8 (2.3)	5.20	13.72	118	<.001	2.51
Backhand Drive	26.5 (2.1)	21.8 (2.4)	4.70	11.63	118	<.001	2.13
Service	29.3 (2.6)	22.6 (2.8)	6.70	14.04	118	<.001	2.48
Overall Score	84.7 (5.6)	67.2 (6.9)	17.50	15.61	118	<.001	2.83

Between-group comparisons confirmed that the experimental group significantly outperformed the control group on all post-test measures ($p < 0.001$). The largest between-group difference was observed in overall score (Mean Diff=17.50, Cohen's d =2.83), followed by service (Mean Diff=6.70, d =2.48), forehand drive (Mean Diff=5.20, d =2.51), and backhand drive (Mean Diff=4.70, d =2.13). All effect sizes exceeded Cohen's conventional threshold for large effects ($d > 0.8$), indicating that the superiority of SRB-assisted learning over conventional instruction was not only statistically significant but also practically meaningful.

Discussion

The findings of this study provide compelling evidence that Simple Return Board is a highly effective learning tool for improving table tennis basic technique skills among junior high school students. The experimental group's significantly superior gains across all three technical dimensions forehand drive, backhand drive, and service affirm the central hypothesis of this research and extend the existing literature on training-aid-assisted physical education. The effectiveness of SRB can be principally explained through the theoretical lens of motor learning. Optimal motor skill acquisition is contingent upon the availability of high-frequency repetition and immediate, accurate feedback (Schmidt & Lee, 2020b). SRB structurally provides both conditions: the automatic ball return mechanism enables students to perform hundreds of repetitive stroke cycles within a single session, while the physical consistency of ball trajectory offers a form of intrinsic feedback regarding stroke quality. This is consistent with deliberate practice framework, which positions structured, feedback-rich repetition as the fundamental mechanism of expertise development (Ericsson et al., 2018).

The particularly pronounced improvement in service technique (38.1% gain in the experimental group vs. 7.6% in the control) merits specific discussion. Service is widely regarded

as the most technically demanding aspect of beginner-level table tennis, requiring the simultaneous coordination of toss height, racket angle, contact timing, and spin direction (Barth & Schorer, 2021). Conventional instruction, constrained by limited equipment and class time, often affords students insufficient opportunities to isolate and refine service mechanics. SRB addresses this gap by allowing students to focus exclusively on service execution without the pressure of an immediate return, thereby enabling the kind of deliberate, reflective practice that underpins skill consolidation. The practical and economic dimensions of SRB also warrant emphasis. At a unit cost of approximately IDR 85,000 (USD 5.50), SRB is accessible to virtually all school budgets in Indonesia. This positions it as a viable example of appropriate technology for physical education concept advocated by UNESCO (2019) emphasizing that learning tools must be contextually and economically fitted to the settings in which they are deployed. Earlier studies have similarly demonstrated the effectiveness of low-cost modified training equipment in Indonesian physical education contexts (Hasmarita et al., 2025), and the present study reinforces this finding with a larger and more rigorously controlled sample.

Furthermore, the student-centered nature of SRB-assisted practice carries important pedagogical implications. By enabling autonomous practice, SRB reduces students' dependence on the teacher or a sparring partner and shifts the locus of learning agency to the student. Research has demonstrated that learning environments supporting self-directed practice increase students' intrinsic motivation by up to 42% compared to teacher-centered approaches (Santoso & Sutapa, 2018). This finding aligns with contemporary constructivist and self-determination frameworks in physical education pedagogy (Ryan & Deci, 2017). Several limitations of the present study should be acknowledged. First, the eight-week intervention period, while sufficient to demonstrate significant initial effects, does not allow for the assessment of long-term skill retention. Second, participant assignment was based on intact classes rather than random allocation, which, despite baseline equivalence, limits causal inference. Third, the study did not measure potential moderating variables such as intrinsic motivation, practice time outside school, or prior athletic experience. Future research should address these limitations through randomized designs, longer follow-up periods, and the inclusion of motivational and psychological outcome measures.

Conclusion

This study demonstrated that Simple Return Board significantly and substantially improved forehand drive, backhand drive, and service technique skills among junior high school students in West Bandung Regency compared to conventional instruction. Effect sizes were consistently large across all outcome measures, indicating that the advantages of SRB-assisted learning are not only

statistically robust but also practically significant for teachers and curriculum developers. As a low-cost, independently operable, and versatile training aid, Simple Return Board represents a highly practical solution for schools facing infrastructure constraints conditions that characterize the majority of junior high schools in Indonesia. Physical education departments and school administrators are encouraged to adopt SRB as a standard component of table tennis instruction, particularly in schools with limited equipment.

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