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# The Effectiveness of Drill Smash Practice Methods and Multishuttle Play Methods on Badminton Smash Accuracy in High School Extracurricular Students

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**Abstract**

The accuracy of the smash is an important indicator of badminton performance because it determines the effectiveness of attacks, the ability to pressure the opponent, and the chances of earning points. This study was compiled based on the premise that the improvement of smash accuracy depends not only on the ability to hit the shuttlecock strongly, but also on training methods that are able to form technique consistency, movement response, and the ability to direct the punch to the target area. The purpose of this study was to analyze the change in the accuracy of students' smash after being given the training treatment and to compare the final achievement between the drill smash training group and the multishuttle play method group. The study used a quantitative approach with a design of two pretest-posttest groups. The research subjects amounted to 21 extracurricular badminton students, consisting of 10 students in group 1 and 11 students in group 2. Data was collected through smash precision tests before and after treatment. The results of descriptive statistics show that the total pretest score of 300 increased to 336 in the posttest. The average score also increased from 14.2857 to 16.0000, with a decrease in standard deviation from 1.52128 to 1.30384. These results show a tendency to improve overall smash accuracy after the training treatment. The Shapiro-Wilk normality test showed that the pretest data in both groups were normally distributed, while the posttest data were not normally distributed. Posttest comparison showed that group 2 obtained an average higher than group 1, which was 16.2727 compared to 15.7000. However, the effect size showed Cohen's d of -0.439 with a 95% confidence interval from -1.301 to 0.434, so the differences between groups could not be statistically strong. Thus, the hypothesis that exercises improve smash accuracy is supported descriptively, but the superiority of either method needs to be further tested with a more complete inferential analysis.

**Keywords:** Precision Smash; Drill Smash; Multishuttle; Badminton; Pretest-Posttest.

## INTRODUCTION

Badminton is a racquet sport that requires a combination of technical skills, response speed, body coordination, footwork regulation, and decision-making accuracy in a short period of time. In the context of physical education and extracurricular coaching, badminton not only functions as a recreational activity, but also as a means of developing specific motor skills that can be observed and measured through performance indicators. One of the important technical indicators is the accuracy of the smash. Smash is an offensive punch that is directed to pressure the opponent, create pressure on the game, and increase the chances of earning points. However, the effectiveness of the smash is not only determined by the power of the punch, but also by the player's ability to direct the shuttlecock precisely at the target area. Therefore, smash training in student coaching needs to be directed not only at the repetition of movements, but also at the formation of technique consistency, shuttlecock contact accuracy, racket swing coordination, and stroke direction control.

The development of badminton research shows that player performance can be influenced by various factors, such as age, gender, playing experience, quality of technique, match movement load, and footwork efficiency (Adirahma et al., 2024; Z. Guo et al., 2025; Pambudi et al., 2025; Pugliese et al., 2025). Some recent research has also used technological approaches, such as artificial intelligence-based smash detection, wearable sensing, and frequency analysis of technical actions, to understand the characteristics of hits and game performance more precisely (Feng & Liu, 2025; Jin & LI, 2025; Peng & Zheng, 2025; Sheng et al., 2025). Although these studies provide an important picture of the complexity of badminton performance, the practical needs in the school environment are more related to the selection of simple, directed, and easy-to-apply training methods by teachers or extracurricular coaches. Thus, research on smash precision training remains relevant because it bridges modern performance findings with the need for basic engineering coaching in the school field.

The main problem of this study departs from the need to improve the accuracy of smash smash of extracurricular badminton students of SMA IT Darul Wahdah through training methods that are in accordance with the characteristics of the skills to be developed. A hard but inaccurate smash can reduce the effectiveness of the attack because the shuttlecock does not point to areas that make it difficult for the opponent. Therefore, the problem in coaching does not only lie in how often students practice, but also in how the form of training builds the accuracy of the stroke. The quality of the punches in badminton is related to the coordination of body segments, readiness of movement, and mastery of techniques formed through repetitive and directed training. The difference in movement characteristics between novice and experienced players, for example, can be seen from the acceleration of body segments in forehand shots, so technique improvement requires a systematic training process (Feng & Liu, 2025; Z. Guo et al., 2025, 2025; Huang et al., 2025; Zhao, 2025). Other research has also shown that physical and neuromuscular exercise can contribute to performance components, such as changes in direction, strength, jump, agility, and movement readiness in badminton (Gepfert et al., 2025; Z. Guo et al., 2025; Weng et al., 2025; Xu et al., 2025). In young age groups, core training as well as contrast or complex training are also reported to be relevant to support speed, agility, power, and explosiveness (Cao et al., 2026; Huang et al., 2025; Kahraman & Kızılca, 2025; Lu et al., 2025; Yang et al., 2025). The findings reinforce the view that smash skills need to be developed through practice that is specific, progressive, and in accordance with the demands of the game's movements.

In badminton practice practice, drill smash and multishuttle playing method are two approaches that can be used to improve smash accuracy. Drill smash emphasizes the repetition of punches in a structured manner with a relatively fixed movement pattern. This method is useful for establishing technique consistency, familiarizing the direction of the stroke, and strengthening the coordination pattern between body position, racket swing, contact point, and stroke target. In contrast, the multishuttle method of play still provides repetition of strokes, but in more varied conditions as students must respond to the shuttlecock sequentially from different directions and positions. These variations can encourage students to adjust body position, footwork, timing, and punch control before smashing. Thus, drill smash emphasizes more on stabilizing technique patterns, while multishuttle provides a stimulus that more closely resembles game situations because it involves motion response and passes variation.

Although badminton research has developed widely, there is still a gap between technology-based performance studies or biomechanics and the need for practical practice in the school environment. A few recent studies have focused on OpenPose-based training systems, internet of things sensors, wearable sensing, and automatic smash (Carriedo et al., 2023; Jiang, 2025; Jin & LI, 2025; Marques-Sule et al., 2022; Miao et al., 2024; Nugroho et al., 2025; Peng & Zheng, 2025). Other studies discussed lunge biomechanics, ankle control, anticipatory conditions, direction of motion, gender, injury risk, functional asymmetry, and force efficiency in badminton athletes (Deng et al., 2025; Z. Guo et al., 2025; Huang et al., 2025, 2025; Lin et al., 2025; Peng & Zheng, 2025; Z.

Zhang et al., 2025). The literature is important for understanding badminton performance in general, but it does not directly answer the needs of teachers and school coaches regarding simple field training methods to improve smash accuracy. In this context, the comparison between drill smash and multishuttle play methods becomes important because both can be applied without complex technology but have different training stimulus characters. The novelty of this study lies in the comparative focus between repetitive-structured exercises and repetitive-varied exercises on the accuracy of forehand smash in school extracurricular students.

Based on this description, this study aims to analyze changes in smash accuracy after the application of the drill smash training method, analyze changes in smash accuracy after the application of the multishuttle play method, and compare the trend of smash accuracy results between the two groups after the treatment is given. The scope of the study was limited to forehand smash skills as an attacking technique, with smash accuracy as a dependent variable measured through a ten-punch performance test to the target area. The study-free variables were the drill smash practice method and the multishuttle play method. The hypothesis of this study is that drill smash exercises can improve students' smash accuracy, the multishuttle play method can improve students' smash accuracy, and there is a difference in the tendency of smash accuracy results between the smash drill group and the multishuttle group after treatment. However, because the study was conducted in a field context with a limited number of subjects, the interpretation of the comparison between groups needs to be done carefully and adjusted to the completeness of the available statistical analysis. An important limitation that needs to be considered from the beginning is the lack of detailed information on age, gender, playing experience, injury history, validity and reliability of instruments, and the non-use of ordinal pairing in group divisions. With these limitations, this study is still expected to provide initial empirical evidence for school badminton coaching, especially in choosing appropriate training methods to improve smash accuracy in a more targeted manner.

## METHOD

### *Research Design*

This study employed a quantitative experimental approach using a two-group pre-test-post-test design. The design was selected because the study aimed to examine whether two structured badminton training interventions, namely drill smash training and the multishuttle playing method, produced measurable changes in forehand smash accuracy. The dependent variable was smash accuracy, operationalized as the total score obtained from a performance-based forehand smash accuracy test. The independent variables were the two training treatments. Because the same participants in each group were measured before and after the treatment, the design enabled a within-group comparison of technical performance change. Similar pre-post and intervention-oriented structures have been used in contemporary badminton education and training studies to document changes in student or athlete performance following structured instruction or training programs (Bjerregaard et al., 2022; Gepfert et al., 2025; Lin et al., 2025; Sutikno & Nasrulloh, 2025).

The first group received drill smash training, whereas the second group received the multishuttle playing method. The pre-test was administered before the treatment to identify the initial level of smash accuracy, and the post-test was administered after the treatment using the same testing procedure. The source document describes the research structure as T1-Xa-T2 for the drill smash group and T1-Xb-T2 for the multishuttle group. This design was appropriate for a school-based extracurricular setting because it allowed the researcher to evaluate changes in technical skill under natural training conditions while maintaining a clear sequence of measurement, intervention, and remeasurement. However, the source document reports that group allocation did not use ordinal pairing. Therefore, baseline equivalence between groups could not be fully controlled, and any comparison between drill smash and multishuttle should be interpreted cautiously. The use of field intervention procedures is consistent with recent badminton training research that examines changes in performance after structured physical or neuromuscular training, although stronger designs usually require more explicit control of participant characteristics and allocation procedures (Z. Guo et al., 2025; Ma et al., 2025; Weng et al., 2025; Xu et al., 2025).

**Table 1.** Research Design

| Group | Pre-test | Treatment | Post-test |
|---|---|---|---|
| Drill smash group | T1: forehand smash accuracy test | Xa: drill smash training | T2: forehand smash accuracy test |
| Multishuttle group | T1: forehand smash accuracy test | Xb: multishuttle playing method | T2: forehand smash accuracy test |

***Participants, Sample and Research Setting***

The population consisted of all students who participated in the badminton extracurricular program at SMA IT Darul Wahdah in 2026. The total number of research subjects was 21 students. Because all members of the accessible population were included, the sampling technique was total sampling, which is also described in the source document as a population study. The participants were divided into two treatment groups: 10 students in the drill smash training group and 11 students in the multishuttle playing-method group. The available source data identify the participants as students from classes X and XI. The intervention and testing procedures were conducted at GOR Bulutangkis Jonggat under extracurricular training conditions.

The inclusion criterion was active participation in the badminton extracurricular program at SMA IT Darul Wahdah and involvement in the pre-test, training intervention, and post-test procedures. The exclusion criteria were not explicitly stated in the source document. In addition, the source document did not provide detailed information on age, sex distribution, years of badminton experience, training attendance, injury history, physical condition, or maturity status. These characteristics are important because recent badminton studies indicate that age, sex, training experience, and maturity status may influence performance indicators and responses to training (Haryanto et al., 2024; Pambudi et al., 2025; Sheng et al., 2025; Weng et al., 2025). Accordingly, no additional demographic or clinical information is inferred in this method section. The absence of these participant characteristics should be acknowledged as a reporting limitation, and future studies should document them to improve baseline comparability, reproducibility, and interpretation of training effects.

**Table 2.** Participants and research setting

| Research setting | Sampling technique | Total subjects | Group distribution |
|---|---|---|---|
| SMA IT Darul Wahdah / GOR Badminton Jonggat | Total sampling / population study | 21 students | Drill smash =10 multishuttle = 11 |

***Instruments and Measurement Procedure***

The research instrument was a performance test of badminton forehand smash accuracy. Each participant performed 10 forehand smash attempts directed toward predetermined target areas on the opponent's court. The target areas were marked using lines or tape, and each area was assigned a score according to its level of difficulty. The source document states that the highest score was assigned to the target area considered more difficult and sharper as a smash destination. The total score represented the participant's smash accuracy. Score interpretation in the source document classified 21-30 as good, 11-20 as moderate, and below 11 as poor. The equipment used in the test included a badminton court, rackets, shuttlecocks, whistle, stopwatch, stationery, and score-recording sheets.

To maintain consistency between measurements, the pre-test and post-test used the same test format, scoring principle, number of attempts, court setting, and target areas. However, the source document did not provide detailed information on the exact target-zone layout, the numerical value assigned to each target area, assessor training, assessor blinding, inter-rater reliability, or test-retest reliability. Therefore, the measurement procedure can be interpreted as a feasible field-based performance assessment, but the psychometric strength of the instrument cannot be fully verified from the available information. Contemporary badminton assessment studies increasingly use sensor-based, motion-based, or artificial intelligence approaches to examine technical skills and stroke detection (Jin & LI, 2025; Nugroho et al., 2025; Peng & Zheng, 2025) (Jin & LI, 2025; L. Zhang & Zhong, 2025). In contrast, the present study used a field-based performance test that was more feasible for school extracurricular settings.

**Table 4.** Variable and measurement matrix

| Variable role | Variable / treatment | Indicator | Measurement source |
|---|---|---|---|
| Independent variable 1 | Drill smash training | Structured repetitive forehand smash practice | Training program |
| Independent variable 2 | Multishuttle playing method | Repeated forehand smash practice using multiple shuttlecocks and varied feeds | Training program |
| Dependent variable | Smash accuracy | Score from 10 forehand smash attempts to marked target areas | Forehand smash accuracy test |

***Research Procedures and Training Intervention***

The research procedure consisted of preparation, pre-testing, treatment implementation, post-testing, documentation, and data processing. During the preparation stage, the researcher arranged research permission, coordinated with the extracurricular badminton coach, prepared the court, marked the target areas, and prepared all equipment required for testing and training. The pre-test was then administered to measure initial forehand smash accuracy. After the pre-test, the first group followed the drill smash training program, and the second group followed the multishuttle playing method. The intervention was implemented for approximately six weeks, with three sessions per week on Tuesday, Thursday, and Saturday. The training sessions were conducted from 15.30 to 18.00 WITA according to the source document. The post-test was administered after the treatment period using the same forehand smash accuracy testing procedure as the pre-test.

The drill smash training program used three sets per session, with repetitions progressing across the six weeks from 20 to 45 repetitions and a recovery interval of three minutes. The multishuttle playing method also used three sets per session, with repetitions progressing from 15 to 35 shuttlecocks and a recovery interval of two minutes. In the drill smash group, participants repeatedly practiced smash strokes according to predetermined movement patterns. In the multishuttle group, the feeder delivered multiple shuttlecocks sequentially with varied directions, requiring participants to respond and perform forehand smash strokes from middle, side, front, and rear positions. Thus, the two treatments differed mainly in movement variation and response demand, while both were directed toward improving forehand smash accuracy. This distinction is relevant because current badminton training literature emphasizes that structured training programs may improve performance through repeated exposure to sport-specific physical and technical demands (Deng et al., 2025; C. Guo & Xu, 2025; Liang et al., 2023; Ma et al., 2025).

**Table 3.** Training Intervention Structure

| Method | Duration | Frequency | Set | Repetition progression | Recovery |
|---|---|---|---|---|---|
| Drill smash | 6 weeks | 3 sessions/week | 3 | 20, 25, 30, 35, 40, 45 | 3 minutes |
| Multishuttle | 6 weeks | 3 sessions/week | 3 | 15, 20, 20, 25, 30, 35 | 2 minutes |

***Data Analysis***

The data were analyzed quantitatively to describe changes in forehand smash accuracy and to evaluate the comparison between the drill smash and multishuttle groups. The analysis began with descriptive statistics, including the number of participants, minimum and maximum scores, range, total score, mean, standard deviation, and mean difference between pre-test and post-test scores. These descriptive results were used to identify the general pattern of performance change after the training intervention in each group and across all participants. Before conducting inferential analysis, the distribution of the data was examined using a normality test. Because the number of participants in each group was fewer than 50, the Shapiro-Wilk test was used as the main reference for determining whether the data met the normality assumption. The normality results were important for selecting the appropriate statistical procedure. If the pre-test and post-test differences within each group met the assumption of normality, a paired-sample t-test was considered appropriate for examining within-group changes. However, when the normality assumption was not met, a non-parametric alternative, such as the Wilcoxon signed-rank test, should be used to provide a more suitable analysis of pre-test and post-test differences.

To address the comparative objective of the study, the analysis also needed to examine whether the change in smash accuracy differed between the drill smash and multishuttle groups. This comparison should be conducted using gain-score analysis or analysis of covariance with pre-test scores as covariates, provided that the required statistical assumptions are fulfilled. If the effect size scores or post-test scores are not normally distributed, a non-parametric alternative, such as the Mann-Whitney U test, should be considered. Therefore, the statement that one training method is more effective than the other should only be made when supported by complete between-group inferential analysis, confidence intervals, and effect-size estimates. Recent badminton performance studies and meta-analytic work emphasize that transparent reporting of intervention effects, participant characteristics, assumption testing, effect sizes, and confidence intervals is necessary for interpreting training outcomes across different contexts (Hayashi et al., 2026; Karline Benitha et al., 2026; Ma et al., 2025; Sökmen et al., 2026; Z. Zhang et al., 2025).

## RESULTS

The results of the descriptive analysis showed an increase in smash accuracy scores after treatment in both exercise groups. In the drill smash group, the average pre-test score of 14.70 with a standard deviation of 1.636 increased to 15.90 with a standard deviation of 1.370 in the post-test. The minimum score increased from 13.00 to 14.00, while the maximum score remained at 18.00. Thus, the smash drill group experienced an average increase of 1.20 points. In the multishuttle group, the average pre-test score of 13.73 with a standard deviation of 1.009 increased to 16.27 with a standard deviation of 1.272 in the post-test. The minimum score increased from 12.00 to 15.00, while the maximum score increased from 15.00 to 19.00. The average increase in the multishuttle group was 2.54 points. Descriptively, both groups showed an increase in smash accuracy, but the average improvement in the multishuttle group was greater than in the drill smash group.

**Table 1.** Descriptive statistics of smash accuracy scores

| | Valid | Missing | Mean | Std. Deviation | Shapiro-Wilk | P-value of Shapiro-Wilk | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| Pre-test Drill Smash | 10 | 11 | 14.70 | 1.636 | 0.848 | .055 | 13.00 | 18.00 |
| Post-test Drill Smash | 10 | 11 | 15.90 | 1.370 | 0.888 | .160 | 14.00 | 18.00 |
| Pre-test Multishuttle | 11 | 10 | 13.73 | 1.009 | 0.889 | .134 | 12.00 | 15.00 |
| Post-test Multishuttle | 11 | 10 | 16.27 | 1.272 | 0.851 | .044 | 15.00 | 19.00 |

The normality test using Shapiro-Wilk showed that the pre-test data of the drill smash group was normally distributed, W = 0.848, p = .055. The post-test data of the drill smash group was also normally distributed, W = 0.888, p = .160. In the multishuttle group, the pre-test data was normally distributed, W = 0.889, p = .134, while the post-test data was not normally distributed, W = 0.851, p = .044. Based on these results, the interpretation of the inferential test results needs to consider parametric and non-parametric tests, especially since one of the post-test data does not meet the assumption of normality.

**Table 2.** Results of the pre-test and post-test differences in groups

| Pre-test | | Post-Test | Test | Statistic | z | df | p | Effect Size | SE Effect Size |
|---|---|---|---|---|---|---|---|---|---|
| Drill Smash | - | Drill Smash | Student | -6.000 | | 9 | < .001 | -1.897 | 0.203 |
| | | | Wilcoxon | 0.000 | -2.666 | | .007 | -1.000 | 0.358 |
| Multistage | - | Multistage | Student | -5.369 | | 10 | < .001 | -1.619 | 0.627 |
| | | | Wilcoxon | 0.000 | -2.803 | | .005 | -1.000 | 0.342 |

The results of the paired samples t-test showed that there was a significant increase in the drill smash group, t (9) = -6,000, p <.001, with Cohen's effect size d = -1,897. The results of the Wilcoxon test also support these findings, z = -2,666, p = .007, with effect size matched rank biserial correlation = -1,000. The direction of the negative values in the test statistics and effect size showed that the calculation was carried out in a pre-test sequence minus the post-test. Thus, a negative score does not indicate a decrease but rather indicates that the post-test score is higher than the pre-test score.

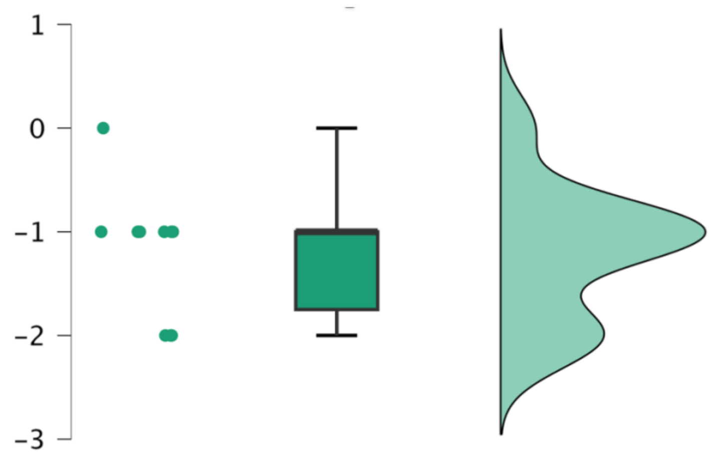


**Figure 1**. Comparation pre and post test drill smash

In the multishuttle group, paired samples t-test also showed a significant improvement, t (10) = -5.369, p <.001, with Cohen's effect size d = -1.619. The results of the Wilcoxon test confirmed the results, z = -2,803, p = .005, with effect size matched rank biserial correlation = -1,000. These findings suggest that the multishuttle method also provides a significant change to the improvement of students' smash accuracy.

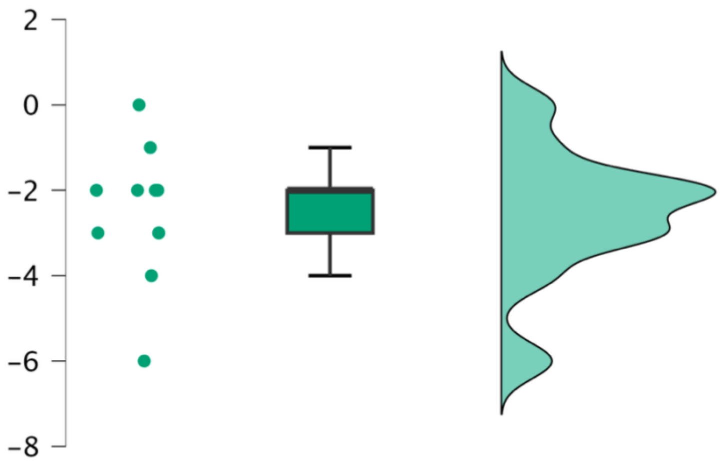


**Figure 2**. Comparation pre and post test multistage

The results of the independent samples t-test in the pre-test data showed that there was no significant difference between the drill smash group and the multishuttle group before the treatment, t (18) = 1.823, p = .085, with Cohen's effect size d = 0.815. The Mann-Whitney results also showed insignificant results, U = 68,500, p = .160, with effect size rank biserial correlation = -0.370. Although not statistically significant, the effect size value in the pre-test showed a tendency for practical initial differences, so the interpretation of the effectiveness comparison between groups needs to be done carefully.

**Table 3.** Results of the difference test between groups

| | Test | Statistic | df | p | Effect Size | SE Effect Size |
|---|---|---|---|---|---|---|
| Pre-test | Student | 1.823 | 18 | .085 | 0.815 | 0.483 |
| | Mann-Whitney | 68.500 | | .160 | -0.370 | 0.259 |
| Post-test | Student | -0.842 | 18 | .411 | -0.377 | 0.455 |
| | Mann-Whitney | 38.000 | | .359 | 0.240 | 0.259 |

In the post-test data, the results of independent samples t-test showed that there was no significant difference between the drill smash group and the multishuttle group, t (18) = -0.842, p = .411, with Cohen's effect size d = -0.377. The Mann-Whitney results also showed a non-significant difference, U = 38,000, p = .359, with effect size rank biserial correlation = 0.240. Thus, although descriptively the multishuttle group obtained a higher post-test average than the drill smash group, the difference could not be statistically significant.

Based on the results of the study, both training methods showed a positive influence on improving the smash accuracy of badminton extracurricular students. The drill smash group saw an average increase from 14.70 to 15.90, while the multishuttle group increased from 13.73 to 16.27. The results of the paired test showed that the increase in each group was statistically significant. Thus, both drill smash drills and multishuttle methods can be viewed as a form of exercise that has the potential to improve smash accuracy.

**DISCUSSION**

The findings of this study show that the training program given to badminton extracurricular students is related to increasing the accuracy of forehand smash descriptively. The increase is understandable because both training methods, namely the drill smash and the multishuttle play method, both provide opportunities for students to repeat skills specific to the target. In learning sports skills, repetition directed at a specific movement goal is necessary so that students can build movement consistency, recognize hitting errors, and adjust the direction of the shuttlecock to the target area. Thus, the improvement in the accuracy of the smash in this study cannot be separated from the character of the practice that directly places the forehand smash as the focus of coaching.

Drill smash exercises serve as a basic form of exercise that emphasizes technique stabilization. Through a relatively fixed pattern of repetition, students gain the opportunity to familiarize themselves with body position, racket swing, shuttlecock contact points, and stroke direction more consistently. In the context of extracurricular students, the character of this kind of exercise is important because not all participants have the same experience of playing, movement coordination, or stroke control. Drill smash allows students to focus on key techniques without too much distraction from variations in the direction of the bait or complex response demands. Therefore, the tendency to increase after drill smash training can be explained because of the formation of a more stable movement pattern through repetitive, directed, and goal-oriented exercises**.**

Meanwhile, the multishuttle play method provides a different stimulus to exercise. This method still contains an element of repetition, but the reps are performed under more varied conditions because the shuttlecock is given sequentially with a changed direction and position. This condition requires students to not only perform smash punches, but also adjust body positions, set paces, determine timing, and control the direction of the punch in a shorter amount of time. Therefore, the tendency for higher final scores in the multishuttle group can be understood as an indication that more varied exercises have the potential to provide a movement experience that is closer to a game situation. However, this interpretation must still be placed with caution as the available data does not provide complete inferential evidence to state that multishuttle is statistically superior to drill smash.

Thus, the main rationale of this study's findings is that smash precision can be improved through exercises that combine repetition, target orientation, and motion adjustment. Drill smash emphasizes strengthening basic technique patterns, while multishuttle adds elements of variation, response, and movement transition. These character differences explain why both methods are equally relevant but have different potential contributions to the development of smash precision. However, because this study was conducted on a small sample, with a group that did not use ordinal pairing, and did not report the full inferential analysis, the findings are more appropriate to be understood as preliminary descriptive evidence, rather than as a conclusion regarding the comparative effectiveness of the two exercise methods.

The findings of this study are in line with the study of badminton learning and training which emphasizes the importance of structured instruction, repetition of techniques, and the suitability of exercises with the goals of movement to be achieved. (Coenga et al., 2026; Sutikno & Nasrulloh, 2025) and (de Oliveira et al., 2022; Wu et al., 2025; L. Zhang & Zhong, 2025) show that the performance of badminton skills can be improved when the learning or training process is systematically designed and directed at specific technical characteristics. In the context of this study, drill smash and multishuttle exercises both provide a clear exercise structure, which directs students to perform forehand smashes to the target area. The support reinforces the interpretation that the increase in smash accuracy does not occur solely because students play more often, but because the exercises are geared towards skills that are the variables of the study.

The findings also relate to research showing that smash, footwork, and error control are important indicators in the performance of young badminton players. (Adirahma et al., 2024; Gepfert et al., 2025; Pambudi et al., 2025; Sutikno & Nasrulloh, 2025) emphasized that badminton performance can be influenced by age, gender, experience, and technical indicators, (Acevedo et al., 2022; Ahmed et al., 2021; Astorino et al., 2025; Huang et al., 2025) showed that there is a difference in movement organization between beginner and experienced players based on the acceleration characteristics of body segments. Although the study did not measure body acceleration or the biomechanics details of punches, both studies support the premise that smash quality has to do with engineering skills formed through practice. Therefore, the improvement of smash accuracy in students can be understood as part of the process of forming technique quality, although the mechanism of movement cannot be explained directly through the data of this study.

This research also intersects with technology-based studies in badminton, such as the use of mobile applications, Kinect, wearable sensors, Internet-of-Things, and artificial intelligence to detect or evaluate hitting techniques (Jiang, 2025; Jin & LI, 2025; Lin et al., 2025; Nugroho et al., 2025; Peng & Zheng, 2025; L. Zhang & Zhong, 2025). What these studies have in common with these studies lies in the attention to the quality of badminton skills and the need to improve the accuracy or efficiency of movement. However, the differences are quite fundamental: technology-based studies generally provide objective feedback and more detailed measurements, while these studies use field performance tests that are simpler and appropriate for the school environment. This difference shows that the contribution of this research is not to the development of sophisticated measurement systems, but to the provision of preliminary practical evidence regarding training methods that can be applied by teachers or extracurricular trainers. In relation to multishuttle, the findings of this study are in line with research that emphasizes the importance of progressive training, agility, strength, change of direction, neuromuscular coordination, core control, and movement readiness in supporting badminton performance (Başandaç et al., 2025; Gepfert et al., 2025, 2025; Gołaś et al., 2026; C. Guo & Xu, 2025; Z. Guo et al., 2025; Huang et al., 2025; Kahraman & Kızılca, 2025; Ma et al., 2025; Weng et al., 2025; Z. Zhang et al., 2025).

Multishuttle requires students to move and respond to the pass repeatedly, so it is conceptually closer to the demands of changing positions in the game. However, this relationship should not be interpreted too far because this study did not measure physical variables such as agility, strength, explosiveness, or neuromuscular coordination. Thus, the literature serves as conceptual support that exercises that combine specific movements and response variations may be relevant to badminton performance, rather than as direct evidence that certain physical mechanisms cause improvement in this study.

On the other hand, there are also differences between this study and a number of studies that discuss external loads, footwork energy costs, lunge direction, anticipation, fatigue, lower leg control, injury risk, and frequency of technical actions in badminton matches (Deng et al., 2025; Z. Guo et al., 2025; Huang et al., 2025; Lambert et al., 2025; Pugliese et al., 2025; Weng et al., 2025; Xie et al., 2025; Z. Zhang et al., 2025). The studies provide a broader understanding of the complexities of badminton performance, but most do not directly compare drill smash and multishuttle methods in the context of school extracurriculars. Predictive analytics-based research and match modeling also confirm that technical actions can be used to understand game strategy and outcomes, although the approach differs from the field intervention design used in the study (Aliriad et al., 2024; Astutik et al., 2023; Baktiar, 2023; Feng & Liu, 2025; Jo, 2025; Sheng et al., 2025). Thus, the results of this study fill a practical space that has not been answered much by technology-based studies, biomechanics, or match analysis, namely how two simple training methods can be used to foster smash accuracy in a school environment.

Theoretically, the results of this study can be understood through the principle that motor skills develop through specific, repetitive, and oriented exercises towards movement goals. The precision of the smash is not only a result of the ability to generate punch power, but also of the ability to set a sequence of motions so that the shuttlecock falls on the target area. In a smash drill, students train at a more stable condition so that they can develop a relatively consistent hitting pattern. Exercises like this are important at the technique formation stage because students need to understand the relationship between body position, racket swing, point of contact, and direction of stroke.

In the next stage, the skills that have been formed through fixed patterns need to be developed in more varied conditions. This is where multishuttle has development value. The shuttlecock's variation in direction and sequential response demands mean that students must adapt smash techniques to changing motion situations. Conceptually, this condition is closer to the character of the badminton game, which is open, fast, and not always predictable. Therefore, multishuttle can be seen as a form of transition exercise from engineering stabilization to engineering application in more dynamic situations.

However, this theoretical interpretation needs to be limited by the research design. The study did not measure variables such as changes in stroke biomechanics, footwork quality, reaction speed, explosiveness, fatigue, or neuromuscular coordination. Therefore, explanations regarding technique stabilization and transfer to game situations should not be stated as a directly proven mechanism. The explanation is more appropriately positioned as a developmental interpretation supported by the character of the exercise and related literature. This restriction is important so that the discussion does not go beyond the available empirical evidence and remains in line with the reviewer's comments regarding the prudence of interpreting the results.

Considering these results and limitations, the development of smash training programs in the school environment should not place smash drills and multishuttles as two methods that completely replace each other. Both can be understood as complementary methods. Drill smash can be used to build a foundation of technique and consistency of strokes, while multishuttle can be used to expand students' ability to respond to bait variations and control strokes in moving conditions. This framework provides a more balanced foundation as opposed to stating that one method is superior.

Practically, this study provides direction for physical education teachers and badminton extracurricular coaches that smash precision training needs to be designed in stages and goal oriented. In the early stages, drill smashes can be used to help students understand the basics of forehand smash, improve swing consistency, and familiarize the direction of the shots to the target area. This exercise is suitable for students when they still need to strengthen basic techniques and more stable stroke control.

Once students have a better technical foundation, the multishuttle play method can be used to increase the variety of exercises. Coaches can set the direction of the pass, the number of shuttlecocks, the tempo of training, and the recovery time so that students gain experience hitting in conditions that are more like the game. However, increasing the volume of exercises needs to be accompanied by supervision of the quality of the technique. High-rep exercises are potentially less effective if students only chase the number of strokes without maintaining accuracy, body position, and movement control.

The next implication is the importance of periodic evaluation. Teachers or trainers need to record individual progress through pretest, posttest, and observation during training. This recording is useful to find out if the improvement occurs evenly in all students or only in some participants. In addition, documentation of attendance, physical condition, injury history, and playing experience needs to be prepared so that the results of the training can be interpreted more accurately. This need is even more important because this study has limitations in small sample sizes, unbalanced groups, the absence of ordinal pairing, and incomplete information on participant characteristics.

## CONCLUSION

This study shows that drill smash practice and multishuttle playing method have a positive tendency to increase the accuracy of forehand smash of extracurricular badminton students of SMA IT Darul Wahdah. Drill smash acts as an exercise that helps students build technical consistency through targeted repetition of strokes, while multishuttle provides a more varied training experience through changes in pass direction and motion response demands. Descriptively, the multishuttle group showed a higher average posttest than the drill smash group; However, these findings cannot be concluded as significant advantages because inferential analyses between groups, gain scores, and change confidence intervals have not been fully reported. Thus, the results of this study are more appropriately understood as preliminary evidence that both methods have the potential to be used in fostering smash accuracy, rather than as a conclusion regarding comparative effectiveness. Practically, physical education teachers and extracurricular coaches can use drill smash to reinforce the basics of the technique, then integrate multishuttle to train stroke response and accuracy in more dynamic conditions.

## RECOMMENDATION

Based on the findings of the study, physical education teachers and badminton extracurricular coaches are advised to use drill smash exercises and multishuttle playing methods gradually and complement each other, instead of placing one method as a superior option. Drill smash exercises can be applied in the early stages to establish technique consistency, improve swing patterns, control the shuttlecock's point of contact, and familiarize the direction of the shot to the target area. Once the student's technique is more stable, the multishuttle playing method can be used to improve exercise variety, response readiness, body position adjustment, and stroke accuracy in more dynamic situations. However, the application of both methods needs to be done by paying attention to the training load, the number of repetitions, rest time, the quality of technique, and the individual abilities of students so that the improvement in performance is not only seen from the number of strokes, but also from the precision and stability of movement. Coaches also need to conduct periodic evaluations through pretests, posttests, and recording individual development. For further studies, it is recommended to use a larger sample, group division through randomization or ordinal pairing, as well as reporting participant characteristics such as age, gender, playing experience, practice attendance, and injury history.

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