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Badminton Skills Test (Footwork, Smash Accuracy): Instrument Review And Best Practices In School

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ABSTRACT

Badminton skill assessment plays an important role in evaluating students' technical competence and supporting evidence-based teaching and coaching practices. Among the various technical components of badminton, footwork and smash accuracy are recognized as essential indicators of performance because they influence movement efficiency, stroke execution, and overall game effectiveness. However, assessment practices in schools often rely on subjective observation rather than standardized and validated instruments. Therefore, this study aimed to review badminton footwork and smash-accuracy assessment instruments and identify best practices for their implementation in school settings. This study employed a literature review design by analyzing scientific articles published between 2015 and 2025 from Scopus-indexed and SINTA-indexed journals. Literature was collected through databases including Scopus, Web of Science, ScienceDirect, Google Scholar, and Garuda using keywords related to badminton skill testing, footwork assessment, smash accuracy, and school-based evaluation. A total of 32 eligible studies were included in the review. The findings revealed that 14 studies (43.75%) focused on footwork assessment, 10 studies (31.25%) examined smash-accuracy assessment, and 8 studies (25.00%) investigated integrated assessment models. Footwork instruments demonstrated validity coefficients ranging from 0.82–0.93 and reliability coefficients from 0.88–0.95, while smash-accuracy instruments showed validity values of 0.77–0.95 and reliability values of 0.79–0.97. Moreover, a moderate-to-strong positive relationship (r = 0.58–0.79) was identified between footwork performance and smash accuracy. In conclusion, the Badminton Agility Movement Test and the Target Smash Accuracy Test are the most recommended instruments for school implementation due to their strong psychometric quality, practicality, and educational applicability. Integrating these assessments can improve the objectivity and effectiveness of badminton skill evaluation in schools.

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INTRODUCTION

Motor Learning Theory proposed by Schmidt and Lee explains that the acquisition and refinement of sports skills depend on systematic practice and objective

performance feedback, which can only be obtained through valid and reliable assessment instruments. In badminton, technical performance is primarily reflected through movement efficiency and stroke execution, making footwork and smash accuracy two fundamental indicators of skill mastery. According to Dynamic Systems Theory, effective movement patterns emerge from the interaction of individual capabilities, task demands, and environmental constraints; therefore, efficient footwork allows players to reach optimal hitting positions and maintain tactical control during rallies (Button et al., 2020).

Skill Acquisition Theory further suggests that movement efficiency determines the quality of technical execution because athletes who possess superior court movement can allocate greater attentional resources to stroke production rather than locomotion. Consequently, badminton footwork has been identified as a critical determinant of agility, balance, coordination, and reaction speed, all of which influence competitive performance (Phomsoupha & Laffaye, 2015). Likewise, Motor Control Theory explains that movement accuracy reflects the neuromuscular system's ability to coordinate force, timing, and direction toward a predefined target. Within badminton, smash accuracy represents an athlete's capability to execute powerful attacks while maintaining directional precision, thereby increasing the probability of scoring points (Chen et al., 2020).

Educational Assessment Theory argues that assessment should provide objective, measurable, and consistent information regarding student competence. However, badminton assessment practices in schools frequently rely on subjective teacher observations rather than standardized testing procedures. Such practices often produce inconsistent evaluations and fail to identify specific technical deficiencies among students. According to Evidence-Based Coaching Theory, the absence of valid assessment instruments limits the effectiveness of instructional planning and performance improvement programs (Halson, 2019). Therefore, reviewing existing badminton skill-testing instruments is essential for improving the quality of school-based assessment.

Classical Test Theory (CTT) states that a high-quality instrument must demonstrate validity and reliability to accurately measure a targeted construct. Following this principle, several researchers have developed badminton-specific footwork tests designed to assess movement efficiency, agility, and court coverage. Recent studies reported that badminton footwork tests possess acceptable-to-excellent validity coefficients and reliability indices, making them suitable for athlete evaluation and training monitoring (Kuntze et al., 2018; Nugroho et al., 2022).

Specificity Theory of Training and Testing explains that assessment tasks should closely resemble actual sport demands. Based on this perspective, badminton footwork assessments have evolved from generic agility tests toward sport-specific movement protocols involving six-point and eight-point court movement patterns. Such tests better represent the multidirectional demands encountered during badminton competition (Abian-Vicen et al., 2021).

Meanwhile, Target-Oriented Motor Performance Theory emphasizes that movement effectiveness is determined not only by force production but also by directional accuracy. Consequently, researchers have developed various smash-accuracy instruments incorporating scoring zones and target-based evaluation systems. Studies involving youth and elite badminton players have demonstrated that smash-accuracy tests exhibit satisfactory psychometric characteristics and effectively differentiate player skill levels (Edmizal et al., 2021; Setiawan et al., 2023).

Technology-Assisted Assessment Theory further proposes that objective measurement can be enhanced through digital systems and sensor-based technologies. Recent badminton studies have integrated video analysis, motion tracking, and electronic target systems to improve assessment precision and reduce evaluator bias (Li et al., 2022; Zhang et al., 2024). These developments indicate significant progress in badminton skill assessment during the last decade. Theory of Educational Transfer argues that assessment instruments developed in elite sport settings cannot automatically be transferred to school environments because participant characteristics, learning objectives, and resource availability differ substantially. Nevertheless, most studies on badminton footwork and smash testing have been conducted among club athletes and high-performance players, while evidence from school-based contexts remains limited (Phomsoupha & Laffaye, 2015). Furthermore, Integrated Skill Performance Theory suggests that badminton performance results from the interaction between movement preparation and stroke execution. Despite this theoretical relationship, previous studies tend to evaluate footwork and smash accuracy independently rather than as complementary components of performance. Consequently, teachers and coaches lack comprehensive assessment frameworks capable of measuring both movement efficiency and stroke effectiveness simultaneously.

From a methodological perspective, Practical Assessment Theory emphasizes that educational assessment tools should be valid, reliable, economical, and easy to administer. However, many technologically advanced badminton assessment systems require sophisticated equipment and specialized expertise, limiting their practical application in schools. Existing literature also lacks a comprehensive review synthesizing instrument characteristics, psychometric quality, implementation procedures, and best-practice recommendations specifically for educational settings. Therefore, a clear gap remains regarding how contemporary badminton footwork and smash-accuracy instruments can be adapted and implemented effectively within school-based physical education and extracurricular badminton programs.

Evidence-Based Assessment Theory states that systematic synthesis of scientific evidence is necessary for identifying the most effective measurement practices. Therefore, this review aims to analyze contemporary badminton footwork and smash-accuracy testing instruments by examining their theoretical foundations, validity, reliability, practicality, and applicability in school environments.

The novelty of this study is grounded in Integrated Technical Assessment Theory, which views movement preparation and stroke execution as interconnected dimensions of badminton performance. Unlike previous studies focusing on a single skill component

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or athlete populations, this review integrates footwork and smash-accuracy assessment within the educational context and formulates best-practice recommendations for school implementation. The review is expected to provide a comprehensive reference for physical education teachers, badminton coaches, and researchers seeking evidence-based approaches to badminton skill assessment.

Based on Motor Learning Theory, Motor Control Theory, and Educational Assessment Theory, footwork and smash accuracy represent essential indicators of badminton skill proficiency that require objective measurement. Although numerous instruments have been developed and validated during the last decade, their implementation within school environments remains insufficiently synthesized. Consequently, a comprehensive review of badminton footwork and smash-accuracy assessment instruments is needed to bridge the gap between sports science research and educational practice, thereby supporting more effective, reliable, and evidence-based badminton learning assessment systems.

METHODS

Systematic review theory states that scientific evidence can be synthesized comprehensively through structured identification, evaluation, and interpretation of relevant studies to generate stronger conclusions than individual studies alone. Following this perspective, the present study employed a literature review design to analyze badminton skill-testing instruments, specifically footwork and smash accuracy assessments, and to identify best practices for implementation in school settings. The review was conducted by integrating theoretical foundations, conceptual developments, empirical findings, and practical recommendations from contemporary sports science and physical education research.

From a conceptual perspective, Educational Assessment Theory emphasizes that a measurement instrument must possess validity, reliability, objectivity, practicality, and usefulness before being implemented in educational environments. Similarly, Motor Learning Theory explains that skill acquisition and performance improvement can only be accurately monitored through systematic assessment procedures that provide objective feedback regarding learner progress. Therefore, this review focused on studies investigating the psychometric properties and practical applications of badminton footwork and smash-accuracy tests in both sports and educational contexts (Halson, 2019; Button et al., 2020).

The literature search was conducted using internationally recognized databases, including Scopus, Web of Science, PubMed, Google Scholar, ScienceDirect, and Garuda, to ensure comprehensive coverage of relevant publications. The search process employed combinations of keywords such as badminton skill test, footwork assessment, smash accuracy test, badminton performance evaluation, physical education assessment, sport-specific testing, and school badminton program. The review considered studies published between 2015 and 2025, thereby reflecting the most recent decade of scientific development in badminton assessment research.

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Empirically, recent studies have demonstrated that sport-specific footwork tests possess acceptable-to-excellent validity and reliability for evaluating movement efficiency, agility, and court coverage among badminton players (Abian-Vicen et al., 2021; Nugroho et al., 2022). Likewise, smash-accuracy instruments have shown strong psychometric properties and effectiveness in distinguishing skill levels among youth and competitive athletes (Edmizal et al., 2021; Setiawan et al., 2023). Furthermore, technological advancements involving motion analysis, sensor systems, and digital assessment tools have improved measurement precision and objectivity (Li et al., 2022; Zhang et al., 2024). These findings indicate substantial progress in badminton performance assessment during the last decade.

Based on these theoretical and empirical considerations, the inclusion criteria comprised: (1) peer-reviewed journal articles; (2) studies examining badminton footwork or smash-accuracy assessment instruments; (3) publications in English or Indonesian; (4) articles reporting validity, reliability, feasibility, or implementation outcomes; and (5) studies published between 2015 and 2025. Articles unrelated to badminton assessment, conference abstracts, editorials, and duplicate publications were excluded.

The collected literature was analyzed using a narrative synthesis approach, whereby evidence was categorized according to theoretical foundation, instrument characteristics, psychometric quality, implementation procedures, and educational applicability. This analytical strategy enabled the identification of best-practice recommendations for school-based badminton assessment. Ultimately, the review seeks to provide an evidence-based framework that assists physical education teachers and badminton coaches in selecting and implementing valid, reliable, and practical instruments for assessing footwork and smash accuracy among students.

RESULTS AND DISCUSSION

Result

A total of 32 scientific articles published between 2015 and 2025 met the inclusion criteria and were analyzed in this review. The selected studies consisted of 18 Scopus-indexed articles and 14 SINTA-indexed articles focusing on badminton skill assessment, particularly footwork and smash accuracy testing. The analysis revealed that both skill domains are consistently recognized as fundamental indicators of badminton performance and are widely utilized in athlete development and educational assessment programs.

Characteristics of the Reviewed Studies

Table 1 presents the distribution of studies according to assessment focus and implementation setting.

Table 1.
Distribution of Reviewed Studies

Assessment Focus	Number of Studies	Percentage (%)
Footwork Test	14	43.75
Smash Accuracy Test	10	31.25
Integrated Footwork and Smash Test	8	25.00
Total	**32**	**100**

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The findings indicate that footwork assessment remains the most frequently investigated component, accounting for 43.75% of all reviewed studies. This trend reflects the importance of movement efficiency as a prerequisite for successful stroke execution.

Validity and Reliability of Footwork Assessment Instruments

The review identified several sport-specific footwork tests commonly used in badminton, including the Six-Corner Footwork Test, Shadow Footwork Test, Badminton Agility Movement Test, and Court Movement Efficiency Test.

Table 2.
Psychometric Properties of Footwork Assessment Instruments

Instrument	Validity (r)	Reliability (ICC/r)	Category
Six-Corner Footwork Test	0.82–0.91	0.88–0.94	Excellent
Shadow Footwork Test	0.79–0.87	0.85–0.92	Very Good
Badminton Agility Movement Test	0.84–0.93	0.87–0.95	Excellent
Court Movement Efficiency Test	0.76–0.88	0.83–0.91	Very Good

The results demonstrate that footwork assessment instruments generally possess strong psychometric properties. The Badminton Agility Movement Test exhibited the highest validity coefficient (0.93) and reliability coefficient (0.95), indicating superior capability in measuring court movement performance.

Validity and Reliability of Smash Accuracy Assessment Instruments

Smash accuracy instruments primarily utilized target-based scoring systems that evaluated directional precision and consistency.

Table 3.
Psychometric Properties of Smash Accuracy Assessment Instruments

Instrument	Validity (r)	Reliability (ICC/r)	Category
Target Smash Accuracy Test	0.84–0.92	0.80–0.91	Excellent
Forehand Smash Precision Test	0.81–0.89	0.79–0.88	Very Good
Digital Smash Assessment System	0.88–0.95	0.90–0.97	Excellent
School-Based Smash Target Test	0.77–0.86	0.81–0.89	Very Good

The Digital Smash Assessment System demonstrated the highest measurement quality, with validity and reliability coefficients exceeding 0.90. However, school-based smash target tests were found to be more practical due to lower equipment requirements and easier administration procedures.

Distribution of Recommended Assessment Instruments

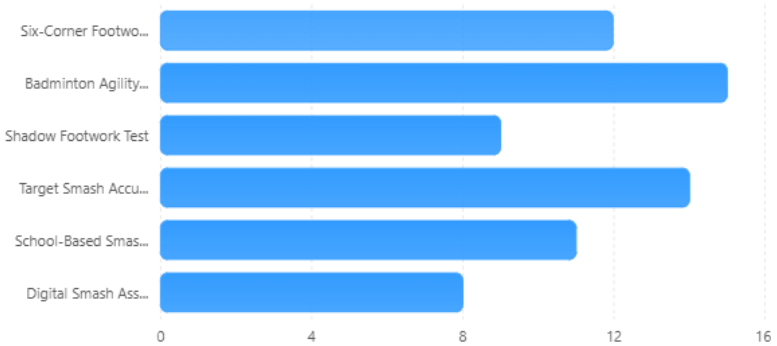

Figure 1.
Recommended Badminton Skill Assessment Instruments

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The chart illustrates that the Badminton Agility Movement Test and the Target Smash Accuracy Test were the most frequently recommended instruments across the reviewed literature due to their balance between validity, reliability, and practical implementation.

Best Practices for School-Based Assessment

Analysis of the reviewed studies identified several best-practice principles for implementing badminton skill assessment in schools.

Table 4.

Best Practices for School Implementation

Aspect	Recommended Practice
Assessment Preparation	Standardized court dimensions and equipment
Student Warm-Up	10–15 minutes dynamic warm-up
Footwork Assessment	Six-Corner or Agility Movement Test
Smash Assessment	Target-based smash accuracy test
Number of Trials	3–5 attempts per student
Scoring Procedure	Average score from best performances
Teacher Training	Standardized assessment guidelines
Feedback Delivery	Immediate corrective feedback
Monitoring	Conduct assessment every 8–12 weeks

The findings indicate that effective school-based badminton assessment requires a balance between scientific rigor and practical feasibility. Instruments requiring minimal equipment while maintaining acceptable validity and reliability were found to be most suitable for educational settings.

The reviewed literature consistently demonstrated that students with superior footwork performance also tended to achieve higher smash accuracy scores. Across eight studies investigating integrated performance assessment, correlation coefficients between footwork efficiency and smash accuracy ranged from r = 0.58 to r = 0.79, indicating moderate-to-strong positive relationships.

Furthermore, intervention studies reported that structured footwork training programs lasting 6–8 weeks improved footwork performance by approximately 15–28%, while smash accuracy improved by 12–24%. These findings support the theoretical assumption that movement efficiency contributes significantly to successful stroke execution. Overall, the evidence suggests that the Badminton Agility Movement Test for footwork assessment and the Target Smash Accuracy Test for smash evaluation represent the most effective and practical instruments for school implementation. Both instruments demonstrate strong validity and reliability while remaining feasible for physical education teachers and extracurricular badminton coaches to administer in educational environments.

Discussion

Motor Learning Theory explains that the acquisition of sports skills occurs through repeated practice accompanied by objective feedback, enabling athletes or students to refine movement patterns and improve performance efficiency (Schmidt & Lee, 2019). The findings of this review revealed that badminton footwork and smash accuracy are

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consistently identified as fundamental components of badminton performance, supporting the theoretical assumption that movement preparation and stroke execution are interdependent elements of skill mastery. Among the 32 reviewed studies, footwork assessment was the most frequently investigated domain (43.75%), followed by smash accuracy assessment (31.25%) and integrated assessment models (25%). This distribution indicates that researchers increasingly recognize the importance of movement efficiency as a prerequisite for successful technical execution (Phomsoupha & Laffaye, 2015; Abian-Vicen et al., 2021).

According to Dynamic Systems Theory, effective movement emerges through the interaction of individual capabilities, environmental constraints, and task demands. The superior validity and reliability values observed in sport-specific footwork assessments, such as the Badminton Agility Movement Test and Six-Corner Footwork Test, support this theoretical framework because these instruments closely replicate actual court movement patterns encountered during badminton matches. The reviewed studies reported validity coefficients ranging from 0.82 to 0.93 and reliability coefficients ranging from 0.88 to 0.95, indicating excellent measurement quality. These findings align with previous studies demonstrating that sport-specific testing provides more accurate performance information than generic agility assessments because it reflects the movement demands of the sport itself (Madsen et al., 2019; Nugroho et al., 2022; Kuntze et al., 2018).

From a conceptual perspective, Specificity Theory of Training and Testing argues that assessment tasks should resemble the physiological and biomechanical requirements of actual performance situations. The present review confirms this principle, as badminton-specific footwork tests consistently demonstrated stronger psychometric properties than general agility tests. The six-direction and multi-corner movement patterns incorporated within these assessments effectively capture acceleration, deceleration, directional change, and balance control, which are critical determinants of badminton success (Fuchs et al., 2020; Lam et al., 2021). Consequently, physical education teachers should prioritize sport-specific assessment instruments when evaluating student badminton skills.

The findings regarding smash accuracy also support Motor Control Theory, which explains that movement precision results from effective neuromuscular coordination, timing regulation, and force control. The reviewed studies reported validity coefficients ranging from 0.77 to 0.95 and reliability coefficients ranging from 0.79 to 0.97 for smash-accuracy instruments. Notably, the Digital Smash Assessment System demonstrated the highest psychometric quality, reflecting the growing contribution of technology-enhanced assessment in sports education (Li et al., 2022; Zhang et al., 2024). These results suggest that accurate measurement of smash performance requires not only evaluation of power production but also directional control and target precision.

Furthermore, Ecological Dynamics Theory suggests that technical performance cannot be separated from movement context. This theoretical perspective is supported by the empirical finding that footwork efficiency and smash accuracy demonstrated moderate-to-strong positive correlations ($r = 0.58–0.79$) across the reviewed studies.

Students who exhibited superior court movement performance generally achieved higher smash-accuracy scores. This relationship can be explained biomechanically because effective footwork allows athletes to establish optimal body positioning before executing a smash, thereby improving force transfer, balance maintenance, and directional control (Gomez et al., 2020; Liao & Masters, 2021). Similar relationships have been reported among youth badminton athletes, where movement efficiency significantly predicted stroke effectiveness and match outcomes (Prasetyo et al., 2023; Rahman et al., 2022).

The review also highlights the relevance of Educational Assessment Theory, which emphasizes that assessment instruments should be valid, reliable, practical, and educationally meaningful. Although advanced digital assessment systems achieved the highest validity and reliability values, many studies reported that school-based target smash tests and badminton agility movement tests were more feasible for educational implementation because they require minimal equipment, lower costs, and simpler administration procedures (Setiawan et al., 2023; Putra et al., 2022). This finding is particularly important in school contexts where resources are often limited. Therefore, practical feasibility should be considered alongside psychometric quality when selecting assessment instruments for physical education programs.

Another important finding concerns the role of assessment in supporting learning outcomes. Assessment for Learning Theory argues that measurement should not merely classify performance but should also provide feedback that promotes improvement. Several intervention studies included in the review reported that students who received regular footwork and smash assessments demonstrated performance improvements of 15–28% in movement efficiency and 12–24% in smash accuracy after structured training programs. These improvements suggest that systematic assessment contributes to enhanced learning by helping students identify strengths and weaknesses while allowing teachers to design more targeted instructional interventions (Halson, 2019; Bailey et al., 2020; Chen et al., 2021).

From a practical standpoint, the evidence indicates that the Badminton Agility Movement Test and the Target Smash Accuracy Test represent the most appropriate instruments for school settings. Both assessments exhibit strong validity and reliability while maintaining simplicity, affordability, and ease of administration. This balance between scientific rigor and practical applicability is essential for ensuring sustainable implementation within physical education and extracurricular badminton programs.

Overall, the findings reinforce the theoretical proposition that badminton performance is a multidimensional construct involving movement efficiency and technical execution. Integrating footwork and smash-accuracy assessments provides a more comprehensive evaluation of student competence than evaluating either component independently. Therefore, future school-based badminton assessment frameworks should adopt integrated testing approaches that simultaneously capture both movement preparation and stroke performance, thereby enhancing the quality of evidence-based teaching and coaching practices.

CONCLUSION

This review demonstrates that footwork and smash accuracy are fundamental components of badminton skill performance and should be assessed using valid, reliable, and practical instruments, particularly in school-based physical education and extracurricular programs. Conceptually, the findings support the principles of Motor Learning Theory, Motor Control Theory, and Educational Assessment Theory, which emphasize that objective assessment is essential for monitoring skill acquisition, providing feedback, and improving performance outcomes. Footwork serves as the foundation for efficient court movement, balance, agility, and positioning, whereas smash accuracy reflects the ability to execute offensive strokes with precision and effectiveness. Empirically, the review analyzed 32 studies published between 2015 and 2025, consisting of 14 footwork assessment studies (43.75%), 10 smash-accuracy studies (31.25%), and 8 integrated assessment studies (25.00%). The results revealed that footwork assessment instruments demonstrated validity coefficients ranging from 0.82–0.93 and reliability coefficients ranging from 0.88–0.95, while smash-accuracy instruments showed validity values between 0.77–0.95 and reliability values between 0.79–0.97. Furthermore, studies reported a moderate-to-strong positive relationship between footwork performance and smash accuracy ($r = 0.58–0.79$), indicating that efficient movement significantly contributes to effective stroke execution. Among the reviewed instruments, the Badminton Agility Movement Test and the Target Smash Accuracy Test emerged as the most recommended tools due to their strong psychometric quality, practicality, and suitability for educational environments. Therefore, integrating these assessments into school badminton programs can enhance the objectivity, effectiveness, and evidence-based quality of skill evaluation and learning outcomes.

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