

Development and Validation of a Volleyball Serving Skill Performance Test for School-Level Players

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Abstract: *The volleyball serve is a fundamental technical skill that initiates every rally and can directly influence the tactical development and competitive performance of young players. However, school-level physical education programmes require simple, objective, reliable, and age-appropriate instruments for evaluating serving performance. The purpose of this study is to develop and validate a Volleyball Serving Skill Performance Test specifically for school-level players. The proposed test combines service accuracy, successful execution, and consistency while maintaining a simple administration procedure suitable for school settings. The development process involves literature review, identification of serving-performance components, expert evaluation, pilot testing, content validation, test-retest reliability, inter-rater reliability, and criterion-related validity.*

Keywords: Skill Performance Test, Test Development, Validity, Reliability, School-Level Players, Sports Assessment.

I. INTRODUCTION

Volleyball is a technically demanding team sport in which players must perform several fundamental skills, including serving, passing, setting, attacking, blocking, and defensive movements. Among these skills, the serve is particularly important because it initiates every rally and provides the serving team with an opportunity to apply tactical pressure to the opponent. Therefore, systematic assessment of serving ability is important for monitoring skill development and identifying areas requiring improvement.

At the school level, volleyball assessment is particularly relevant because students are developing basic motor coordination, technical competence, decision-making abilities, and sport-specific confidence. Reliable skill testing can assist teachers and coaches in determining current performance levels, designing appropriate training programmes, monitoring improvement, and identifying talented players.

Traditional volleyball skill assessments have included tests of serving, passing, setting, and spiking. Gabbett and Georgieff (2006), for example, developed a standardized skill assessment for junior volleyball players and reported high reproducibility for both accuracy and technical measurements. Their study involved junior players with an average age of approximately 15.5 years and demonstrated that skill-based testing could distinguish different playing levels and detect training-related improvements.

Serving accuracy has also been examined under different physiological conditions. Lidor et al. (2007) investigated adolescent volleyball players performing service tests under rested and physically exerted conditions and found a very high correlation between the overall service-test score and successful target serves. This suggests that target-based serving tests can provide useful information about technical performance.

More recently, Costa et al. (2024) developed and evaluated a volleyball overhand serve accuracy test. Expert assessment supported its content validity, while face validity was also satisfactory. Test-retest reliability was high among both novice and experienced participants, with ICC values of 0.81 and 0.84, respectively. These findings provide contemporary support for the development of standardized serving assessments.



Despite the availability of several volleyball skill tests, there remains a need for a simple test specifically designed for school-level players. A school-oriented test should require minimal equipment, have clearly defined scoring criteria, be easy for physical education teachers to administer, and demonstrate acceptable psychometric properties. Therefore, the present study proposes the development and validation of a Volleyball Serving Skill Performance Test for school-level players.

II. NEED AND SIGNIFICANCE OF THE STUDY

Assessment is an essential component of physical education and sports training. Without an objective assessment procedure, teachers may depend heavily on subjective judgments when evaluating volleyball serving ability. Such judgments can be influenced by experience, expectations, and differences between evaluators.

A standardized serving test can provide several advantages:

1. It provides an objective numerical measure of serving performance.
2. It allows comparison among students of similar age and playing level.
3. It helps teachers identify weaknesses in serving accuracy.
4. It can be used before and after a training programme.
5. It provides a basis for talent identification.
6. It can assist coaches in individualizing technical training.
7. It can be incorporated into school-level physical education examinations.
8. It provides researchers with a standardized outcome measure.

Earlier research supports the importance of reliability in sports testing. Reliability refers to the reproducibility or consistency of measurements obtained from repeated testing. Hopkins (2000) emphasized the importance of examining measurement error and within-subject variation when evaluating sports-performance tests.

Similarly, Koo and Li (2016) recommended the appropriate use and reporting of ICC when assessing test-retest or inter-rater reliability. They note that ICC values above .90 are generally interpreted as excellent, whereas values between .75 and .90 indicate good reliability.

III. REVIEW OF RELATED LITERATURE

1. Volleyball Skill Assessment

Gabbett and Georgieff (2006) developed a standardized skill assessment covering spiking, setting, serving, and passing among junior volleyball players. The study found high reproducibility of accuracy and technique measurements and demonstrated that performance increased progressively with playing level.

Earlier work on volleyball testing also attempted to develop practical instruments suitable for school-age players. Kronqvist and Brumbach's (1968) modification of the Brady Volleyball Skill Test for high-school boys reported a validity coefficient of .767 and reliability coefficient of .817, demonstrating the longstanding interest in objective volleyball skill measurement.

2. Volleyball Serving Accuracy

Serving accuracy is commonly measured by requiring players to serve repeatedly toward predetermined target zones. Lidor et al. (2007) used a target-based service test among adolescent volleyball players and found a very high relationship between total test scores and successful target serves.

The recent study by Costa et al. (2024) provides particularly relevant evidence for the present research. Their volleyball serve accuracy test demonstrated satisfactory content and face validity and high test-retest reliability. The researchers concluded that the test could be useful for evaluating beginners in teaching-learning contexts.

Research involving school children has also reported high reliability for volleyball serving assessments, supporting the feasibility of standardized skill-testing procedures in younger populations.



3. Validity and Reliability of Skill Tests

A test must demonstrate adequate validity and reliability before it is recommended for practical use. Content validity determines whether the test adequately represents the intended skill domain. Criterion-related validity examines the relationship between test performance and an external criterion. Reliability determines whether the test produces consistent results under similar conditions.

The COSMIN framework identifies content validity, reliability, measurement error, construct validity, criterion validity, responsiveness, and interpretability among important measurement properties. Although COSMIN was developed primarily for health measurement instruments, its conceptual emphasis on clearly evaluating measurement properties is useful when developing performance assessment instruments.

IV. METHODOLOGY

1. Research Design

A methodological research design involving test development and validation will be adopted. The study will be conducted in several sequential stages:

Literature Review → Test Construction → Expert Evaluation → Pilot Testing → Reliability Testing → Validity Testing → Standardization

This approach is consistent with previous volleyball skill-test development research in which test content, reliability, validity, and sensitivity to differences in playing ability were examined.

2. Participants

The proposed study may include approximately 60–100 school-level volleyball players, preferably within the age range of 12–18 years. Participants should be regularly involved in school physical education or volleyball training.

For reliability analysis, a subsample of approximately 30–40 players may complete the test on two separate occasions under standardized conditions. A separate group or the full sample may be used for validity analysis depending on the final research design.

Players should be excluded if they have a current musculoskeletal injury, illness, or any condition preventing safe participation in volleyball activities.

3. Expert Panel

A panel of approximately 5–10 experts may be selected for content validation. Experts may include:

1. volleyball coaches,
2. physical education teachers,
3. sports scientists,
4. university physical education faculty, and
5. experienced volleyball trainers.

Experts will evaluate the relevance, clarity, appropriateness, feasibility, and representativeness of the proposed test components.

Development of the Volleyball Serving Skill Performance Test

The proposed VSSPT is designed around the central component of serving accuracy.

I. Test Equipment

The following equipment will be required:

1. standard volleyballs,
2. volleyball court,
3. volleyball net,
4. measuring tape,
5. floor markers/cones,
6. target-zone markings,
7. score sheets,



8. whistle, and
9. recording device if required.

II. Test Area

The standard volleyball court will be used. Target zones will be marked in the opponent's court to create different scoring areas.

III. Proposed Test Procedure

1. The player performs a standardized warm-up.
2. The examiner explains and demonstrates the test.
3. The player receives a small number of practice serves.
4. After practice, the player performs **10 scored serves**.
5. Each serve is directed toward the designated target area.
6. A score is assigned according to the zone in which the ball lands.
7. A ball landing outside the target area receives a lower score or zero, depending on the scoring system.
8. The total score of the 10 serves constitutes the player's serving-performance score.

V. PROPOSED SCORING SYSTEM

Serving outcome	Proposed score
Ball lands in highest-value target zone	5
Ball lands in second target zone	4
Ball lands in third target zone	3
Ball lands in court but outside target zones	1
Service fault/out of bounds/net	0

Maximum score = 50 points

The scoring structure can be modified following expert review and pilot testing.

A target-zone system is supported by previous research in which successful serves directed into designated target areas were used to quantify service performance.

VI. CONTENT VALIDATION

The initial test will be presented to the expert panel. Experts will evaluate:

1. relevance of serving accuracy,
2. appropriateness for school-level players,
3. clarity of instructions,
4. adequacy of target zones,
5. appropriateness of the number of trials,
6. scoring objectivity,
7. safety,
8. feasibility, and
9. overall suitability.

A Content Validity Index or Content Validity Ratio may be calculated.

Items receiving inadequate expert agreement will be modified or removed. The final version will be prepared after incorporating expert recommendations.

VII. PILOT STUDY

A pilot study will be conducted with approximately 15–20 school-level players who are not included in the main validation sample.

The pilot study will determine:



1. clarity of instructions,
2. average administration time,
3. difficulty of the test,
4. suitability of target zones,
5. equipment requirements,
6. scoring problems,
7. participant understanding, and
8. potential ceiling or floor effects.

Any procedural problems identified during pilot testing will be corrected before the main study.

VIII. RELIABILITY TESTING

1. Test-Retest Reliability

Test-retest reliability will be established by administering the VSSPT twice under similar conditions, preferably with an interval of approximately 5–7 days.

The Intraclass Correlation Coefficient will be calculated. ICC is widely used for evaluating the reproducibility of measurements obtained during repeated testing.

A general interpretation may be:

ICC value	Interpretation
< 0.50	Poor
0.50–0.74	Moderate
0.75–0.89	Good
≥ 0.90	Excellent

These thresholds are consistent with commonly used ICC interpretation guidelines.

2. Inter-Rater Reliability

Two or more trained evaluators will independently score the same serving trials.

Inter-rater reliability will be examined using ICC. High agreement would demonstrate that the test can be administered objectively without substantial dependence on the individual scorer.

3. Measurement Error

The Standard Error of Measurement (SEM) and, where appropriate, coefficient of variation (CV) will be calculated. These indicators provide additional information about the precision of individual measurements. Hopkins (2000) emphasized the importance of examining typical error and within-subject variation in sports testing.

IX. STATISTICAL ANALYSIS

Data may be analyzed using SPSS, R, Jamovi, or equivalent statistical software.

The following statistical procedures are recommended:

Statistical procedure	Purpose
Mean ± SD	Descriptive analysis
Frequency/percentage	Participant characteristics
CVI/CVR	Content validity
ICC	Test-retest reliability
ICC	Inter-rater reliability
SEM	Measurement error
CV%	Relative measurement error
Pearson correlation	Criterion-related validity



Independent t-test	Two-group comparison
One-way ANOVA	Comparison of three playing-level groups
Post-hoc test	Identification of group differences
Bland–Altman analysis	Agreement between repeated measurements, if appropriate

The selection and reporting of ICC should clearly identify the specific ICC model and definition because different ICC forms have different assumptions and interpretations.

X. PROPOSED RESULTS PRESENTATION

Because this is a **test-development study**, numerical results should only be inserted after actual data are collected and analyzed. The following table provides the recommended format rather than fabricated findings.

Table 1. Content Validity of the VSSPT

Test component	Expert agreement	CVI/CVR	Decision
Test instructions	—	—	Retain/modify
Serving technique	—	—	Retain/modify
Target zones	—	—	Retain/modify
Number of serves	—	—	Retain/modify
Scoring system	—	—	Retain/modify
Overall test	—	—	Retain/modify

X. DISCUSSION

The development of a standardized serving test is important for school-level volleyball because technical performance needs to be assessed using procedures that are objective, reproducible, and appropriate for the developmental level of the players. A target-based serving assessment provides a direct numerical representation of accuracy and is relatively easy to understand and administer.

The proposed VSSPT builds on previous volleyball testing research while focusing specifically on serving performance. Gabbett and Georgieff (2006) demonstrated that standardized skill testing can provide reliable measures of junior volleyball performance. Lidor et al. (2007) further demonstrated the usefulness of target-based serving scores among adolescent volleyball players.

The recent work of Costa et al. (2024) is especially relevant because it directly investigated the validity and reliability of a volleyball serve accuracy test. The reported ICC values indicate that serving accuracy can be measured consistently through standardized testing.

The proposed VSSPT differs conceptually by emphasizing school-level applicability, including simple administration, low equipment requirements, clear scoring, and suitability for physical education environments. Such characteristics may make the test useful not only for research but also for routine assessment.

Reliability alone, however, is insufficient to establish that a test measures the intended construct. The test should therefore undergo multiple forms of validation. The broader measurement literature emphasizes the importance of considering content validity, reliability, measurement error, construct or criterion validity, and responsiveness where relevant.

XI. EDUCATIONAL AND PRACTICAL IMPLICATIONS

The proposed test may be useful for:

1. Physical education teachers for student assessment.
2. School volleyball coaches for identifying technical weaknesses.
3. Sports academies for monitoring player development.
4. Researchers conducting intervention studies.
5. Talent identification programmes for preliminary screening.



6. Students for monitoring individual improvement.

The test may also be administered before and after a structured volleyball training programme to determine whether serving accuracy has improved.

XII. CONCLUSION

The development of a standardized Volleyball Serving Skill Performance Test (VSSPT) can provide an objective and practical approach for assessing serving ability among school-level players. The proposed test emphasizes serving accuracy through a controlled target-zone procedure and can be administered with limited equipment. Its psychometric evaluation should include content validity, test-retest reliability, inter-rater reliability, measurement error, and criterion-related validity.

Existing evidence indicates that standardized volleyball skill assessments can demonstrate strong reliability and can differentiate players according to skill level. Contemporary research specifically examining volleyball serve accuracy has also demonstrated satisfactory validity and high test-retest reliability. Therefore, after empirical validation with an appropriate school-level sample, the VSSPT could serve as a useful instrument for physical education assessment, coaching, talent identification, and sports research.

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