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Development of Tennis Spin Serve Technique Observation Instrument: The Quality Tennis Learning in Higher Education

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ABSTRACT

This study aims to develop and test the validity and reliability of an observation instrument for spin serve techniques in tennis. We designed this instrument to measure seven main aspects of the spin serve movement: coiling, toss, backswing, uncoiling, strike zone, follow-through, and fall-in. Using a quantitative approach and descriptive correlational design, this study involved 30 students who had taken advanced tennis lessons. The validity of the instrument was tested using the Pearson product-moment correlation, while the reliability was tested using the Cronbach's alpha coefficient. The results indicated that all aspects had correlation values above 0.3, and the reliability of the instrument was in the moderate category (α = 0.552). These findings indicate that the developed observation instrument is feasible to use in the context of spin serve tennis. We can conclude that novice athletes can effectively evaluate their performance using the observation instrument for spin serve techniques in tennis. All aspects have adequate validity, and the instrument as a whole shows moderate reliability. This instrument can be an initial reference in the process of training more objective and systematic spin-speak techniques, although it still needs improvement to increase reliability.

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1. INTRODUCTION

Tennis is a sport that combines elements of technique, physical strength, reaction speed, and strategic intelligence in every aspect of the game (Renò et al., 2017; Najami & Ghannam, 2025; Ünver et al., 2023). To achieve optimal performance, a tennis athlete must master various basic and advanced skills, including service techniques that play a central role in opening each point of the game (Gorce & Jacquier-Bret, 2024; Jacquier-Bret & Gorce, 2024). Among the various types of serves used, the spin serve is a very strategic and complex technique because it can produce a ball with a certain rotation that makes it difficult for the opponent to return the shot (Brito et al., 2024; Lambrich

& Muehlbauer, 2023). The resulting spin creates an unexpected bounce, so it can be a mainstay weapon in facing competitive matches.

In the context of sports training and research, an athlete's ability to perform a spin serve is not only assessed by the final result, such as ball speed or accuracy, but also by the accompanying technical processes, such as coiling, tossing, backswing, uncoiling, and advanced stages such as follow-through and fall-in (Kocib et al., 2020; Aprilo et al., 2023). Therefore, a test instrument is needed to measure these technical aspects comprehensively and in depth. The instrument must have satisfactory validity to measure what should be measured truly and have high reliability so that the measurement results are consistent when applied repeatedly in similar situations.

Most of the test instruments used to assess tennis service techniques are still subjective and have not gone through a systematic validity and reliability testing process (Tubez et al., 2017; Faber et al., 2021; Bilić et al., 2023; Caprioli et al., 2025; Zhang et al., 2025). These deficiencies can lead to inconsistent evaluation of athlete performance, both in the context of training and scientific research. There is a lack of studies specifically focused on developing and testing observation instruments for spin serve techniques that meet scientific standards, particularly in the context of teaching and coaching novice athletes. Most previous studies have only focused on performance results rather than on the movement process systematically (Logan et al., 2018; Szaszi et al., 2018). The study tested an observation instrument for spin serve techniques based on specific motion component analysis, which has not been widely developed in similar studies in the field of tennis coaching science.

This study aims to measure the validity and reliability of the observation instrument of the spin serve motion process in tennis, which includes technical aspects such as coiling, toss, backswing, uncoiling, strike zone, follow-through, and fall-in. The validity test was conducted using the Pearson correlation method, while the reliability test used the Cronbach's alpha coefficient. The results of this study are expected to make an important contribution to the development of objective, standard, and applicable sports technique measurement tools, especially in the training and evaluation of tennis athletes.

2. METHOD

This study used a quantitative approach with a descriptive correlational design to evaluate the validity and reliability of the observation instrument for the spin serve technique in tennis. Validity was tested through correlation between items using Pearson Product Moment, while reliability was tested using Cronbach's Alpha. The subjects in this study were 30 students in the advanced tennis course who were selected purposefully based on the criteria of being 18–22 years old, having passed the basic tennis course, and having studied basic service techniques, including spin serves.

The test instrument used to assess the technique for the spin tennis serve consisted of 7 main aspects, namely coiling, toss, backswing, uncoiling, strike zone, follow-through, and fall-in. Data was collected through video recordings taken using the Kinovea application. The recordings were taken using a Canon EOS 1100D DSLR

camera. The first camera was placed five metres to the right of the service box and positioned perpendicular to the service line to record body movements from the side when serving. The second camera is installed in the middle, parallel to the centre line of the court, to record the path of the ball towards the service box as a landing area to determine whether the ball enters the service box. The third camera is positioned behind the participant to record the angle of the body tilt when the impact occurs between the racket and the ball.

Analysis of the recorded data was carried out using Kinovea software, and the assessment was carried out based on the tennis spin serve technique assessment instrument. Validity testing was carried out using the Pearson correlation between each item and the total score. The test item is declared valid if the calculated r value is > 0.30. We conducted reliability testing using the Cronbach's alpha coefficient, interpreting the instrument as reliable if the alpha value is less than 0.60. Data analysis was carried out with the assistance of SPSS statistical software.

3. RESULTS AND DISCUSSION

Results

Before using the instrument to collect data, a test was done to determine if each question or indicator could really measure what it was supposed to, which in this case was the technical parts of the tennis spin serve movement. We conducted the validity test by comparing the score of each indicator with the total score of the entire instrument using the Pearson Product Moment correlation. An indicator is deemed valid when the correlation value r exceeds 0.361, based on a sample size of N = 30 and a significance level of 5%. Table 1 below presents the results of the validity test on the seven main aspects of the spin serve movement, which include coiling, tossing, backswinging, uncoiling, the strike zone, follow-through, and falling in.

Table 1. Instrument Validity Test

Variable	N	Mean	Std. Deviasi	Pearson Product Moment
Coiling	30	3,57	0,57	0,518
Toss	30	3,63	0,49	0,446
Backswing	30	3,70	0,47	0,469
Uncoiling	30	3,53	0,58	0,565
Strike zone	30	3,83	0,38	0,677
Follow through	30	3,57	0,50	0,547
Fall in	30	3,67	0,48	0,476

Table 1 showed that all aspects show a Pearson correlation value above 0.361, which means that the seven indicators are valid and suitable for use as instruments in measuring the quality of spin serve technique movements in tennis. The strike zone aspect has the highest correlation value (r = 0.677), indicating that this indicator has the strongest relationship with the overall total score. Meanwhile, the toss aspect has the lowest correlation value (r = 0.446) but is still within the acceptable validity limits. The results of this validity test indicate that all instrument indicators have met the validity

requirements and can be used in further research to assess the technical performance of athletes in performing spin serves.

After the validity test is carried out, the next step is to conduct a reliability test to determine the extent to which the instrument provides consistent results when used repeatedly under the same conditions. We test reliability using the Cronbach's Alpha coefficient, which ranges from moderate (0.50–0.70) to good (0.70–0.90) to very good (>0.90). The instrument used in this study consists of seven items representing each technical aspect in the tennis spin serve movement. The results of the reliability test are presented in Table 2 below.

Table 2. Instrument Reliability Test

	N	Cronbach Alpha	Cronbach Alpha By Item
Spin Serve	7	0,552	0,573

Table 2 showed that the Cronbach's alpha value of 0.552 indicates that the instrument has a moderate level of reliability, which means that the seven items in this instrument have generally shown acceptable internal consistency. This shows that every aspect measured, from coiling to falling in as a whole, has a stable relationship in measuring the performance of the spin serve technique. The Cronbach's alpha value based on the item 0.573 also strengthens the conclusion that no single item significantly reduces the overall reliability, so that all indicators can still be used without the need for major deletion or revision. This instrument is suitable for use in data collection in this study, both in terms of validity and reliability.

Discussion

The study's results indicate that the seven parts of the spin serve technique observation tool—coiling, toss, backswing, uncoiling, strike zone, follow-through, and fall-in—are valid based on the Pearson Product Moment correlation analysis. All correlation values obtained are above the minimum limit of 0.3, which is the general threshold for stating the validity of items in social and sports research. The result indicates that each item or indicator in the instrument has a fairly strong relationship to the overall total score, thus reflecting the consistency between individual items and the concept being measured as a whole. Each aspect measured by the instrument contributes significantly to the assessment of spin serve technique performance in tennis, and none of the indicators shows correlational weaknesses to the main construct. It can be concluded that the seven aspects are relevant and representative in measuring the technical skills of spin serve and are worthy of use in evaluating athlete performance and in the context of broader scientific research. The strike zone aspect obtained the highest correlation value of 0.677, which indicates that mastery of the hitting area is the most prominent indicator and has the strongest relationship with the total score in the spin serve technique assessment.

Recent studies have confirmed that an athlete’s success in directing the ball to the optimal hitting area (strike zone) plays a crucial role in the effectiveness and quality of spin serves in tennis. Upper body coordination, such as shoulder elevation and elbow

flexion at ball contact, is critical to the quality of the serve (Jacquier-Bret & Gorce, 2024; Lambrich & Muehlbauer, 2023). The efficiency of the movement, including the timing of the service execution, is influenced by the mastery of the technique, which is closely related to the control of the strike zone (Brocherie & Dinu, 2022; Busuttil et al., 2022). The correct ball contact position, achieved through the coordination of trunk rotation and upper arm position, is a key factor in producing an effective spin serve (Murata & Fujii, 2022; van Trigt et al., 2024). Mastery of the strike zone is not only the result of technical skills but also reflects a complex biomechanical synergy that must be honed through structured and focused training.

The ability to control the contact position of the ball in the strike zone not only determines the direction and rotation of the ball but also reflects mature technical coordination between the preparation, stroke, and follow-through phases of the movement. On the other hand, other aspects, such as toss, backswing, and fall-in, also showed decent positive correlation values, each above the minimum validity threshold, indicating that the three components still contribute significantly to overall performance. An accurate toss, for example, plays an important role in determining the timing and position of the stroke, while the backswing reflects explosive power readiness, and the fall-in indicates balance and body control after the stroke (Carboch, 2016; Carboch & Süss, 2015; Aprilo et al., 2022). Thus, these findings reinforce that all observed technical elements work synergistically and complement each other and have an important role in producing effective and competitive spin serves.

We conducted the reliability test of the spin serve technique observation instrument using the Cronbach's Alpha method, yielding a value of 0.552. This value is included in the moderate reliability category, which indicates that although the instrument has shown fairly satisfactory validity on each item, the level of internal consistency between items is not yet fully optimal. In other words, the correlation between items in the instrument still shows disharmony or inconsistency in measuring the same construct consistently. Numerous factors can contribute to this condition. One of these factors is the fact that novice athletes, who often exhibit greater technique variations and inconsistency in movement execution, were the subjects of this study.

Reliability in the evaluation of tennis service technique can be achieved through various approaches, both qualitative and quantitative (Wood et al., 2023; Caprioli et al., 2025). Tennis coaches can provide reliable assessments of aspects of service mechanics, such as power, rhythm, and body movement quality, using two-dimensional video recordings, although there are challenges in assessing shoulder internal rotation (Wood et al., 2023; Caprioli et al., 2025). The inter-session reliability of biomechanical variables related to the tennis serve is rated as acceptable to excellent in both laboratory and field contexts (Tubez et al., 2019; Brocherie & Dinu, 2022). The use of inertial measurement systems can also provide reliable and consistent data in the assessment of forehand and service technique (Caprioli et al., 2025; Wen & Wang, 2025). Overall, these results confirm that with the right methods and tools, reliability in the evaluation of tennis service techniques can be maintained well, thus supporting the accuracy of the overall analysis of athlete performance.

Overall, this instrument has great potential to be used as an evaluation tool for spin serve techniques in the context of training and research, especially among novice athletes. In the future, improvements can be made through additional training for observers, development of more detailed indicators, and retesting on a wider population.

4. CONCLUSION

Building upon the results of the validity and reliability tests, it can be concluded that the observation instrument for spin serve techniques in tennis is suitable for evaluating the performance of novice athletes. All aspects have adequate validity, and the instrument as a whole shows moderate reliability. This instrument can be an initial reference in the process of training more objective and systematic spin serve techniques, although it still needs improvement to increase reliability.

As a suggestion, this measure possesses significant promise as an evaluative tool for assessing spin serve strategies in training and research, particularly for inexperienced athletes. Supplementary training for observers, the development of more comprehensive indicators, and retesting across a broader demographic may lead to future enhancements.

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