

Development of Assessment Standards for Jump-Serve Ability in Volleyball-Major Students at The University of Danang - University of Science and Education

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Abstract: This study aimed to select suitable tests and develop assessment standards for jump-serve ability in volleyball-major students at The University of Danang - University of Science and Education. Based on document review and two expert surveys with 32 valid responses, seven of nine candidate tests with a frequent-use rate above 70% were retained. Test-retest correlations ranged from 0.78 to 0.85 in males and from 0.78 to 0.82 in females ($p < 0.01$). Individual data from 36 students, including 20 males and 16 females, were used to determine mean, SD and CV, construct sex-specific five-level standards, standardize each test using Z-scores and the C-scale to obtain a 10-point score, and establish an overall classification from the sum of seven test scores. Average classification was most frequent in both males (75.0%) and females (68.75%). The developed standards provide a practical tool for assessment and monitoring of jump-serve-related physical and technical performance within comparable volleyball-major student groups.

Keywords: volleyball; jump serve; assessment standards; C-scale; volleyball-major students.

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I. INTRODUCTION

In modern volleyball, the serve is not only used to put the ball into play but also functions as a direct attacking action. The jump serve enables contact at a higher point and can produce greater ball speed and a more difficult trajectory for the receiving team. Its effectiveness depends on several components, including explosive lower-limb power, approach-to-take-off coordination, contact height, and technical consistency. Studies on plyometric and combined strength training have demonstrated meaningful improvements in jump performance among volleyball players [6], [7].

For volleyball-major students, assessment of jump-serve ability should therefore reflect both physical and technical components. Relying only on course grades or qualitative judgement provides limited information about individual strengths and limitations and makes it difficult to monitor progress across tests measured in different units. A structured test battery with acceptable repeatability and clear interpretation criteria can improve the objectivity of pedagogical assessment.

Accordingly, this study aimed to select a suitable test battery and develop sex-specific assessment standards for jump-serve ability in volleyball-major students at The University of Danang - University of Science and Education, including five-level criteria, a 10-point C-scale, and an overall seven-test classification.

II. RESEARCH SUBJECTS AND METHODS

2.1. Research subjects and participants

The research object was the test system and assessment standards for jump-serve ability. The criterion-development sample consisted of 36 volleyball-major students, including 20 males and 16 females. In addition, 35 lecturers, coaches, experts and sport administrators were invited to participate in expert consultation; 32 valid responses were obtained in two survey rounds.

2.2. Research methods

The study used document analysis, expert consultation, pedagogical observation, field testing and statistical analysis. Nine candidate tests were initially proposed from the literature and teaching practice. A test was retained when more than 70% of valid expert responses rated it as frequently used in both survey rounds. The retained tests were repeated under comparable conditions two weeks apart to examine the stability of repeated measurements.

2.3. Statistical analysis

Descriptive statistics included mean, standard deviation (SD), coefficient of variation (CV), and test-retest correlation (r). Five-level standards were derived separately by sex using mean $\pm$ SD: Poor < mean-2SD; Weak from mean-2SD to mean-SD; Average from mean-SD to mean+SD; Good from mean+SD to mean+2SD; and Very good > mean+2SD [1]-[4].

To place tests measured in different units on a common scale, raw scores were standardized as $Z = (X - \text{mean}) / \text{SD}$ and converted to the C-scale using $C = 5 + 2Z$. C values were converted to integer scores from 1 to 10. The sum of the seven test scores was used for overall assessment, and sex-specific five-level composite standards were derived from composite mean $\pm$ SD.

III. RESULTS AND DISCUSSION

3.1. Selection of the jump-serve assessment test battery

Table 1. Expert screening of candidate jump-serve assessment tests (n=32)

No.	Test	Frequently used (%) Round 1	Frequently used (%) Round 2	Decision
1	Standing vertical jump (cm)	78.13	81.25	Retained
2	Ball speed after serve (m/s)	50.00	50.00	Excluded
3	Approach vertical jump (cm)	71.88	71.88	Retained
4	Standing long jump	78.13	81.25	Retained
5	Continuous jumps for 30 s (reps)	81.25	81.25	Retained
6	Target jump serve (10 attempts)	75.00	78.13	Retained
7	Contact height during jump serve (cm)	81.25	81.25	Retained
8	Serve accuracy (successful attempts)	56.25	56.25	Excluded
9	Jump serve over the net (10 attempts)	78.13	78.13	Retained

Table 1 shows that seven of the nine candidate tests exceeded the 70% frequent-use criterion in both survey rounds and were retained. Ball speed after serve and general serve accuracy did not reach the threshold. The selected battery covers four sport-specific physical components and three measures directly related to jump-serve execution. This structure reflects the multidimensional nature of the skill rather than evaluating jump height alone.

3.2. Test-retest stability and descriptive characteristics

Table 2. Test-retest correlations of the seven tests by sex

No.	Test	Male r (n=20)	Female r (n=16)	P
1	Standing vertical jump (cm)	0.83	0.81	<0.01
2	Approach vertical jump (cm)	0.78	0.82	<0.01
3	Standing long jump	0.79	0.78	<0.01
4	Continuous jumps for 30 s (reps)	0.79	0.80	<0.01
5	Target jump serve (10 attempts)	0.85	0.81	<0.01
6	Jump serve over the net (10 attempts)	0.80	0.82	<0.01
7	Contact height during jump serve (cm)	0.81	0.79	<0.01

Test-retest correlations ranged from 0.78 to 0.85 in males and from 0.78 to 0.82 in females, all with $p < 0.01$. These results indicate a relatively stable ranking of participants across repeated assessments and support the use of the tests in the criterion-development stage. Atkinson and Nevill [5] emphasized the importance of reproducibility in measurement; in the present study, correlation coefficients were used as indicators of relative repeated-measure stability.

Table 3. Descriptive characteristics of the seven tests in male and female students

Test	Male mean $\pm$ SD	CV (%)	Female mean $\pm$ SD	CV (%)
Standing vertical jump (cm)	50.76 $\pm$ 3.25	6.40	35.44 $\pm$ 2.31	6.52
Approach vertical jump (cm)	61.94 $\pm$ 4.64	7.49	43.70 $\pm$ 3.15	7.21
Standing long jump (cm)	251.95 $\pm$ 7.99	3.17	214.63 $\pm$ 7.22	3.36

Test	Male mean $\pm$ SD	CV (%)	Female mean $\pm$ SD	CV (%)
Continuous jumps for 30 s (reps)	25.80 $\pm$ 1.70	6.61	23.69 $\pm$ 2.27	9.59
Target jump serve (10 attempts)	5.85 $\pm$ 1.27	21.68	5.31 $\pm$ 1.08	20.30
Jump serve over net (10 attempts)	6.55 $\pm$ 1.28	19.49	6.44 $\pm$ 1.55	24.04
Contact height during jump serve (cm)	273.20 $\pm$ 11.54	4.22	226.94 $\pm$ 6.71	2.96

As shown in Table 3, the physical tests and contact height demonstrated comparatively low variability in both sexes. CV values for these outcomes ranged from 3.17% to 7.49% in males and from 2.96% to 9.59% in females. In contrast, target jump serve and jump serve over the net showed greater dispersion, with CV values of 19.49%-21.68% in males and 20.30%-24.04% in females. This pattern suggests greater individual differentiation in technical consistency than in most jump-related physical capacities.

3.3. Development of sex-specific five-level standards

Table 4. Five-level assessment standards for male students

Test	Poor	Weak	Average	Good	Very good
Standing vertical jump (cm)	<44.26	44.26-47.51	47.51-54.01	54.01-57.26	>57.26
Approach vertical jump (cm)	<52.66	52.66-57.30	57.30-66.57	66.57-71.21	>71.21
Standing long jump (cm)	<235.97	235.97-243.96	243.96-259.94	259.94-267.93	>267.93
Continuous jumps 30 s (reps)	<22.39	22.39-24.10	24.10-27.50	27.50-29.21	>29.21
Target jump serve (10 attempts)	<3.31	3.31-4.58	4.58-7.12	7.12-8.39	>8.39
Jump serve over net (10 attempts)	<4.00	4.00-5.27	5.27-7.83	7.83-9.10	>9.10
Contact height (cm)	<250.12	250.12-261.66	261.66-284.74	284.74-296.28	>296.28

Table 5. Five-level assessment standards for female students

Test	Poor	Weak	Average	Good	Very good
Standing vertical jump (cm)	<30.82	30.82-33.13	33.13-37.76	37.76-40.07	>40.07
Approach vertical jump (cm)	<37.40	37.40-40.55	40.55-46.85	46.85-50.00	>50.00
Standing long jump (cm)	<200.19	200.19-207.41	207.41-221.84	221.84-229.06	>229.06
Continuous jumps 30 s (reps)	<19.14	19.14-21.42	21.42-25.96	25.96-28.23	>28.23
Target jump serve (10 attempts)	<3.16	3.16-4.23	4.23-6.39	6.39-7.47	>7.47
Jump serve over net (10 attempts)	<3.34	3.34-4.89	4.89-7.99	7.99-9.53	>9.53
Contact height (cm)	<213.51	213.51-220.22	220.22-233.65	233.65-240.37	>240.37

Tables 4 and 5 convert raw scores into five practical performance levels. Separate standards were developed for males and females because the central values of several jump-related tests and contact height differed substantially between the two groups. In practice, these tables allow instructors to identify which component of an individual student is Weak, Average, Good, or Very good and to adjust training content accordingly.

3.4. Development of the 10-point C-scale and composite standards

Table 6. Conversion of the C-scale to a 10-point score

Score	C interval	Z interval
1	$C < 1.50$	$Z < -1.75$
2	$1.50 \leq C < 2.50$	$-1.75 \leq Z < -1.25$
3	$2.50 \leq C < 3.50$	$-1.25 \leq Z < -0.75$
4	$3.50 \leq C < 4.50$	$-0.75 \leq Z < -0.25$
5	$4.50 \leq C < 5.50$	$-0.25 \leq Z < 0.25$
6	$5.50 \leq C < 6.50$	$0.25 \leq Z < 0.75$
7	$6.50 \leq C < 7.50$	$0.75 \leq Z < 1.25$
8	$7.50 \leq C < 8.50$	$1.25 \leq Z < 1.75$
9	$8.50 \leq C < 9.50$	$1.75 \leq Z < 2.25$
10	$C \geq 9.50$	$Z \geq 2.25$

The C-scale was used to place the seven tests on a common 10-point metric. For example, a male student with a standing vertical jump of 54.2 cm, compared with a male mean of 50.76 cm and SD of 3.25 cm, has $Z \approx 1.06$ and $C \approx 7.12$, corresponding to 7 points. The same procedure was applied to the remaining tests using sex-specific mean and SD values.

Table 7. Five-level standards for the seven-test composite score by sex

Sex	Composite mean $\pm$ SD	Poor	Weak	Average	Good	Very good
Male	35.30 $\pm$ 10.54	≤ 14	15-24	25-45	46-56	≥ 57
Female	35.06 $\pm$ 9.95	≤ 15	16-25	26-45	46-54	≥ 55

The mean seven-test composite score was 35.30 $\pm$ 10.54 points in males and 35.06 $\pm$ 9.95 points in females. Sex-specific five-level composite standards were established from composite mean $\pm$ SD. This approach retains information from each component score while also providing a practical overall index for monitoring jump-serve-related ability during training.

3.5. Application of the standards to the study sample

Table 8. Overall jump-serve classification of the 36 students

Classification	Male n	Male (%)	Female n	Female (%)
Very good	0	0.00	1	6.25
Good	2	10.00	1	6.25
Average	15	75.00	11	68.75
Weak	3	15.00	3	18.75
Poor	0	0.00	0	0.00

Table 8 indicates that Average was the most common classification in both sexes: 75.0% of males and 68.75% of females. Among males, 10.0% were classified as Good and 15.0% as Weak, with no Very good or Poor cases. Among females, 6.25% were Very good, 6.25% Good, and 18.75% Weak, with no Poor cases. The distribution shows that the overall level of the study sample was concentrated around Average, while the proportion reaching Good or Very good remained limited.

From an applied perspective, the seven-test battery, five-level standards, C-scale and composite score provide two complementary forms of assessment: component-level evaluation and overall classification. This is useful for pedagogical monitoring. However, the criterion-development sample was limited to one institution; further studies with larger and independent samples are required before the standards are generalized more broadly.

IV. CONCLUSION

Two rounds of expert consultation retained seven tests for assessing jump-serve ability. Test-retest correlations ranged from 0.78 to 0.85 in males and from 0.78 to 0.82 in females, all $p < 0.01$.

Based on individual data from 36 volleyball-major students, sex-specific five-level standards were developed and raw test results were standardized through the C-scale to obtain 10-point scores.

The sum of the seven test scores provided an overall jump-serve classification. Average was the predominant level in both males (75.0%) and females (68.75%). The standards can support assessment and monitoring within comparable volleyball-major student groups.

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