JOURNAL OF SPORTS AND PHYSICAL ACTIVITY
2026.VOL 2, NO 2, (58-67)
e-ISSN: 3109-5119
https://www.jospa.spdfharmony.com/index.php/jospa/index
DOI: 10.64268/jospa.v2i2.25

OPEN ACCESS Check for updates

From knowing to doing: Volleyball knowledge and skills performance among physical education teacher-education students

Muhaijhie M Alap[1*], Ivy Grace D Labisto[1] & Sherwin T Oceña[1]

[1]Saint Columban College, Philippines

ABSTRACT

Background: Physical education (PE) teacher-education programs commonly assume that students who know a sport well also perform it well, yet direct evidence for prospective PE teachers is scarce. **Aim:** To describe the levels of volleyball knowledge and skills performance among third-year Bachelor of Physical Education (BPED) students and to estimate the association between them. **Methods.** In this cross-sectional study (STROBE-reported), all 73 eligible third-year BPED students of a government college in Pagadian City, Philippines, were enrolled. Volleyball knowledge was measured with a 30-item researcher-made test (rules and scoring, player positions, strategies, and tactics). Skills performance (serving, passing, setting, spiking, blocking, digging) was rated by trained observers from ten trials per skill on a five-point scale. Data were analyzed with descriptive statistics and Pearson's r with a 95% confidence interval (CI). **Results.** Knowledge was moving towards mastery (M = 20.60/30, SD = 4.08; MPS = 68.67%), and skills performance was rated good (M = 2.66, SD = 1.15), with serving highest (M = 3.34) and blocking lowest (M = 2.24). Knowledge and skills were weakly and non-significantly related, r = .141, 95% CI [−.09, .36], p = .233, r^2 = .02. With N = 73, the study had 80% power only for |r| ≥ .32. **Conclusion.** The data provide no evidence of a substantial knowledge–skill association in this cohort, although a small-to-moderate association cannot be excluded. Programs should not assume that declarative knowledge transfers automatically to execution and should assess both, ideally in game-like conditions.

To cite this article: Alap, M. M., Labisto, I. G. D., & Oceña, S. T. (2026). From knowing to doing: Volleyball knowledge and skills performance among physical education teacher-education students. *Journal of Sports and Physical Activity, 2*(2), 58-67. https://doi.org/10.64268/jospa.v2i2.25

ARTICLE HISTORY

Received: May 15, 2026
Revised: July 12, 2026
Accepted: September 22, 2026

KEYWORDS

Volleyball;
Declarative knowledge;
Procedural knowledge;
Skills performance;
Game-based assessment.

INTRODUCTION

Physical education (PE) teacher-education programs rest on a convenient assumption: that students who understand a sport well will also play it well, and that graduates who can do both will teach it well. Global guidance on physical activity places schools among the settings in which movement competence and lifelong participation are cultivated (Bull et al., 2020), which makes the quality of PE teaching a matter of public as well as academic concern. For Bachelor of Physical Education (BPED) students, the stakes are doubled, because they are expected both to perform fundamental skills competently and to teach them to future learners (Rara & Bulilawa, 2026). If theoretical knowledge and observable skill develop largely independently, curricula that allocate

Corresponding Author: Alap, M. M., Saint Columban College, Philippines alapmuhaijhie@gmail.com
Open access under a Creative Commons Attribution-ShareAlike 4.0 International License Copyright © 2026 by Authors

time on the presumption of transfer may be inefficient, and assessment that relies on written tests may misrepresent practical competence. Whether declarative knowledge of a sport corresponds to skilled execution is therefore a question of both scientific and curricular urgency.

Motor learning theory distinguishes declarative knowledge (knowing facts, rules, and tactical principles) from procedural knowledge (knowing how to execute an action in real time). In classic accounts of skill acquisition, learning begins with declarative representations that are gradually converted into procedures through practice (Anderson, 1982), and information-processing models describe performance as a sequence of stimulus identification, response selection, and response programming, each with its own demands (Schmidt et al., 2019). These accounts imply that knowledge is a resource for skill, but not that the two will be strongly correlated at any given moment, because conversion depends on the quantity and quality of practice. Experimental work is more cautionary still: explicit rule knowledge can be detrimental when performers consciously monitor a well-learned movement under pressure (Masters, 1992), and instructions that direct attention to body movements tend to be less effective than those that direct attention to movement effects (Wulf, 2013). The expected direction and size of the knowledge–skill association in a teacher-preparation cohort is thus an empirical question rather than a foregone conclusion (Figure 1).

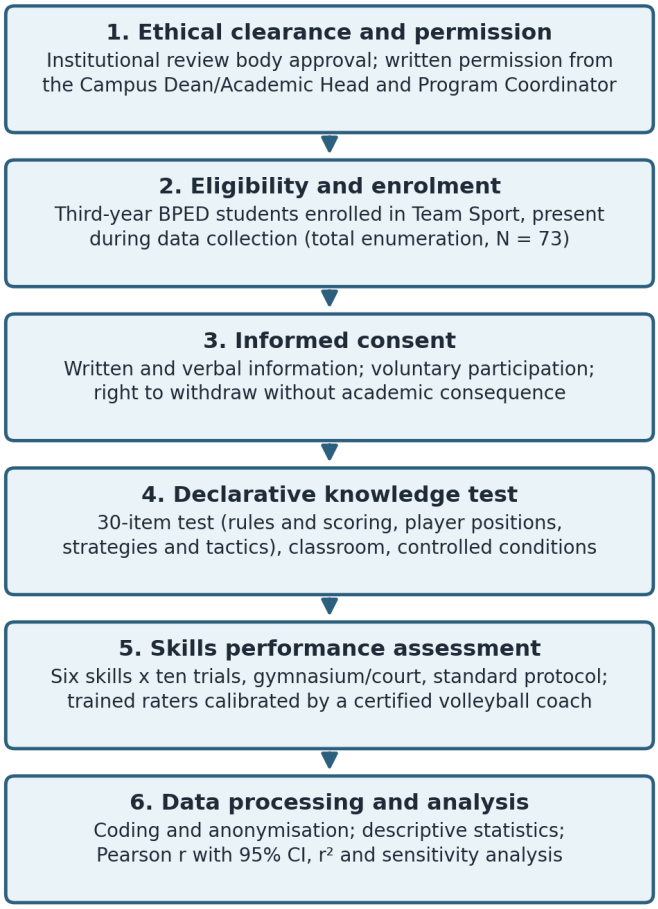

Figure 1. Conceptual Framework of the Study: Declarative Knowledge, Procedural Execution, and Conditions That May Moderate the Link Between Them

Volleyball is a suitable test case. Its fundamental skills (serving, passing, setting, spiking, blocking, and digging) are executed under severe time constraints and differ in how much they depend on perception and decision-making. Research on youth players has examined how tactical-technical behavior and decision-making respond to training constraints such as court dimensions (Rodrigues et al., 2022) and pendular training models (Castro et al., 2022), and how cognitive functions relate to sport-specific performance (Trecroci et al., 2021). The measurement of volleyball knowledge has also matured: declarative tactical knowledge has been combined with functional

fitness for talent identification in youth volleyball (Sgrò et al., 2024), a dedicated Declarative Tactical Knowledge Test has been developed and validated (Quinto et al., 2026), and declarative and procedural knowledge have been compared across practice levels and ages (Gil et al., 2012). Similar attention to tactical knowledge exists in other team sports; in youth soccer, for instance, tactical skills such as positioning and decision-making have been identified as key factors in talent development (Kannekens et al., 2011). These studies, however, were conducted mainly with athletes or youth players rather than with prospective PE teachers, who learn volleyball as a curricular subject and must later teach it.

A second body of work concerns how volleyball and other games should be taught. Game-based and tactical approaches have been reviewed extensively (Stolz & Pill, 2014), and recent syntheses examine their effects on decision-making, knowledge, and motor skills (Manninen et al., 2025) as well as the content and quality of studies comparing tactical game-centered approaches (Breed et al., 2025). Volleyball interventions based on Teaching Games for Understanding have reported outcomes for skills and enjoyment (Popović et al., 2021) and for physical fitness and body composition (Stojanović et al., 2023), while cooperative learning has been synthesized across PE outcomes (Boke et al., 2025). Among BPED students, video-based presentations have been examined for their effect on learning performance (Culajara, 2022). Much of this literature evaluates the effect of an instructional intervention on an outcome. Studies that measure knowledge and game performance together in volleyball are comparatively rare; one example examined grouping students by skill level within a Sport Education season (Mahedero et al., 2021), but it addressed a different question in a different population.

Three gaps follow. First, in theory, the assumed link between declarative knowledge and procedural execution has seldom been examined directly among PE teacher trainees, for whom knowledge is both a learning outcome and a professional tool. Second, in method, studies typically assess either knowledge or skill, or evaluate interventions, rather than estimating the naturally occurring association between an independently measured written knowledge test and observed performance across the six fundamental volleyball skills in the same cohort. Third, in context, local work in the Philippines has described volleyball skill levels and the factors affecting skill acquisition (Fernandez et al., 2023; Rara & Bulilawa, 2026), but in the literature we reviewed, those skill profiles have not been related to students' volleyball knowledge. Within the program studied here, no such evidence exists, so decisions about sequencing theory and practice courses, and about integrated versus separate assessment, rest on assumptions. The novelty claimed for this study is therefore modest but specific: it provides an estimate, with its uncertainty, of the knowledge–skill association in a teacher-education cohort where that association has not been quantified, using measures that map onto the declarative–procedural distinction.

Guided by this declarative-to-procedural framework, the study asked what levels of volleyball knowledge and skills performance third-year BPED students display, and whether stronger knowledge is associated with stronger skills performance. We hypothesized a positive association. The study contributes theoretically by testing this expectation outside laboratory and athlete samples, and practically by giving BPED programs locally grounded evidence for curriculum sequencing and assessment design, evidence that is also relevant to comparable programs internationally.

METHOD

Research Design

A cross-sectional, descriptive-correlational design was used, and the report follows the STROBE recommendations for observational studies (von Elm et al., 2008). The descriptive component characterized third-year BPED students' volleyball knowledge and skills performance; the correlational component estimated the association between the two without experimental manipulation. The design suits the aim of quantifying existing knowledge and skill levels and their association under everyday instructional conditions, although it cannot support causal inference.

Participant

Data were collected in the second semester of Academic Year 2025–2026 at a government college in Pagadian City, Philippines, that offers the BPED program. The campus provides classrooms

for declarative instruction and a gymnasium and outdoor courts for skill-based training; limited sports equipment restricted the frequency of practical training, and curriculum overload competed with opportunities for deliberate skill integration, which makes the setting ecologically valid for examining how students translate knowledge into performance under everyday instructional constraints. The study population comprised all officially enrolled third-year BPED students taking the Team Sport subject, of which volleyball is a major component. Students were eligible if they were (a) officially enrolled third-year BPED students, (b) currently taking Team Sport, and (c) present during the data-collection period. Criterion-based total enumeration was used, so all eligible students were invited; varsity volleyball players meeting these criteria were retained to preserve representativeness. All 73 eligible students took part, with complete data on both measures for every participant. Third-year students were targeted because Team Sport is offered only at that stage, so knowledge and skills are taught and assessed concurrently. Because the entire eligible cohort was enrolled, sample size was fixed by the population rather than by an a priori power calculation. A sensitivity analysis (Lakens, 2022) showed that, with $N = 73$, $\alpha = .05$ (two-tailed) and 80% power, the study could detect population correlations of $|r| \geq .32$; power was .40 for $r = .20$ and .74 for $r = .30$. Population and the methods of sampling; instrumentation (sample of questions, scoring method, and psychometric properties (validity and reliability):

Volleyball Knowledge Test

Declarative knowledge was measured with a 30-item multiple-choice and situational test with ten items for each of three indicators: rules and scoring, player positions, and strategies and tactics. Illustrative content includes substitution limits and rotation order (rules and scoring), the designated role of the libero and the responsibilities of the setter (player positions), and recognizing legitimate offensive strategies and time-out adjustments (strategies and tactics). Each correct answer scored one point (range 0–30), converted to a percentage and interpreted with the Mean Percentage Score (MPS) scale (Table 1 note).

Instrument

Volleyball Skills Performance Checklist

Procedural performance was measured with a Researcher-Rated Volleyball Skill Performance Checklist covering serving, passing, setting, spiking, blocking, and digging. Each student performed ten trials per skill; the number of correct attempts was converted into a descriptive category (from Mastery, 9–10 correct, to Incorrect, 0–2 correct) and then into a score from 5 (Excellent) to 1 (Poor). Raters also scored five technical criteria per skill on the same five-point metric (for example, stance and platform formation, leg-driven force generation, jump timing in blocking, and landing mechanics in spiking). Skill scores were interpreted with hypothetical mean ranges from Poor (1.00–1.80) to Excellent (4.21–5.00).

Development and Psychometric Properties

Both instruments were developed in consultation with a certified volleyball coach and reviewed by three expert PE teachers for content validity, item clarity, and adherence to sound test and rubric construction; all reviewers approved them for use, following the logic of the content validity index (Polit & Beck, 2006), Cronbach's α (Tavakol & Dennick, 2011), and inter-rater reliability of the skills checklist (ICC with 95% CI; Koo & Li, 2016).

Procedures and, if Relevant, the Time Frame

The procedure is summarized in Figure 2. Written permission was obtained from the Campus Dean or Academic Head and the Program Coordinator, and ethical clearance was secured before any data collection. The knowledge test was then administered to all participants in a controlled classroom setting. Immediately afterwards, skills were assessed in the gymnasium or on the volleyball court under standardized conditions, with trained researchers, calibrated by the certified coach, rating each participant. Students with scheduling conflicts were accommodated in alternative time slots within the data-collection window. Data were then encoded, anonymized, and organized for analysis.

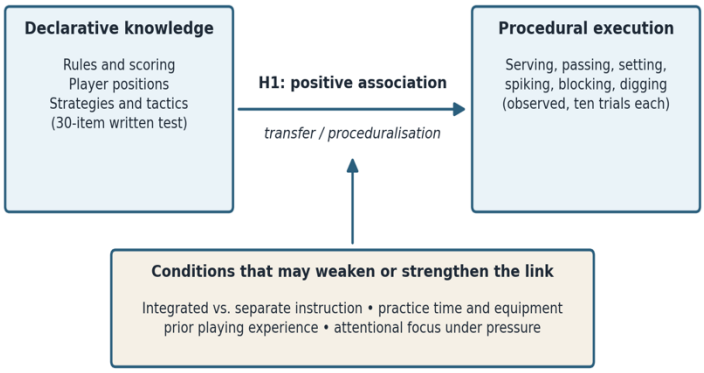

Figure 2. Data-Gathering Procedure

Analysis Plan

Descriptive statistics (frequencies, means, standard deviations, and MPS) were computed for the knowledge and skills scores. The association between total knowledge and total skills performance was estimated with Pearson's product-moment correlation, tested two-tailed at $\alpha = .05$. Because a p-value alone conveys little about magnitude or precision, we also report the 95% CI of r (Fisher z transformation), the coefficient of determination (r^2), and a sensitivity analysis of the smallest detectable correlation (Lakens, 2022). Magnitude was described using the study's benchmark scale (negligible to low, .00–.20, up to very high, .80–1.00) and, for context, the empirically derived guideline that r values of .10, .20, and .30 are relatively small, typical, and relatively large in individual-differences research (Gignac & Szodorai, 2016; see also Schober et al., 2018). Mean scores derived from five-point ratings were treated as interval-level data, a common and defensible practice for summed or averaged Likert-type scores (Norman, 2010). Several features of the method bound the inferences that can be drawn. The cross-sectional design precludes causal or directional inference. Enrolling the whole eligible cohort removes sampling error within that cohort, but it does not license generalization to other institutions. Both instruments were researcher-made and validated primarily through expert judgment. The skills checklist assessed technique over standardized trials rather than tactical decision-making during play, so it captures execution more than game performance, and prior playing experience was not measured as a covariate.

RESULTS AND DISCUSSION

Results

Students obtained a mean score of 20.60 out of 30 (SD = 4.08), an MPS of 68.67%, interpreted as moving towards mastery (Table 1). Performance was highest for strategies and tactics (MPS = 72.90%) and lowest for rules and scoring (MPS = 65.30%, average), with player positions in between (MPS = 67.80%). Item-level inspection showed that students handled broad tactical ideas, such as recognizing legitimate offensive strategies and time-out adjustments, better than technical regulatory details such as collegiate-specific substitution limits and rotation direction. A similar pattern appeared for positions: students readily identified distinctive roles such as the libero but were less consistent on nuanced responsibilities such as the setter's rotational timing.

Table 1. Level of Volleyball Knowledge of Third-Year BPED Students (N = 73)

Indicator	M	SD	MPS (%)	Interpretation
Rules and scoring	6.53	79	65.30	Average
Player positions	6.78	47	67.80	Moving towards mastery
Strategies and tactics	7.29	81	72.90	Moving towards mastery
Total (max = 30)	20.60	4.08	68.67	Moving towards mastery

Note. Each indicator had 10 items (maximum = 10). MPS = Mean Percentage Score. MPS scale: 96–100% = Mastered; 86–95% = Closely approximating mastery; 66–85% = Moving towards mastery; 35–65% = Average; 16–34% = Low; 5–15% = Very low; 0–4% = No mastery. Overall skills performance was rated good (M = 2.66, SD = 1.15; Table 2). Serving was the strongest skill (M = 3.34), followed by passing (M = 3.04) and spiking (M = 2.69), all in the good range. Setting (M = 2.35),

digging (M = 2.35), and blocking (M = 2.24) were rated only fair and were the least developed skills, with a spread of 1.10 points between the strongest and weakest skill.

Item-level ratings showed a consistent pattern. Students scored highest on static, preparatory components, such as maintaining a stable serving stance or forming a passing platform, and lowest on dynamic components requiring coordinated lower-body engagement: leg-driven force generation in passing (M = 2.88) and digging (M = 2.19), jump timing in blocking (M = 2.18), and landing mechanics in spiking (M = 2.60). The recurrence of this pattern across passing, digging, and blocking points to a shared weakness in lower-body integration rather than isolated deficits in single skills.

Table 2. Level of Volleyball Skills Performance of Third-Year BPED Students (N = 73)

Skill	M	SD	Interpretation
Serving	3.34	1.05	Good
Passing	3.04	1.01	Good
Setting	2.35	1.03	Fair
Spiking	2.69	1.15	Good
Blocking	2.24	1.21	Fair
Digging	2.35	1.05	Fair
Overall	**2.66**	**1.15**	**Good**

Note. Five-point scale (1 = Poor, 5 = Excellent). Interpretation ranges: 1.00–1.80 = Poor; 1.81–2.60 = Fair; 2.61–3.40 = Good; 3.41–4.20 = Very good; 4.21–5.00 = Excellent.

Total knowledge and total skills performance were positively but weakly correlated, r(71) = .141, 95% CI [−.09, .36], p = .233 (Table 3). The association was not statistically significant, so the null hypothesis of no linear association could not be rejected. Knowledge accounted for about 2% of the variance in skills performance (r^2 = .02). The confidence interval spans a slightly negative to a moderate positive association. The sensitivity analysis showed that the study could reliably detect only correlations of |r| ≥ .32. The result should therefore be read as an absence of evidence for a substantial association, not as evidence that no association exists.

Table 3. Correlation between Volleyball Knowledge and Skills Performance (N = 73)

Variables		95% CI	^{2}	(71)		Decision
Knowledge – Skills	141	[−.09, .36]	020	20	233	No significant relationship

Note. Pearson product-moment correlation, two-tailed, α = .05. Interpretation on the study scale: negligible to low. The 95% CI was computed with the Fisher z transformation. With N = 73, power = .80 for |r| ≥ .32.

Discussion

Students who were enrolled in a dedicated Team Sport course had not fully consolidated their volleyball knowledge (MPS = 68.67%), and the weakest domain was the one most closely tied to officiating and refereeing: rules and scoring. This pattern may reflect an instructional emphasis on broadly applicable tactical concepts over granular regulatory detail, although the present design cannot test that explanation. The relatively stronger tactical knowledge is consistent with the growing emphasis on tactical understanding in game-based approaches (Manninen et al., 2025; Stolz & Pill, 2014), and with the availability of validated tools for measuring declarative tactical knowledge in volleyball (Quinto et al., 2026; Sgrò et al., 2024).

The skills profile is best read through the classic distinction between closed and open skills. Serving is self-paced and relatively predictable, so it can be rehearsed alone and automatized early, whereas setting, blocking, and digging depend on perceiving an external event, selecting a response, and timing an action against it, which demands that the perceptual-decision stages of information

processing be loaded (Schmidt et al., 2019). Research on volleyball training constraints shows that tactical-technical behavior is sensitive to the conditions under which skills are practiced (Castro et al., 2022; Rodrigues et al., 2022), which suggests that isolated drilling may leave reactive skills underdeveloped. The low landing-mechanics rating in spiking, although only descriptive here, also warrants attention from an injury-prevention perspective.

The central finding is a small, non-significant association between knowledge and skills. Two cautions govern its interpretation. First, the 95% CI [−.09, .36] is compatible with a negligible association and with one that would be considered relatively large in individual-differences research (Gignac & Szodorai, 2016), and the study had adequate power only for $|r| \geq .32$; the data therefore do not show that knowledge and skill are unrelated, only that any association is unlikely to be strong in this cohort. Second, the result should not be over-interpreted as a test of information-processing stages, since the study measured two constructs concurrently and cannot locate where, if anywhere, transfer breaks down. Four explanations deserve consideration: knowledge may become procedural only through practice, so students with similar declarative knowledge can differ in execution because they differ in practice history (Anderson, 1982); explicit rule knowledge is not necessarily what performers draw on during rapid execution, and conscious control can disrupt well-learned movement under pressure (Masters, 1992; Wulf, 2013); the two measures may simply tap different constructs, since the knowledge test emphasized rules, positions, and tactics while the checklist rated technique with limited tactical decision making, which is why game-performance instruments such as the Game Performance Assessment Instrument have been developed (Oslin et al., 1998); and unmeasured factors such as prior playing experience, motivation, and physical conditioning probably explain more variance in skills than declarative knowledge does (Gil et al., 2012).

Implications

For BPED programs, the findings caution against assuming transfer. Written knowledge tests and skills tests appear to capture largely distinct information, so both are needed to judge readiness to teach volleyball, and game-performance observation would give a more valid picture of applied tactical knowledge. Instructors may also consider lessons in which conceptual explanation is followed immediately by game-like application, so that students retrieve and use knowledge while performing. Because the study did not evaluate any intervention, these implications should be treated as hypotheses supported by the broader game-based literature, not as findings of this study.

Research Contribution

This study contributes empirical, context-specific evidence to Philippine physical education literature by directly testing, rather than assuming, the knowledge–skill relationship among BPED students. Theoretically, it refines the declarative-to-procedural framework by treating the strength of the knowledge–skill link as contingent on instructional design and measurement, rather than as a fixed property of cognitive architecture. Practically, it offers this institution's BPED program, and comparable programs elsewhere, empirical grounds for reconsidering curriculum sequencing, instructional strategy, and assessment design.

Limitations

This study has limitations. The cross-sectional correlational design cannot establish causality or direction. The single-institution cohort of 73 students limits generalizability and statistical power. Both instruments were researcher-made and validated mainly by expert judgment, and rater-based scoring may carry measurement error. Skills were assessed through standardized trials rather than live play, and only total scores were correlated, so relationships between specific knowledge domains and specific skills were not examined. Prior playing experience, motivation, and physical conditioning were not measured and may confound the association.

Suggestions

Future studies should use larger, multi-institution samples powered to detect $r \approx .20$ (roughly 195 participants for 80% power), and should examine domain-level associations, for example between tactical knowledge and setting, blocking, and digging. Pairing validated declarative tactical knowledge tests (Quinto et al., 2026) with game-performance observation (Oslin et al., 1998) would

test whether the association strengthens when execution is assessed in play. Quasi-experimental or longitudinal designs comparing integrated and sequential instruction, for example, Teaching Games for Understanding or Sport Education models, would show whether deliberately bridging knowledge and execution strengthens the link over time, and mixed-methods work could explore the mechanisms qualitatively.

CONCLUSION

Third-year BPED students in this study showed knowledge that was moving towards mastery and skills performance that was good overall, with serving strongest and blocking weakest. Knowledge and skills performance were weakly and non-significantly associated ($r = .141$, 95% CI [−.09, .36]), which answers the research question: there is no evidence of a substantial association between declarative volleyball knowledge and skill execution in this cohort, although the modest sample leaves a small-to-moderate association possible. The results suggest that BPED programs should not assume that knowledge will transfer automatically to performance; they should assess both, and test instructional designs that require students to use what they know while they play. Replication in larger and more diverse samples, with game-performance measures, is needed before firm curricular conclusions are drawn.

ACKNOWLEDGMENT

The authors thank the participating BPED students, the certified volleyball coach, and the expert physical education teachers who reviewed the instruments.

AUTHOR CONTRIBUTION STATEMENT

MA conceived the study, developed the instruments, and led data collection and analysis. IL contributed to instrument validation, data collection, and manuscript drafting. SO supervised the study and critically reviewed the manuscript. All authors read and approved the final manuscript.

AI DISCLOSURE STATEMENT

The authors used Claude (Anthropic) during the preparation of this work for language editing, statistical cross-checking, reference verification, and formatting the manuscript to the journal template. After using the tool, the authors thoroughly reviewed and edited the content as needed and take full responsibility for the content of the publication.

CONFLICTS OF INTEREST

The authors declare that they do not have any conflicts of interest related to the publication of this article, whether financial, institutional, or personal, that could influence the research process, analysis, writing, or publication of this manuscript.

REFERENCES

Anderson, J. R. (1982). Acquisition of cognitive skill. *Psychological Review, 89*(4), 369–406. https://doi.org/10.1037/0033-295X.89.4.369

Boke, H., Aygun, Y., Tufekci, S., Yagin, F. H., Canpolat, B., Norman, G., Prieto-González, P., & Ardigò, L. P. (2025). Effects of cooperative learning on students' learning outcomes in physical education: A meta-analysis. *Frontiers in Psychology, 16*, Article 1508808. https://doi.org/10.3389/fpsyg.2025.1508808

Breed, R., Lindsay, R., Kittel, A., & Spittle, M. (2025). Content and quality of comparative tactical game-centered approaches in physical education: A systematic review. *Review of Educational Research*. https://doi.org/10.3102/00346543241227236

British Educational Research Association. (2024). *Ethical guidelines for educational research* (5th ed.). BERA.

Bull, F. C., Al-Ansari, S. S., Biddle, S., Borodulin, K., Buman, M. P., Cardon, G., Carty, C., Chaput, J.-P., Chastin, S., Chou, R., Dempsey, P. C., DiPietro, L., Ekelund, U., Firth, J., Friedenreich, C. M., Garcia, L., Gichu, M., Jago, R., Katzmarzyk, P. T., ... Willumsen, J. F. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *British Journal of Sports Medicine, 54*(24), 1451–1462. https://doi.org/10.1136/bjsports-2020-102955

Castro, H. de O., Praça, G. M., Mesquita, I. M. R., Afonso, J., Costa, G. D. C. T., Moreno, M. P., Morales, J. C. P., & Greco, P. J. (2022). The impact of pendular model on decision-making and tactical-technical performance of U18 male volleyball players. *International Journal of Sports Science & Coaching*. https://doi.org/10.1177/17479541211048586

Culajara, C. J. (2022). The impact of video-based presentations on BPED students' learning performance. *Edu Sportivo: Indonesian Journal of Physical Education, 3*(2), 137–148. https://doi.org/10.25299/es:ijope.2022.vol3(2).9418

Fernandez, Y., Busalanan, C., Busalanan, R., Orapa, L., Dapar, J., & Bulilawa, R. Y. (2023). Level of volleyball skills and factors affecting students' skill acquisition: Towards the development of an instructional material. *Psychology and Education: A Multidisciplinary Journal, 15*(9), 902–910. https://doi.org/10.5281/zenodo.10431637

Gignac, G. E., & Szodorai, E. T. (2016). Effect size guidelines for individual differences researchers. *Personality and Individual Differences, 102*, 74–78. https://doi.org/10.1016/j.paid.2016.06.069

Gil, A., Moreno, M. P., García-González, L., Moreno, A., & Del Villar, F. (2012). Analysis of declarative and procedural knowledge in volleyball according to the level of practice and players' age. *Perceptual and Motor Skills, 115*, 632–644. https://doi.org/10.2466/30.10.25.PMS.115.5.632-644

Kannekens, R., Elferink-Gemser, M. T., & Visscher, C. (2011). Positioning and deciding: Key factors for talent development in soccer. *Scandinavian Journal of Medicine & Science in Sports, 21*(6), 846–852. https://doi.org/10.1111/j.1600-0838.2010.01104.x

Koo, T. K., & Li, M. Y. (2016). A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *Journal of Chiropractic Medicine, 15*(2), 155–163. https://doi.org/10.1016/j.jcm.2016.02.012

Lakens, D. (2022). Sample size justification. *Collabra: Psychology, 8*(1), Article 33267. https://doi.org/10.1525/collabra.33267

Mahedero, M. P., Calderón, A., Hastie, P., & Arias-Estero, J. L. (2021). Grouping students by skill level in mini-volleyball: Effect on game performance and knowledge in sport education. *Perceptual and Motor Skills*. https://doi.org/10.1177/00315125211021812

Manninen, M., Magrum, E., Campbell, S., & Belton, S. (2025). The effect of game-based approaches on decision-making, knowledge, and motor skill: A systematic review and a multilevel meta-analysis. *European Physical Education Review*. https://doi.org/10.1177/1356336X241245305

Masters, R. S. W. (1992). Knowledge, knerves and know-how: The role of explicit versus implicit knowledge in the breakdown of a complex motor skill under pressure. *British Journal of Psychology, 83*(3), 343–358. https://doi.org/10.1111/j.2044-8295.1992.tb02446.x

National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. (1979). *The Belmont report: Ethical principles and guidelines for the protection of human subjects of research*. U.S. Department of Health and Human Services.

Norman, G. (2010). Likert scales, levels of measurement and the "laws" of statistics. *Advances in Health Sciences Education, 15*(5), 625–632. https://doi.org/10.1007/s10459-010-9222-y

Oslin, J. L., Mitchell, S. A., & Griffin, L. L. (1998). The Game Performance Assessment Instrument (GPAI): Development and preliminary validation. *Journal of Teaching in Physical Education, 17*(2), 231–243. https://doi.org/10.1123/jtpe.17.2.231

Polit, D. F., & Beck, C. T. (2006). The content validity index: Are you sure you know what's being reported? Critique and recommendations. *Research in Nursing & Health, 29*(5), 489–497. https://doi.org/10.1002/nur.20147

Popović, S., Jaksic, D., Matic, R., & Guzvic, M. (2021). Effects of teaching program based on Teaching Games for Understanding model on volleyball skills and enjoyment in secondary school students. *Sustainability, 13*(2), Article 606. https://doi.org/10.3390/su13020606

Quinto, A., Nicolosi, S., Barca, M., Mollame, F., Schembri, R., & Sgrò, F. (2026). The development and validation of a Declarative Tactical Knowledge Test (DTK-T) in volleyball. *International Journal of Sports Science & Coaching*. https://doi.org/10.1177/17479541251367008

Rara, S. M., & Bulilawa, R. Y. (2026). Volleyball skill level assessment as basis for a training program among BPED students. *International Journal of Physical Education, Sports and Health, 13*(4), 343–347. https://doi.org/10.22271/kheljournal.2026.v13.i4d.4439

Rodrigues, M. C. J., Rocha, A. C. R., Lira, C. A. B., Figueiredo, L. S., Lima, C. O. V., Laporta, L., & Costa, G. D. C. T. (2022). How small-sided games' court dimensions affect tactical-technical behavior in beginner volleyball athletes. *International Journal of Sports Science & Coaching*. https://doi.org/10.1177/17479541211058447

Schmidt, R. A., Lee, T. D., Winstein, C. J., Wulf, G., & Zelaznik, H. N. (2019). *Motor control and learning: A behavioral emphasis* (6th ed.). Human Kinetics.

Schober, P., Boer, C., & Schwarte, L. A. (2018). Correlation coefficients: Appropriate use and interpretation. *Anesthesia & Analgesia, 126*(5), 1763–1768. https://doi.org/10.1213/ANE.0000000000002864

Sgrò, F., Quinto, A., Lipoma, M., & Stodden, D. (2024). A multidimensional approach to talent identification in youth volleyball through declarative tactical knowledge and functional fitness. *Journal of Functional Morphology and Kinesiology, 9*(1), Article 29. https://doi.org/10.3390/jfmk9010029

Stojanović, D., Stojiljković, N., Stanković, R., Aleksandrović, M., Pavlović, R., & Scanlan, A. T. (2023). School-based TGfU volleyball intervention improves physical fitness and body composition in primary school students: A cluster-randomized trial. *Healthcare, 11*(11), Article 1600. https://doi.org/10.3390/healthcare11111600

Stolz, S., & Pill, S. (2014). Teaching games and sport for understanding: Exploring and reconciling its relationship with coaching, sport and physical education. *European Physical Education Review, 20*(1), 36–71. https://doi.org/10.1177/1356336X13496001

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education, 2*, 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd

Trecroci, A., Duca, M., Cavaggioni, L., Rossi, A., Scurati, R., Longo, S., Merati, G., Alberti, G., & Formenti, D. (2021). Relationship between cognitive functions and sport-specific physical performance in youth volleyball players. *Brain Sciences, 11*(2), Article 227. https://doi.org/10.3390/brainsci11020227

von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., & Vandenbroucke, J. P. (2008). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: Guidelines for reporting observational studies. *Journal of Clinical Epidemiology, 61*(4), 344–349. https://doi.org/10.1016/j.jclinepi.2007.11.008

World Medical Association. (2013). World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects. *JAMA, 310*(20), 2191–2194. https://doi.org/10.1001/jama.2013.281053

Wulf, G. (2013). Attentional focus and motor learning: A review of 15 years. *International Review of Sport and Exercise Psychology, 6*(1), 77–104. https://doi.org/10.1080/1750984X.2012.723728