

Investigating a hybrid learning approach to enhance track and field techniques in preservice physical education teachers

JONGHO MOON¹, DONGWOO LEE²

¹Department of Kinesiology, Montclair State University, USA

²Department of Physical Education, Gwangju National University of Education, SOUTH KOREA

Published online: December 31, 2025

Accepted for publication: December 15, 2025

DOI:10.7752/jpes.2025.12273

Abstract

Physical education teacher education (PETE) programs are increasingly adopting innovative instructional strategies to prepare preservice teachers for the multitude of demands of contemporary physical education. Among these innovations, hybrid learning, which intentionally integrates face-to-face and online instructional environments, has gained recognition as a promising model to improve both pedagogical and performance outcomes. Therefore, in this study, we investigated the effectiveness of a hybrid learning approach in improving preservice physical education teachers' track-and-field performance. During the Fall 2020 semester, 34 preservice teachers ($Mage = 20.73 \pm 1.45$) enrolled in a hybrid-format track-and-field course to participate in this quasi-experimental study. In the course design, we strategically combined in-person sessions, emphasizing skill demonstration and feedback, with online instruction (synchronous and asynchronous formats) centered on content knowledge, technical analysis, video-based modeling/assignments, and reflective practice. We used the South Carolina Physical Education Assessment Tool at baseline and post-intervention to evaluate the participants' technique performance in the 100-meter sprint, 400-meter relay, long jump, shot put, and discus throw. Based on paired-sample t-tests, we examined changes across skill domains at the $p < 0.05$ significance level. Results indicated significant improvements in the 100-meter sprint, shot put, and discus throw ($p < 0.05$), whereas the 400-meter relay demonstrates a marginal but not a significant increase, similar to that in the long jump ($p > 0.05$). These findings reveal that a hybrid learning approach can meaningfully improve preservice teachers' sport-specific technical performance, suggesting that deliberately integrated digital and physical learning environments can sustain and even enhance instructional quality in PETE. Our study contributes to the growing body of evidence supporting technology-integrated instructional design in PETE. Illustrating how hybrid learning fosters skill acquisition, reflection, and performance improvement, we accentuate the potential of hybrid models to bolster PETE curricula. Future research should advance this line of inquiry to other sport domains and pedagogical contexts to delineate optimum practices for designing hybrid courses and ensuring high-quality, skill-based teacher preparation.

Keywords: Teacher preparation; instructional technology; sport skills; psychomotor performance

Introduction

Physical Education Teacher Education (PETE) programs can be instrumental in preparing preservice teachers to deliver high-quality instruction and to facilitate lifelong participation in physical activity (Society of Health and Physical Educators [SHAPE] America, 2017; 2024). The PETE programs should constantly update their instructional approaches to promote both pedagogical and psychomotor competence in future educators to address the diverse and developing demands of contemporary school environments. For PETE, solid personal performance in fundamental and sport-specific skills is pivotal because preservice teachers must possess precise skills, provide accurate instructional cues, and detect movement errors when teaching K–12 learners (SHAPE America, 2017). This level of competence is pivotal for facilitating a positive learning environment and ensuring K–12 students receive the optimum instruction. This approach can ultimately foster their confidence and engagement in physical education and sports.

As PETE programs continue their nationwide expansion and diversify their instructional approaches, the central integration of innovative models, including hybrid learning, has emerged as substantially critical (Álvarez-Chaves & Saborio-Taylor, 2025). This model improves accessibility, supports flexible learning opportunities, and fosters active engagement through varied instructional modes (Ahlin, 2020; Gudoniene et al., 2025; Raes et al., 2020). Improved accessibility and flexible participation support a more diverse preservice teacher population and better prepare future educators for the varied and evolving demands of contemporary school environments (Archambault & Kennedy, 2014; Atmacasoy & Aksu, 2018; Kwon, 2020). The hybrid model in PETE is pivotal because it integrates theoretical knowledge with practical application, enabling future educators to address diverse learning contexts and student needs effectively. Hybrid learning has been most efficient when educators use a face-to-face approach and integrate online components into a single, continuous

learning setting rather than operating as parallel instructional tracks (Singh et al., 2021). Hybrid learning and blended formats differ because online and face-to-face components have a fully integrated and inseparable structure, leading to a continuous learning environment rather than a set of additive instructional parts. This distinction applies explicitly to PETE because hybrid designs that connect online analysis with face-to-face performance practice can yield more meaningful learning than models that integrate digital activities alongside conventional teaching (Osorio Gómez & Duarte, 2012).

The PETE studies with hybrid designs have focused on multiple content areas, including volleyball assessment technique (Moon & Park, 2023), ballet technique (Bayyat, 2020), and fundamental movement skill analysis in mastery-based online modules (Baert, 2024). Moreover, they encompass discrete throwing skills, video analysis, and peer teaching (Beseler et al., 2024) and report equivalent or improved psychomotor outcomes coinciding with improvements in learner motivation and engagement. However, empirical evidence demonstrating the effectiveness of hybrid design in PETE for the development of complex, technical psychomotor skills is scarce. This gap is pivotal because PETE elucidates the simultaneous development of instructional knowledge and performance-based skill proficiency.

Hybrid models have been additive, lacking a complete integration (Fletcher & Hordvik, 2022). This challenge is remarkable in core sport activity courses, where no recommended approach effectively fosters skills development within PETE programs. Track and field is a promising core sport for exploring hybrid efficacy and gathering empirical evidence. Track and field is a foundational component of K–12 physical education and includes diverse events, such as sprinting, relay running, jumping, and throwing. These events are critical because each requires precise biomechanical execution and consistent performance optimization. Preservice must demonstrate their technical competence before they receive teaching. Moreover, limited research has examined whether hybrid modalities that combine online analysis, video-based feedback, and reflective in-person learning can yield psychomotor performance outcomes comparable to or superior to those of traditional face-to-face instruction across the comprehensive skill set of track and field.

Hence, our study addresses this gap by examining the effectiveness of an integrated hybrid learning modality on preservice physical education teachers' performance techniques in a track-and-field course. The course had both online (synchronous and asynchronous) and in-person components over eight weeks, focusing on technical execution, feedback, and reflection through skill-specific events. These events comprised the 100-meter sprint, 400-meter relay, long jump, shot put, and discus throw. Based on empirical evaluation, this study assessed changes in participants' pre- and post-course performance outcomes and collected qualitative feedback concerning their experiences in the hybrid format. The findings can help understand the feasibility and impact of hybrid learning on psychomotor competence in PETE programs.

Methods

Participants and Setting

Participants included 34 preservice physical education teachers ($M_{\text{age}} = 20.73 \pm 1.45$; 21 males, 13 females) enrolled in two sections of a hybrid-format track-and-field class during the Fall 2020 semester at a public university in the Southeastern United States. The section of the course lasted eight weeks, meeting three times per week for 50-minute sessions on a rotational schedule and involved both on-campus and online instructional components. All participants were undergraduate students: freshman (12), Sophomore (15), and junior (7), and pursued a major in PETE. This course was part of the required professional preparation sequence that focused on sport activity-based instruction within the PETE curriculum. The university's outdoor athletic facility hosted face-to-face sessions, which focused on technical skill instruction and performance practice. Online sessions were in both synchronous (via Zoom) and asynchronous (via the university's learning management system, Blackboard) formats. All participants provided informed consent, allowing their performance data to be used for research purposes. All procedures adhered to institutional ethical guidelines for research involving human participants. The study was approved by the Institutional Review Board at the University of South Carolina (Protocol #00107239).

Hybrid Track and Field Course Program

The hybrid track and field course involved engagement in and instruction of core track and field events, focusing on applied performance skills, covering advanced techniques, and utilizing appropriate pedagogical/instructional strategies. This hybrid course has three specific learning outcomes: (a) Exhibit proficiency in executing the sport skills suitable for the specific activities. These activities include the 100-meter sprint, 400-meter relay, long jump, shot put, and discus throw; (b) Describe and/or explain the applicable history, rules, strategies, current research, safety, and etiquette concerning these specific track and field events; and (c) Specify and/or explain the benefits of engaging in track and field activities for both physical and mental health. In the course, preservice physical education teachers developed a well-rounded understanding of the sport and its benefits for overall well-being.

Each week's class included a structured face-to-face practical component and a corresponding online learning activity. The in-person sessions involved technical execution, instructor and peer feedback, and collaborative performance practice. The online sessions strengthened conceptual understanding through guided

worksheets on sport-specific knowledge, targeted discussion tasks (e.g., identifying key factors that improve technique execution), and video-based self-reflection assignments. The hybrid format ensured consistent engagement across both environments and supported the progressive development of performance techniques. To that end, online assignments included two foundational worksheets that covered the history, rules, and performance indicators of track and field and addressed links to physical and mental well-being. Using the South Carolina Physical Education Assessment Program (SCPEAP; Rink & Mitchell, 2003; Rink & Williams, 2003) rubric, students completed a Rubric Assignment in which they recorded and self-assessed their performance. As part of the Match Clip Assignment, students explored a relay race video and exchanged peer comments through the discussion board. Conversely, the Practice Video Proof recorded individual practice outside scheduled sessions. Moreover, students created a Mini Game Plan, suggesting a developmentally appropriate track-and-field activity for school settings. The course concluded with a Final Skills Assessment, in which we evaluated participants on four events using SCPEAP criteria, and a Final Written Exam that assessed knowledge from the earlier worksheets and provided feedback on the hybrid learning experiences. These components provided multiple modes of engagement and assessment, ensuring that preservice teachers acquired both the practical proficiency and conceptual understanding required to conduct and teach track and field effectively. Table 1 illustrates the complete weekly schedule, instructional format, and learning content. Additionally, Figure 1 provides examples of online and face-to-face instructional sessions, such as sprint drills, relay practices, and virtual reflection activities.

Table 1. Weekly Course Schedule with Format and Content

Time	Format	Contents
Week 1	Face-to-face	Track and field skills pre-assessments Basic running techniques and introduction to the 100-meter sprint
	Online (synchronous)	Worksheet 1: Understanding the history, rules, strategies, recent research, safety, and etiquette associated with track and field
Week 2	Face-to-face	Advanced sprinting techniques and application tasks
	Online (synchronous)	Worksheet 2: Identifying key performance indicators for sprinting and relays; understanding the mental and physical health benefits of track and field
Week 3	Face-to-face	Introduction to 400-meter relay and team coordination drills
	Online (synchronous)	Worksheet 3: Teaching and coaching skills, analyzing relay exchange techniques, and identifying common errors
Week 4	Face-to-face	Long jump techniques and practice
	Online (asynchronous)	Video of individual practice in track and field techniques outside of class, and evaluation using an established observation rubric form
Week 5	Face-to-face	Introduction to throwing techniques and application tasks
	Online (synchronous)	Understanding the roles of strength, speed, and technique in shot put and discus throw
Week 6	Face-to-face	Discus throw techniques and practical application
	Online (synchronous)	Appropriate developmental sequence of instruction for shot put and discus throw; understanding the physics of the throw
Week 7	Face-to-face	Track and field skills post-assessments
	Online (asynchronous)	Do a match clip assignment regarding the track and field game, and comment on one other student's assignment.
Week 8	Face-to-face	Modified mini-competition: sprint, relay, long jump, shot put, and discus throw.

Figure 1. Various scenes from the hybrid track-and-field course



Instrumentation

We collected performance data using the SCPEAP rubrics (Rink & Mitchell, 2003). The SCPEAP instrument is a standardized, widely used tool to assess psychomotor skill performance in physical education contexts. In this study, we used event-specific rubrics to assess participants' techniques in five events: the 100-meter sprint, 400-meter relay, long jump, shot put, and discus throw. Each rubric delineated performance criteria addressing multiple technique phases, such as preparation, execution, and follow-through. Specific indicators demonstrated body alignment, coordination, rhythm, force application, and control. We used a 4-point proficiency scale ranging from 1 = Beginning to 4 = Proficient, which enabled us to quantify pre- and post-assessments.

The course instructor and a trained teaching assistant conducted all live-performance assessments. Both evaluators had prior experience using the SCPEAP tool and completed an extended calibration process before data collection to ensure scoring consistency. Calibration involved reviewing the SCPEAP scoring manual together, exploring event-specific performance criteria, and elucidating the meaning of each proficiency level across all rubric items. Subsequently, the evaluators jointly assessed a set of archived sample performance videos, representing multiple proficiency levels.

After scoring each sample independently, the evaluators compared their ratings, specified discrepancies, and reconsidered the rubric language to clarify interpretation. The calibration process continued until the evaluators exhibited stable agreement in applying all rubric indicators across events. To strengthen consistency, both evaluators conducted a short 20-minute rehearsal scoring session onsite before the first pre-assessment, verifying shared expectations for the observation procedure, athlete positioning, and scoring timing. We used identical scoring procedures, evaluators, and event protocols for both the pre- and post-assessments to sustain reliability in the study.

Data Collection

Data collection occurred in Week 1 (pre-assessment) and Week 7 (post-assessment) of the eight-week course. During pre-assessment, participants completed each of the five track-and-field events under standardized conditions. Before formally assessing their performance, we provided them with one or two practice trials. We evaluated each performance using real-time scores and the SCPEAP rubrics. For all testing, we used the university's outdoor athletic facility to maintain consistent environmental conditions. Throughout the semester, participants pursued the previously described hybrid instructional sequence, which combined face-to-face technical sessions with online assignments, reflection tasks, and peer interactions. These learning activities boosted participants' technical proficiency between the two testing periods.

The post-assessment phase in Week 7 and the pre-assessment had identical procedures. The Final Skills assessment involved culminating the evaluation of participants' technical ability, focusing on four key events (100-meter sprint, 400-meter relay, long jump, shot put, and discus throw). We compiled performance scores from both assessment phases for statistical analysis to determine changes in technical proficiency across the course period.

Data Analysis

We conducted descriptive and inferential statistical analyses to assess changes in participants' performance from pre- to post-assessment. We employed the Shapiro–Wilk test (Shapiro & Wilk, 1965) to evaluate the normality of data for each event. Results confirmed that the data met the assumptions for parametric testing ($p > 0.05$). Subsequently, we conducted paired-sample t-tests to determine whether significant differences existed between pre- and post-assessment means for each of the five track-and-field events. We used SPSS statistical software (version 26.0; IBM Corp., Armonk, NY, USA) for the analyses, with a significance level of $p < 0.05$. Descriptive analysis involved calculating means and standard deviations for all variables, grouped by the event type, to demonstrate where significant differences occurred.

Results

The following section outlines the statistical results of the pre- and post-assessments conducted for five track-and-field events. Results revealed that the data met the assumptions for parametric testing ($p > 0.05$). We observed significant improvements in participants' performance techniques following completion of the hybrid-format course. Statistical analyses demonstrated gains in the 100-meter sprint, shot put, and discus throw events ($p < 0.05$). Even though the 400-meter relay scores increased from pre- to post-assessment, the difference was not significant ($p = 0.27$).

We did not find a significant change in the long jump ($p = 0.75$). Shot put and discus throw events demonstrated the largest mean score increases, followed by the 100-meter sprint. The 400-meter relay displayed moderate improvement, whereas the long jump remained relatively stable between the two assessments. Table 2 illustrates the mean pre- and post-assessment scores, standard deviations, and p-values for each event.

Table 2. Comparisons of pre- and post-course performance techniques in track and field events

Event	Pre-assessment (Mean $\pm$ SD)	Post-assessment (Mean $\pm$ SD)	t(33)	P-value
100-meter sprint	15.78 $\pm$ 1.41	18.45 $\pm$ 1.12	2.53	0.017*
400-meter relay	14.56 $\pm$ 2.23	17.89 $\pm$ 2.12	1.12	0.272*
Long jump	13.89 $\pm$ 1.75	14.03 $\pm$ 1.79	0.32	0.751
Shot put	17.27 $\pm$ 2.56	20.25 $\pm$ 2.44	2.25	0.031*
Discus throw	18.43 $\pm$ 3.34	21.12 $\pm$ 3.10	2.79	0.010**

* $p < 0.05$, ** $p < 0.01$

Discussion

The objective of this study was to explore the efficacy of a hybrid learning modality in enhancing preservice physical education teachers' performance techniques in track and field. The findings revealed notable improvements in three of the five assessed events, specifically the 100-meter sprint, shot put, and discus throw, suggesting that a structured hybrid course could effectively enhance psychomotor performance in skill-based PETE coursework. Although the 400-meter relay and the long jump did not show a significant increase in mean performance, the overall results suggest that hybrid instruction can be viable for developing and maintaining performance proficiency in PETE programs. Our findings provide empirical evidence that hybrid learning can effectively support technical skill development in PETE. The notable gains in the 100-meter sprint, shot put, and discus indicate that when carefully designed, hybrid courses can produce meaningful improvements in both running and throwing techniques. Furthermore, these results underscore that the quality of integration, rather than modality alone, is a key determinant of success, aligning with studies demonstrating that mastery-based or video-augmented online modules improve movement analysis and motor learning when tightly integrated with face-to-face practice (Baert, 2019; Elsissey, 2013). These results are consistent with previous studies indicating that blended instructional formats combined with in-person practice aligned with technology-mediated learning facilitate engagement and elevate motor performance (Wang et al., 2024).

Research on hybrid learning further demonstrates that the most meaningful learning gains occur when one deliberately designs instructional components to form a continuous, interconnected learning process, rather than treating them as separate or supplementary tasks (Alonso et al., 2005; Osorio Gómez & Duarte, 2012; Singh, 2017). Further, Beseler et al. (2024) report that video-supported hybrid instruction can notably enhance specific sport techniques. In the present study, we utilized a sustained, integrated course design over eight weeks, suggesting that a consistent, bidirectional feedback loop could support the acquisition of complex, demanding skills. Our study's positive outcomes in shot put and discus throw reinforce the value of visual feedback and online-offline integration for technique refinement. In particular, the observed improvements in core track and field techniques reveal that preservice physical education teachers can attain higher levels of performance competence within a hybrid format, which is pivotal for displaying skills, providing accurate cues, and modeling safe and effective movement in school settings.

Notably, our study provides evidence that hybrid formats can support the acquisition of technical skills required for PETE coursework. The hybrid model used in this course sustained the essential experiential components of physical skill instruction while offering flexible online learning opportunities that enabled students to analyze performance data and implement feedback independently. This balance between flexibility and structure sustains the quality and rigor of PETE preparation in developing instructional contexts. At the program level, these results posit that hybrid course designs can be instrumental in maintaining and purposefully advancing performance benchmarks that many PETE standards attribute to preservice teachers' own motor competence. Accordingly, PETE programs should diversify instructional approaches to meet their dual mission of developing teaching competence and technical proficiency. This finding aligns with previous evidence indicating that blended approaches reliably improve cognitive learning, motivation, and satisfaction—factors that support preservice teachers' engagement in skill-intensive coursework (Giannousi et al., 2014; Liu et al., 2022).

Although most participants' technique outcomes were positive, performance in the long jump did not exhibit a notable improvement, and the 400-meter relay displayed a marginal, but not significant, mean increase. The non-significant improvement for the 400-meter relay suggests that team-based coordination tasks may not align well with the current balance of online and in-person components. This finding is consistent with prior evidence indicating that hybrid formats are typically more effective for individual, technique-driven skills than for interdependent group skills that require real-time coordination and shared timing (Bain, 2012). Moreover, the non-significant improvement in the long jump, a skill with complex spatial coordination and kinetic sequencing, deserves special consideration. Fitts and Posner's (1967) three-stage model suggests that skills requiring higher coordination require additional time in the associative stage before movement patterns stabilize. Similarly, Gentile's (1972) two-stage model indicates that complex skills involving variable environments or multiple movement components demand larger practice variability and more targeted feedback for refinement. In this context, integrating structured in-person segmental practice (e.g., approach run, takeoff, and landing practiced separately) or increasing the frequency of formative feedback during practical sessions may address these challenges. Accordingly, curriculum design for hybrid PETE courses should consider equitable attention to all event types and allocate adequate time and instructional scaffolding for technique-intensive skills.

Future research and practical implications for PETE

Our findings have implications beyond the current track-and-field context. Hybrid learning can be broadly applicable across multiple physical education content areas, where both conceptual understanding and motor execution are pivotal. Future studies should address how hybrid instruction impacts various sports, movement patterns, and levels of task complexity. Future research should use designs such as randomized controlled trials or well-structured quasi-experimental comparisons with specified intervention and control groups to bolster the methodological rigor of this work. Through the use of such designs, researchers can conduct more robust comparisons among hybrid, face-to-face, and fully online delivery formats while accounting for pre-existing differences in skill level, prior experience, and course placement. Alongside psychomotor performance and motivation, future studies should incorporate more comprehensive metrics, including cognitive knowledge understanding, affective responses, and the ability to apply instructional strategies, pursuing the multidimensional outcome categories underlined in prior comprehensive reviews.

Hybrid learning, within the PETE context, can apply to multiple physical education content areas. For instance, PETE faculty can customize video-based modeling using GoReact platform and structured self-reflection tasks while teaching various sports techniques (Moon & Lee, 2022), and provide online analysis activities alongside rubric-based performance evaluations (SHAPE America, 2019). This approach supports tactical understanding in rubric-based performance evaluations in team sports. These applications illustrate that we can transfer core elements of this hybrid model to other sport-specific skill domains. Providing consistent feedback mechanisms and using validated rubrics can substantially boost instructional alignment and transparency. By systematically assessing these elements, scholars can develop robust hybrid models to prepare preservice teachers for the instructional and performance expectations of contemporary physical education.

Conclusion

Our study proves that hybrid learning effectively enhances preservice physical education teachers' track-and-field performance techniques. By integrating online and in-person instruction, we produced measurable improvements in sprinting and throwing performance, indicating a meaningful and engaging learning experience. Even though specific complex motor skills may require additional instructional adaptations, the hybrid approach used in our study is a practical and pedagogically sound strategy to prepare prospective physical educators. Future research should involve more diverse cohorts of preservice teachers to reinforce generalizability and address whether similar outcomes emerge across varied sports activity courses. Ongoing research can further clarify how we can optimize hybrid learning to support the dual objectives of psychomotor competence and pedagogical effectiveness in PETE programs.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Declaration of generative AI and AI-assisted technologies in the writing process

The authors declare that no generative AI or AI-assisted technologies were used in the writing process of this manuscript.

References

- Ahlin, E. M. (2020). A mixed-methods evaluation of a hybrid course modality to increase student engagement and mastery of course content in undergraduate research methods classes. *Journal of Criminal Justice Education*, 32(1), 22–41.
- Alonso, F., López, G., Manrique, D., & Viñes, J. M. (2005). An instructional model for web-based e-learning education with a blended learning process approach. *British Journal of Educational Technology*, 36(2), 217–235.
- Álvarez-Chaves, A., & Saborío-Taylor, S. (2025). Hybrid learning in higher education: Considerations for its implementation in course design. *Journal of Digital Educational Technology*, 5(1), ep2505.
- Archambault, L., & Kennedy, K. (2014). Teacher preparation for K–12 online and blended learning. In *Handbook of research on K–12 online and blended learning* (pp. 225–244).
- Atmacasoy, A., & Aksu, M. (2018). Blended learning at pre-service teacher education in Turkey: A systematic review. *Education and Information Technologies*, 23(6), 2399–2422.
- Baert, H., True, L., Madden, M., Pratt, E., & Gilbert, E. (2024). Exploring the perception and retention of movement analysis skills through online mastery-based modules. *JTRM in Kinesiology*, 10, 10–17.
- Bayyat, M. (2020). Blended learning: A new approach to teach ballet technique for undergraduate students. *Turkish Online Journal of Distance Education*, 21(2), 69–86.
- Beseler, B., Plumb, M. S., Spittle, M., Johnson, N. F., Harvey, J. T., & Mesagno, C. (2024). Examining single session peer-teaching instructional approaches on pre-service physical education teachers' throwing techniques. *Perceptual and Motor Skills*, 131(1), 246–266.
- Elsissy, A. L. Y. (2013). Effect of hybrid learning on student's satisfaction in faculty of physical education. *Ovidius University Annals, Series Physical Education and Sport/Science, Movement and Health*, 13, 396–403.

- Fitts, P. M., & Posner, M. I. (1967). *Human performance*. Brooks/Cole.
- Fletcher, T., & Hordvik, M. M. (2022). Miscibility in blended approaches to PETE practice. *Movimento*, 28(e28018), 1–16.
- Gentile, A. M. (1972). A working model of skill acquisition with application to teaching. *Quest*, 17(1), 3–23.
- Giannousi, M., Vernadakis, N., Derri, V., Antoniou, P., & Kioumourtzoglou, E. (2014). A comparison of student knowledge between traditional and blended instruction in a physical education in early childhood course. *Turkish Online Journal of Distance Education*, 15(1), 99–113.
- Gudoniene, D., Staneviciene, E., Huet, I., Dickel, J., Dieng, D., Degroote, J., Rocio, V., Butkiene, R., & Casanova, D. (2025). Hybrid teaching and learning in higher education: A systematic literature review. *Sustainability*, 17(2), 756.
- Kwon, E. H. (2020). Review of online learning in physical education teacher education (PETE) program. *Journal of Physical Education and Sport*, 20(6), 3560–3568.
- Liu, H., Zhu, J., Duan, Y., Nie, Y., Deng, Z., Hong, X., Haugen, M., Baker, J. S., & Liang, W. (2022). Development and students' evaluation of a blended online and offline pedagogy for physical education theory curriculum in China during the COVID-19 pandemic. *Educational Technology Research and Development*, 70(6), 2235–2254.
- Moon, J., & Lee, D. (2022). Bridging reflection theory and practices in physical education: A scoping review of teacher education. *Journal of Physical Education and Sport*, 22(3), 635–644.
- Moon, J., & Park, Y. (2023). Evaluation of assessment techniques for preservice physical education teachers in volleyball skills during blended learning. *Journal of Physical Education and Sport*, 23(3), 648–657.
- Osorio Gómez, L. A., & Duart, J. M. (2012). A hybrid approach to university subject learning activities. *British Journal of Educational Technology*, 43(2), 259–271.
- Raes, A., Detienne, L., Windey, I., & Depaepe, F. (2020). A systematic literature review on synchronous hybrid learning: Gaps identified. *Learning Environments Research*, 23(3), 269–290.
- Rink, J., & Mitchell, M. (2003). State-level assessment in physical education: The South Carolina experience [Monograph]. *Journal of Teaching in Physical Education*, 22(5), 471–472.
- Rink, J., & Williams, L. (2003). Chapter 1: Developing and implementing a state assessment program. *Journal of Teaching in Physical Education*, 22, 473–493.
- SHAPE America – Society of Health and Physical Educators. (2017). *National standards for initial physical education teacher education*. Human Kinetics.
- SHAPE America – Society of Health and Physical Educators. (2019). *PE metrics* (3rd ed.). Human Kinetics.
- SHAPE America – Society of Health and Physical Educators. (2024). *National physical education standards* (3rd ed.). Human Kinetics.
- Shapiro, S. S., & Wilk, M. B. (1965). An analysis of variance test for normality (complete samples). *Biometrika*, 52(3–4), 591–611.
- Singh, J. (2017). Enhancing student success in health care programs: Active learning in a hybrid format. *Journal of Instructional Pedagogies*, 18, 1–14.
- Singh, J., Steele, K., & Singh, L. (2021). Combining the best of online and face-to-face learning: Hybrid and blended learning approach for COVID-19, post-vaccine, and post-pandemic world. *Journal of Educational Technology Systems*, 50(2), 140–171.
- Wang, C., Yuan, Y., & Ji, X. (2024). Effects of blended learning in physical education on university students' exercise attitudes and basketball skills: A cluster randomized controlled trial. *BMC Public Health*, 24(1), 3170.