Article

Construction of a Smart Education-Supported Blended Teaching Model for Long Jump among Physical Education Majors in Chinese Universities

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Abstract: Long jump technique is characterized by a continuous movement sequence, extremely short durations of critical phases, and significant individual differences among learners. Traditional instructional approaches, including one-time demonstrations, uniform practice arrangements, and summative assessments, are insufficient to fully support students in developing stable movement representations and autonomous error-correction abilities. To meet the requirements of talent cultivation in university physical education programs, this study employs literature review, logical analysis, and instructional design research methods. Based on existing research on smart education and blended physical education, a blended teaching model is proposed around the technical chain of the long jump, including the approach run, take-off, flight, and landing phases. The proposed model consists of four interconnected components: pre-class task-driven cognitive preparation, in-class differentiated diagnostic practice, post-class evidence-based reflection, and multi-source process evaluation. The model uses movement videos as learning evidence, problem lists as task-oriented guidance, and differentiated practice as the core instructional approach, while integrating technical performance, error-correction progress, teaching expression, and safety organization into a unified evaluation framework. Theoretical analysis indicates that the value of digital technologies in long jump instruction does not lie in replacing face-to-face practice, but rather in extending observation and feedback opportunities, preserving evidence of technical changes, and improving the alignment between training tasks and students' individual foundations. The proposed model provides a practical instructional framework for the digital transformation of long jump courses in university physical education programs and establishes a foundation for future comparative classroom studies.

Keywords: smart education; physical education majors; long jump instruction; blended learning; movement feedback; process evaluation

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1. Introduction

Digital transformation in education is reshaping the organization of curriculum resources, teacher--student interactions, and learning assessment approaches in higher education. China Education Modernization 2035 emphasizes the need to promote the deep integration of information technology and education, and to advance the digital, intelligent, and personalized development of education, providing an important policy foundation for curriculum reform in universities [1]. For physical education major courses, however, digital transformation should not be limited to uploading teaching materials, conducting online attendance, or storing classroom videos. Instead, it should address the most challenging aspects of motor skill learning, including movement observation, error diagnosis, differentiated practice, and continuous feedback. Long jump combines speed, strength, and technical coordination, requiring students to complete accurate take-off board placement, rapid take-off, body posture adjustment during flight, and safe landing under high-speed approach conditions. Since key movements are completed within a very short time period, students often find it difficult to develop clear, stable, and repeatedly verifiable movement representations through only teacher demonstrations and verbal explanations.

The course population examined in this study consists of undergraduate students majoring in physical education-related disciplines in Chinese universities, including physical education, sports training, strength and conditioning, and social sports guidance and management programs [2]. These students are expected not only to master personal technical performance but also to undertake future responsibilities in school physical education, youth training, competition organization, and sports safety management. Therefore, the objectives of long jump instruction should not be reduced to achieving a certain performance distance; rather, they should also encompass technical understanding, movement execution, error identification, practice design, and instructional communication abilities.

Currently, long jump instruction in universities still largely follows a linear process of "teacher demonstration--collective imitation--centralized correction--final assessment." Although this approach is convenient for classroom organization, it may lead to three major problems. First, students often have insufficient opportunities to observe details such as the final approach steps, take-off leg support, and transition into the flight phase. Second, standardized approach distances, practice difficulty levels, and assessment criteria cannot fully accommodate differences among students in speed, strength, coordination, and technical experience. Third, movement problems after class often lack traceable evidence, resulting in a disconnect between teacher feedback and students' independent practice. Therefore, this study attempts to reconstruct long jump instruction within a smart education environment, integrating digital resources, face-to-face practice, and process evaluation around the same technical learning pathway.

This study employs literature review, logical analysis, and instructional design research methods. Literature review is used to examine research on blended physical education, motor skill learning, and long jump biomechanics. Logical analysis is applied to identify structural problems in traditional instructional approaches. Instructional design research is used to integrate course objectives, learning tasks, practice levels, feedback mechanisms, and evaluation criteria into a comprehensive teaching framework. As this study has not yet implemented classroom experiments involving experimental and control groups, the data and findings cited in this paper are used only as external evidence and design references, rather than as empirical evidence of the effectiveness of the proposed model.

2. Key Challenges in Long Jump Learning

2.1. The Contradiction between the Continuity of the Technical Chain and Discontinuous Classroom Observation

Long jump consists of four continuous technical phases: the approach run, take-off, flight, and landing. The runway, take-off board, landing area, and the validity of attempts must comply with the World Athletics Competition and Technical Rules [3]. These phases are dynamically coupled, with each stage exerting a direct influence on the subsequent movement. The approach speed and rhythm of the final strides determine the accuracy of take-off board placement and the quality of take-off preparation. During the take-off phase, athletes must generate sufficient vertical velocity while minimizing the loss of horizontal velocity. The flight phase primarily serves to regulate body posture and prepare for landing, whereas the landing phase directly affects both performance outcomes and movement safety. Linthorne et al. reported that the optimal take-off angle varies considerably among individuals, indicating that a uniform technical standard is inappropriate for evaluating all learners [4]. For novice learners, the primary difficulty often lies not in recognizing the names of technical movements but in identifying the stage at which technical errors originate. For example, backward body inclination during landing may result from insufficient trunk control during the flight phase or from inadequate body positioning and limb coordination during take-off. Immediate verbal correction in traditional classroom settings is often insufficient to reveal these causal relationships throughout the entire technical sequence.

2.2. The Contradiction between Uniform Instructional Progression and Individual Differences in Student Ability

Although physical education majors generally possess a certain level of athletic ability, considerable differences exist in their combinations of speed, strength, coordination, and previous technical experience. Some students demonstrate high approach speed but insufficient take-off power, whereas others possess adequate lower-limb strength but struggle to maintain a consistent approach rhythm. In addition, some students exhibit poor coordination during the flight and landing phases. When all students are required to practice using the same approach distance, flight technique, and training intensity, those with weaker foundations may develop fear and frustration following repeated failures, while more advanced students may remain confined to low-level training tasks. Consequently, both instructional efficiency and learning outcomes are likely to be compromised.

2.3. The Contradiction between Outcome-Oriented Assessment and the Development of Professional Teaching Competence

Jumping distance is an important indicator of long jump performance. However, for physical education majors, evaluating learning outcomes solely on the basis of final performance is inadequate. A student who achieves a satisfactory jumping distance may not necessarily be capable of explaining approach rhythm, identifying technical errors during take-off, or organizing safe practice activities. Conversely, some students with relatively modest athletic performance may demonstrate strong abilities in movement analysis and instructional communication. If course assessment focuses exclusively on the final jumping distance, improvements in technical execution, error correction, and professional teaching competence are likely to be overlooked, making it difficult to fully reflect the professional training objectives of university physical education programs.

3. Evidence Basis and Design Principles of the Model Construction

3.1. External Evidence from Previous Research

Previous studies have demonstrated that long jump performance is not determined by a single physical attribute, but rather results from the combined effects of multiple factors, including approach speed, take-off board accuracy, velocity conversion during take-off, flight posture, and landing technique. Linthorne et al. reported that the optimal take-off angle in long jump varies considerably among individuals, suggesting that a unified angle standard should not be applied to all learners [4]. Kinomura et al. found that changes in the number of approach steps and approach speed among novice learners significantly influence take-off preparation and movement stability [5]. Through three-dimensional biomechanical analysis, Tucker and Bissas further demonstrated that the rhythm of the final approach steps, body posture, and take-off preparation directly affect take-off performance [6]. Meanwhile, blended learning emphasizes the complementary advantages of online learning and face-to-face practice, providing a new instructional approach for motor skill development [7]. Collectively, these studies provide theoretical support for technical diagnosis, differentiated training design, and the development of a blended teaching model for long jump. The relevant evidence supporting the proposed model is summarized in Table 1.

Table 1. Research Evidence Supporting the Construction of the Blended Teaching Model for Long Jump

Source	Research Focus	Main Findings	Implications for Instructional Design
Linthorne et al. (2005)	Analyzed the relationships among take-off velocity, take-off height, and take-off angle in long jump athletes	The optimal take-off angle varies among individuals and should not be applied as a unified technical standard for all learners	Individualized technical diagnosis should be conducted based on students' approach speed and take-off ability
Kinomura et al. (2013)	Examined changes in take-off performance when novice learners increased the number of approach steps	Variations in approach distance and speed influence take-off preparation and movement stability	Progressive practice tasks should be designed using short-, middle-, and full-distance approaches
Tucker and Bissas	Investigated the three-dimensional biomechanical characteristics of the preparation phase before long jump take-off	The rhythm of the final approach steps, body posture, and take-off preparation directly affect take-off performance	Video recording should cover the connection between the final approach steps and take-off phase
World Athletics Technical Rules (2026)	Specified requirements for the runway, take-off board, landing area, and validity criteria of attempts	Long jump instruction should address not only movement techniques but also competition rules, spatial awareness, and safety requirements	Take-off board accuracy, foul identification, and landing safety should be incorporated into the evaluation system
Garrison and Vaughan (2008)	Explained the integration mechanism between online learning and face-to-face instruction	Blended learning should achieve functional complementarity between different learning environments	Online learning should support cognitive preparation and reflection, while face-to-face sessions should focus on specialized practice

and technical correction

Collectively, these studies highlight the complexity of long jump skill acquisition from multiple perspectives, including take-off angle, approach-step configuration, take-off preparation, and competition rules. Therefore, rather than relying directly on the reported effectiveness of blended learning in general physical education, the present study adopts a long jump-specific perspective to address technical learning challenges. By integrating digital video technology into instruction, the proposed model aims to facilitate repeated observation of movement execution, continuous tracking of technical errors, and evidence-based differentiated practice.

3.2. Design Principles of the Model

First, the principle of event specificity requires all digital learning tasks to be designed around the technical sequence of the long jump. Indicators such as platform activity and video-viewing time should not be treated as substitutes for actual learning quality. Second, the principle of practice priority emphasizes that online learning should support movement cognition, problem identification, and reflective documentation, whereas the development of core motor skills must still rely on teacher-guided, face-to-face practice. Third, under the principle of differentiated adaptation, student grouping should not be regarded as a fixed classification. Instead, it should be adjusted dynamically according to students' approach consistency, take-off ability, body control during flight, and landing safety. Fourth, the principle of evidence-based feedback requires every video recording, assessment task, and reflective activity to contribute to the identification and improvement of specific technical problems. Fifth, the principle of professional competence means that the course should evaluate not only whether students can perform the long jump, but also whether they can observe, correct, explain, and organize its teaching and practice.

Based on the event-specific characteristics, practical problems, and technological affordances discussed above, this study further develops an overall framework for a smart education-supported blended teaching model for long jump among physical education majors in Chinese universities, as shown in Figure 1.

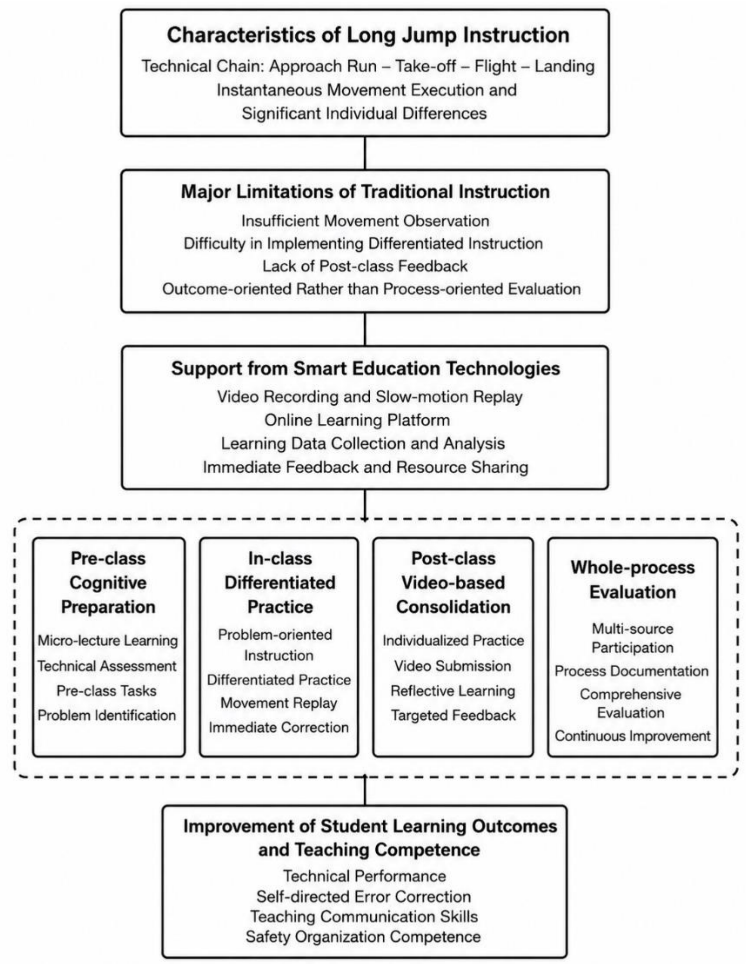

Figure 1. Research Framework of the Smart Education-Supported Blended Teaching Model for Long Jump

4. Smart Education-Supported Blended Teaching Model for Long Jump

In this study, the instructional process is reconstructed into a cyclic system consisting of pre-class identification, in-class diagnosis, post-class refinement, and evaluation-driven redesign. Rather than simply separating online and face-to-face instruction according to the teaching schedule, the proposed model is organized around students' technical problems. Specifically, an initial list of technical issues is identified before class; these problems are then verified through differentiated practice and video-based observation during class, followed by targeted post-class learning tasks for further improvement. Finally, the evaluation results are incorporated into the subsequent cycle of instructional design.

The proposed model establishes a closed-loop instructional mechanism through pre-class learning diagnosis, in-class technical practice, post-class feedback and refinement, and whole-process evaluation. The overall structure of the model is illustrated in Figure 2.

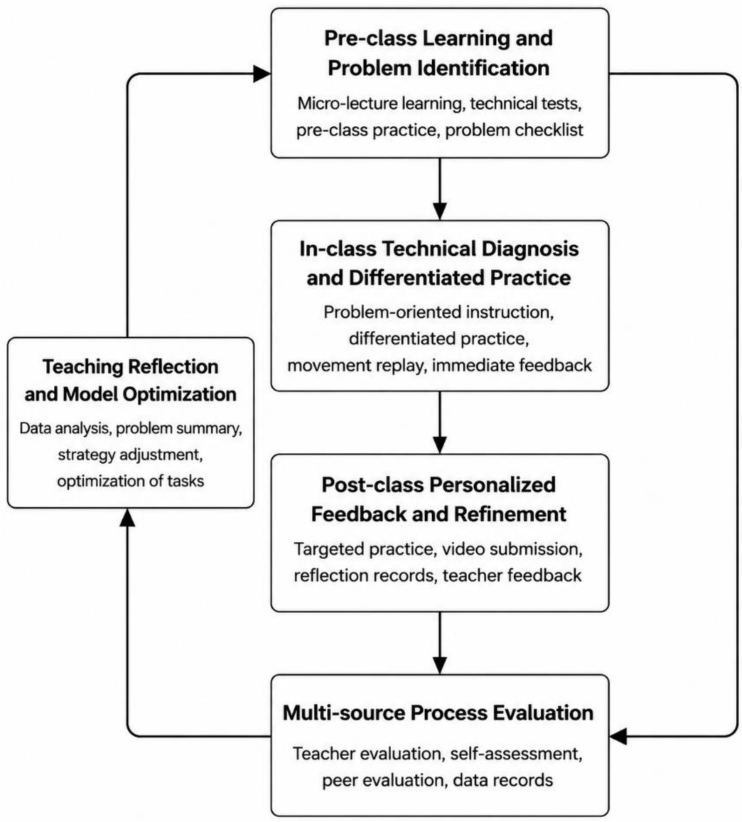

Figure 2. Closed-loop Structure of the Smart Education-Supported Blended Teaching Model for Long Jump

4.1. Pre-Class: Establishing the Starting Point through Movement Identification

Rather than uploading complete classroom recordings, instructors should develop 3--5-minute micro-lectures focusing on a single technical issue. The learning resources may cover topics such as approach rhythm and stride control, adjustment of the final two strides, coordination between the take-off leg and arm swing, body posture transition during the flight phase, landing extension and cushioning, as well as common fouls and safety precautions. Each micro-lecture should present the correct technique, typical technical errors, and observation cues simultaneously, enabling students to understand what to observe, rather than merely what to watch.

After completing the micro-lectures, students are required to take a brief technical knowledge quiz and upload videos of low-risk preparatory exercises, such as standing arm-swing take-off drills, short-approach take-off marker drills, and standing knee-tuck exercises. Based on the quiz results and submitted videos, instructors can generate a class-wide distribution of technical problems to determine which issues require whole-class instruction, which are better addressed through small-group practice, and which students require reduced task difficulty. In this way, classroom instruction shifts from repetitive knowledge delivery to problem-oriented technical intervention.

4.2. In-Class: Organizing High-Quality Practice through Differentiated Diagnosis

The classroom is organized around a recurring instructional sequence consisting of problem identification, demonstration and comparison, differentiated practice, immediate video review, and re-practice for verification. Instructors first present the most common technical problems identified before class and then assign differentiated learning tasks according to students' technical proficiency. Students in the foundation group focus on improving approach rhythm, take-off board control, and landing safety through short-approach runs, marker-based drills, low-intensity take-off exercises, and sand-pit landing practice. The intermediate group strengthens take-off leg support, coordination between the swing leg and arm action, and practices either the hang or hitch-kick technique after establishing a stable approach. The advanced group undertakes full-approach practice, rhythm variation drills, and more demanding aerial techniques while simultaneously serving as peer observers and technical demonstrators.

The objective of movement recording is not to maximize the quantity of videos but to obtain high-quality recordings from standardized camera positions using clearly defined observation criteria. A lateral camera view is appropriate for analyzing the rhythm of the final approach steps, take-off board placement, body center of mass, and flight trajectory, whereas an oblique-front or frontal view is more suitable for evaluating body alignment, arm symmetry, and leg extension during landing. During instruction, teachers may use mobile devices to record students' complete long jump performances and immediately replay key video segments to help them identify technical problems related to approach rhythm, take-off execution, and landing technique. As illustrated in Figure 3, on-site video recording transforms abstract technical requirements into observable and comparable learning evidence.

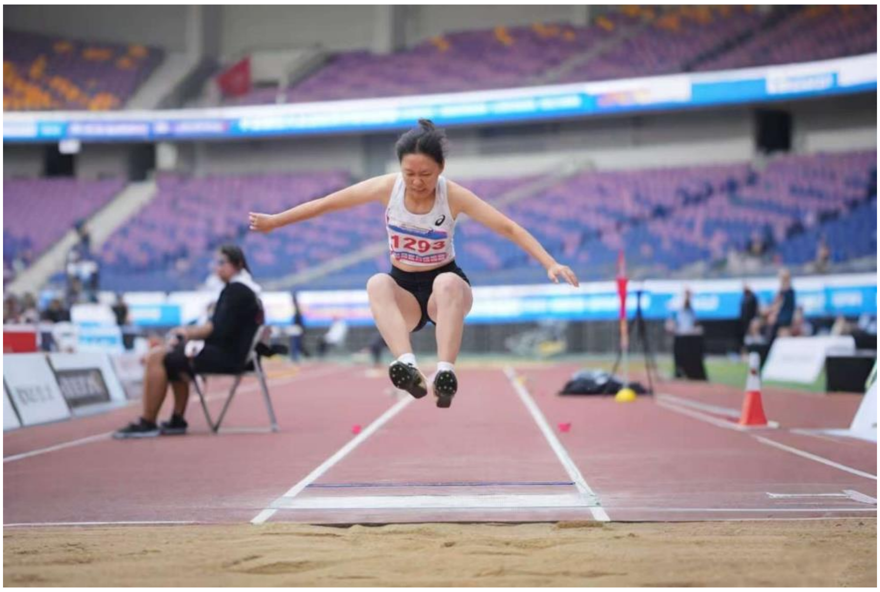

Figure 3. A Practice Scene of Long Jump Technique

Note: Figure 3 shows the author's own long jump technical practice.

After completing one set of practice trials, students immediately review key video segments and use a simplified diagnostic form to record their current status, including "achieved," "needs improvement," and "next task." The instructor then arranges a second round of practice to examine whether the feedback has been effectively transformed into changes in movement performance.

4.3. Post-Class: Extending the Error-Correction Process through Personalized Tasks

Post-class tasks are no longer assigned through uniform check-in requirements but are instead designed according to the technical problems identified during classroom diagnosis. Students with unstable approach rhythm are assigned marker-based running drills and fixed-step approach exercises. Students with insufficient take-off support practice bounding, continuous single-leg jumps, and low-load swing-leg coordination exercises. Students with weak control of flight posture undertake hanging knee-tuck exercises, mat-based technical imitation, and resistance-band-assisted training. Students who demonstrate backward leaning during landing or contact the sand incorrectly practice forward leg extension drills, low-platform landing exercises, and seated sand-pit landing drills. All post-class tasks should follow the principles of safety, low risk, and independent completion, and students should not be required to perform high-intensity full-approach jumps without supervision or protective conditions.

Each student submits a representative practice video and a brief reflection report every week, describing the main technical problems, training methods adopted, and movement changes observed during the week. Teacher feedback should focus on guiding subsequent learning tasks rather than providing general comments such as "good performance" or "keep practicing." Students are not required to solve all technical problems simultaneously. Instead, concentrating on one key limiting factor during each learning cycle is more conducive to generating observable evidence of improvement.

4.4. Evaluation: Connecting Skill Development with Teaching Competence through Learning Evidence

The evaluation system consists of three categories of evidence: technical outcomes, learning processes, and professional competence. Platform records are used only to confirm task participation and should not be directly equated with learning quality. Authentic evaluation should be based on evidence including comparisons of movement videos before and after practice, in-class performance, ability to explain technical problems, quality of peer feedback, and safety organization competence. Final assessment should retain long jump performance outcomes while incorporating technical analysis and micro-teaching tasks, thereby avoiding the limitation of students being able to "perform but not teach." This evaluation framework is consistent with the principles of Outcome-Based Education (OBE), which emphasizes the alignment between learning processes and competency achievement [8]. Based on this evaluation perspective, this study establishes an evaluation indicator system consisting of pre-class cognitive preparation, in-class differentiated practice, post-class continuous refinement, collaborative teaching expression, and comprehensive final performance, as presented in Table 2.

Table 2. Evaluation Indicators and Suggested Weights for the Blended Teaching Model for Long Jump

Evaluation Dimension	Main Evidence	Suggested Weight(%)	Evaluation Focus
Pre-class Cognitive Preparation	Micro-lecture tasks, technical identification quizzes, and preparatory practice videos	10%	Whether students can identify key technical elements and their own initial problems
In-class Differentiated Practice	Practice performance, immediate error correction, and changes in movement performance	35%	Whether students can adjust movements based on feedback while maintaining practice safety
Post-class Continuous Refinement	Personalized practice videos, reflection records, and stage-based	20%	Whether students can continuously practice around major technical

	improvement evidence		problems and generate evidence of improvement
Collaborative Learning and Teaching Expression	Peer observation, technical explanation, practice organization, and safety guidance	15%	Whether students can transform personal skill understanding into teaching competence
Comprehensive Final Performance	Complete technique, valid performance results, technical analysis, and micro-teaching tasks	20%	Comprehensive evaluation of students' abilities to perform, observe, correct, and teach

Evaluation results are not only used to assess students' current technical performance but also serve as an important basis for adjusting subsequent learning tasks and designing differentiated practice activities, thereby establishing a continuously optimized instructional cycle.

5. Implementation Conditions and Application Boundaries

5.1. Resource Development Should Serve Problem-Oriented Retrieval

Micro-lecture resources should adopt a structure of "one problem, one demonstration, and one set of evaluation criteria." A database of typical technical errors should also be established. The case database can be organized according to approach run, take-off, flight, landing, and rule-related safety issues, enabling instructors to quickly match learning resources with students' specific problems. The quantity of learning resources should be appropriately controlled to prevent students from losing focus when confronted with excessive video materials.

5.2. Equipment Configuration Should Prioritize Stability and Usability

Blended long jump instruction does not necessarily require expensive motion capture systems. Mobile phones, tripods, projection equipment, and commonly used learning platforms are sufficient to meet most instructional requirements. The key factors are the standardization of camera positions, consistency of observation criteria, appropriate control of video duration, and maintenance of effective feedback frequency. Schools with stronger technological capabilities may introduce speed measurement devices, approach-step recording tools, or basic movement analysis software; however, technological data should not replace teachers' professional judgment in technical diagnosis.

5.3. Safety Responsibilities Should Not Be Reduced Due to Extended Learning Environments

Pre-class resources should clearly specify requirements related to warm-up procedures, runway and sand-pit inspection, take-off board usage, and landing protection. In-class practice should follow a progressive sequence from short approach runs to full approach runs, from low difficulty to higher difficulty tasks, and from segmented drills to complete techniques. Post-class assignments should be limited to low-risk auxiliary exercises. Although digital platforms can extend learning beyond the classroom, they should not transfer high-risk technical practice to unsupervised environments. Teachers must continue to evaluate task difficulty, students' physical conditions, and facility safety.

5.4. Teachers' Roles Should Shift from Demonstration to Design and Diagnosis

Blended teaching does not automatically reduce teachers' workload; rather, it shifts teachers' responsibilities from repetitive demonstration and explanation toward resource selection, task design, movement diagnosis, and feedback organization. The concept of smart education emphasizes the integration of instructional resources, learning processes, and evaluation data through technological support. Its core purpose is not simply to increase the use of digital tools, but to improve instructional decision-making and learning support mechanisms [9]. To prevent large volumes of video materials from increasing teachers' feedback burden, instructional implementation may adopt strategies such as representative video sampling, peer preliminary evaluation, centralized feedback on common problems, and targeted follow-up of key students. In addition, during the initial stage of course implementation, students should receive training in video recording procedures, the use of technical diagnostic forms, and peer evaluation methods to ensure that digital tools genuinely support technical learning and competency development.

6. Conclusion and Future Research Directions

This study developed a smart education-supported blended teaching model for university long jump courses by addressing several key challenges, including insufficient movement observation, the difficulty of adapting uniform instruction to individual differences, discontinuity in post-class error correction, and excessive reliance on performance distance in assessment. Centered on technical problems, the proposed model integrates pre-class movement identification, in-class differentiated diagnosis, post-class personalized refinement, and multi-source evaluation into a continuous instructional cycle. The primary role of digital technologies is not to replace face-to-face practice or teachers' professional judgment, but to enable repeated observation of rapid movements, preserve evidence of technical changes, and extend teacher feedback beyond the boundaries of the classroom.

Rather than simply transferring a hurdle teaching framework by replacing event-specific terminology with long jump concepts, this model reconstructs technical observation points, differentiated practice tasks, camera perspectives, post-class assignments, and evaluation indicators according to the unique characteristics of long jump. Its ultimate goal extends beyond improving individual performance outcomes to cultivating comprehensive discipline-specific teaching competence among physical education majors. Future research should implement comparative classroom studies involving experimental and control groups, including pre-tests, process-based measurements, and post-tests, to examine the effects of the proposed model on approach-run stability, take-off board accuracy, technical performance scores, self-correction ability, teaching expression, and learning engagement. In addition, student interviews should be conducted to explore how learners with different levels of prior ability adapt to and benefit from the proposed instructional approach.

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