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Research on Long-Term Development Pathways for Blended Teaching in College Physical Education Supported by Intelligent Fitness Media

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Abstract: The rapid iteration of intelligent fitness media has injected technological momentum into blended teaching in college physical education, yet technological empowerment does not automatically translate into sustained teaching effectiveness. Existing studies have largely focused on verifying the short-term instructional effects of intelligent media, leaving the long-term question of how empowerment can be sustained after its initial introduction insufficiently addressed. Based on a review of current practices in blended teaching in college physical education supported by intelligent fitness media, this study identifies three structural dilemmas: insufficient sustainability of teaching effectiveness, lagging renewal of teacher capabilities, and absence of institutional safeguards. It then constructs a long-term development pathway framework from three dimensions: evaluation innovation, teacher development, and institutional provision. The study argues that the core issue of long-term development lies not in continuous technological upgrading but in establishing a dynamic balance between technological embeddedness and endogenous teaching capacity.

Keywords: Intelligent Fitness Media; College Physical Education; Blended Teaching; Long-Term Development; Pathway Construction

1. Introduction

With the deepening of the education digitalization strategy, intelligent fitness media have gradually become embedded in college physical education teaching. Intelligent fitness media here include AI virtual coaches, wearable exercise monitoring devices, intelligent motion analysis systems, and other technological forms. Blended teaching, with its spatial extension between online resources and offline practice, serves as a natural vehicle for intelligent fitness media. Relevant policy documents also explicitly require the integration of information technology with physical education, providing institutional legitimacy for the instructional application of intelligent fitness media. However, a noteworthy reality is that blended teaching supported by intelligent fitness media often demonstrates positive effects in the short term, while its effectiveness tends to decay as the teaching cycle progresses. Some studies have found that blended teaching models show significant short-term effects but suffer from long-term effect decay, and have suggested introducing a dynamic decay and compensation mechanism to balance technological dependence and autonomous learning [1]. This finding suggests that the key question for blended teaching in college physical education supported by intelligent fitness media has shifted from whether technology can empower teaching to how empowerment can be sustained. From the perspective of existing research, the field has accumulated substantial evidence on the instructional effects of intelligent fitness media, but lacks systematic examination of the sustainability mechanisms of such empowerment. Whether there is a necessary relationship between the introduction of technology and the continuous production of teaching effectiveness still requires further inquiry. This article focuses on this core question and attempts to construct an explanatory and operational framework for long-term development pathways based on an analysis of practical dilemmas, thereby providing theoretical reference for the sustainable development of blended teaching in college physical education.

2. Current Practice of Blended Teaching in College Physical Education Supported by Intelligent Fitness Media

2.1 Main Types and Application Scenarios of Intelligent Fitness Media

Current intelligent fitness media used in college physical education can be roughly classified into three categories. The first is motion analysis and feedback, such as AI virtual coach systems, which use computer vision to capture and correct students' movements in real time and provide personalized guidance in a virtual-real integrated environment [2]. The second is physiological data monitoring, such as smart wearable devices, which continuously collect heart rate, blood oxygen, movement trajectories, and other data to provide objective evidence for teaching load regulation and effect evaluation [3]. The third is platform integration, such as smart teaching platforms that integrate pre-class resource delivery, in-class data collection, and post-class feedback tracking into a closed-loop system [1]. These three types of media have different emphases in blended teaching. In the pre-class phase, platform media distribute resources and diagnose preparation. In the in-class phase, motion analysis and data monitoring media are embedded in skill instruction and training monitoring, moving teachers from experience-based judgment to data-driven instructional decisions. In the post-class phase, data feedback drives the delivery and tracking of personalized exercise tasks, forming a continuation mechanism between classroom practice and after-class consolidation [4]. Overall, intelligent fitness media have initially formed an application pattern covering the entire teaching process, but the depth of embeddedness and integration varies markedly across programs and teachers. Some applications remain at the level of tool substitution and have not truly touched the systematic reconstruction of teaching processes. This reality constitutes the practical starting point for understanding the long-term development problem.

2.2 Existing Verification of Teaching Effects

Multiple empirical studies have confirmed the positive impact of intelligent fitness media on blended teaching. After wearable devices were introduced, students in the experimental group improved cardiorespiratory function by 18.5%, extended exercise duration by 22.3%, and teachers' effective instructional guidance time increased by 31.2%. Experiments integrating AI sports products into blended aerobics teaching also showed that the skill level of the experimental class was significantly better than that of the control class [5]. In specific projects such as football, blended teaching supported by digital resources increased the skill pass rate from 68.4% to 89.2%. These data constitute the empirical basis for the instructional effects of intelligent fitness media and provide comparable references for subsequent research. However, it should be noted that the observation periods of these studies are mainly concentrated within a single semester or short cycle, with little tracking of sustained effects across semesters or academic years. Whether teaching effects decay as technological novelty fades, whether teachers' and students' willingness to continue using the technology remains stable, and whether the instructional functions of intelligent media are updated in sync with technological iteration have not been fully addressed in existing research. Methodologically, existing studies mostly adopt quasi-experimental designs and use short-term pre- and post-intervention comparison data as the basis for judging effects. Although such designs can effectively control variables and verify causal relationships, they can hardly capture the dynamic changes in teaching effects over time. In other words, existing research provides proof of technological empowerment but fails to provide a mechanism explanation for sustaining that empowerment. This methodological limitation leaves the long-term development question at the margins of the research field.

3. Practical Dilemmas in the Long-Term Development of Blended Teaching Supported by Intelligent Fitness Media

3.1 Insufficient Sustainability of Teaching Effectiveness

The positive presentation of short-term effects obscures a more fundamental question: when the novelty of technology fades and teaching enters a routine track, can intelligent fitness media continue to function effectively? Tracking data from existing studies indicate that the teaching effects of intelligent fitness media are characterized by novelty dependence. The attractiveness of technology can significantly increase student participation in the initial stage,

but as use becomes routine, its novelty decays and students' autonomous participation motivation may decline. The finding of long-term effect decay in the aforementioned blended teaching experiment is a typical representation of this problem [6]. A deeper issue is that when teaching relies excessively on technology media, the internalization of students' autonomous exercise habits may be replaced by external technological stimulation. Once the technology media are withdrawn or fail to update in a timely manner, teaching effects may risk regression. This tension between technological stimulation and habit internalization constitutes the core mechanism of insufficient sustainability in teaching effectiveness. In addition, current instructional design generally lacks systematic cultivation of students' self-regulatory abilities, so technological empowerment appears more as external push than endogenous drive. From the perspective of self-determination theory, when students' exercise participation is mainly driven by external regulatory factors such as technological feedback, the developmental space for intrinsic motivation and identified regulation may be compressed. The more efficiently technology media provide immediate feedback and incentives, the more likely students are to become dependent on external stimuli, thereby weakening the foundation for autonomous exercise awareness and lifelong physical education capacity. This paradox constitutes a deep contradiction that long-term development must confront.

3.2 Dual Constraints of Teachers' Digital Literacy and Technology Acceptance

The sustained use of intelligent fitness media requires teachers to possess corresponding digital literacy, but there are structural differences in technology acceptance among physical education skill teachers. A survey based on the TAM model shows that college physical education skill teachers' cognition of blended teaching, perceived ease of use, and interactive experience have significant positive effects on their acceptance, and for teachers lacking cognition of blended teaching, ease of use has the greatest impact [7]. This means that the operational complexity of technology platforms directly affects some teachers' willingness to continue using them. At the same time, imbalance in teacher competence structure is a common dilemma in blended teaching in college physical education [8]. Technology training is often concentrated in the initial stage of employment or project launch, lacking continuous support mechanisms that accompany technological iteration. When intelligent fitness media are updated, teachers may face pressure to relearn, and the existing teacher development system has not provided an institutionalized response. More importantly, differences in technology acceptance not only affect teachers' usage behavior but also indirectly influence their overall attitudes toward and investment in blended teaching, thereby forming a differentiated pattern of technology application within the teacher group. From the perspective of teacher professional development theory, physical education skill teachers' technology learning has distinctly embodied characteristics. Their teaching expertise has long been built on physical demonstration and immediate feedback. Intelligent fitness media require teachers to transfer part of their instructional judgment to data systems. This transfer potentially conflicts with teachers' existing professional identity at the epistemological level. Without sufficient epistemological adjustment and supportive dialogue space, the improvement of technology acceptance may remain at the operational level and fail to touch deep changes in teaching beliefs.

3.3 Absence of Institutional Safeguards

Blended teaching supported by intelligent fitness media requires supporting institutional provision, but current institution-building in colleges and universities lags markedly behind. The teaching evaluation system needs to incorporate online learning behavior and process data into assessment, but current evaluation remains dominated by physical fitness tests and skill assessments [8]. The teaching management system needs to clarify credit recognition, workload calculation, and quality standards for blended teaching, but most institutions have not established specialized norms suited to the characteristics of physical education. Technical maintenance and update mechanisms require stable funding and personnel input, but project-based resource allocation makes the sustainability of technical support difficult to guarantee. Institutional absence makes the use of intelligent fitness media depend more on individual teachers' conscientiousness than on

institutionalized arrangements at the organizational level. This individualized operating model can be maintained in the short term by teachers' enthusiasm and sense of responsibility, but it is difficult to form a stable teaching routine at the departmental level. When teachers move or teaching tasks are adjusted, existing technology application experience may be lost, and the achievements of teaching reform may be difficult to deposit as organizational institutional memory. From the perspective of organizational sociology, the instructional application of intelligent fitness media is at a critical stage of transition from individual innovation to organizational institutionalization. Without coordinated support from institutional arrangements such as curriculum management, technical operations, and incentive assessment, technological innovation may remain at the demonstration level of individual teachers and fail to transform into a departmental teaching routine. The lag in institutional provision not only restricts the expansion of the application scope of intelligent fitness media but also exposes existing practical achievements to the risk of loss due to personnel changes. This institutional shortcoming constitutes the most critical bottleneck for long-term development.

4. Pathway Construction for the Long-Term Development of Blended Teaching Supported by Intelligent Fitness Media

4.1 Evaluation Innovation: From Outcome Assessment to Continuous Feedback Driven by Process Data

The evaluation mechanism is a key hub connecting technological empowerment and teaching improvement. Building a diversified evaluation system that incorporates data from intelligent fitness media requires progress on three levels. First, process data recorded by wearable devices and platforms, such as attendance frequency, exercise duration, intensity zones, and movement completion, should be included in course assessment, shifting evaluation from summative judgment to developmental feedback [8]. Second, a cycle of data collection, analysis and diagnosis, teaching adjustment, and effect review should be established. Teachers adjust subsequent teaching strategies based on exercise reports generated by the platform, avoiding the situation where evaluation data are used only for grading and remain dormant [7]. Third, the design of evaluation indicators should balance the objectivity of technical data with the educational nature of physical education, preventing quantitative data from squeezing attention to qualitative dimensions such as students' exercise interest, cooperative awareness, and lifelong physical education concepts. The essence of evaluation innovation is to elevate intelligent fitness media from instructional auxiliary tools to an information infrastructure for teaching decisions, making evaluation no longer the endpoint of teaching but the starting point of continuous improvement. From the development of educational evaluation theory, the core value of process evaluation lies in its diagnostic and regulatory functions for the learning process. The continuous data streams provided by intelligent fitness media precisely offer technical conditions for such diagnosis and regulation. However, the availability of technical conditions does not automatically guarantee the realization of evaluation functions. The key lies in whether teachers possess the professional ability to transform data into instructional insight and whether the evaluation system provides space for students to adjust themselves based on data feedback. Only when an effective dialogue mechanism is established among technical data, teacher judgment, and student reflection can evaluation innovation truly become a core driving force for long-term development.

4.2 Teacher Development: A Tiered Support System Based on Technology Acceptance Patterns

Teachers are the subjective condition for intelligent fitness media to play a long-term role. Findings based on the TAM model show that teachers with rich cognition are more influenced by learning atmosphere and interactivity, while teachers lacking cognition are most influenced by ease of use [3]. This difference suggests that teacher development support should not adopt a uniform model but should be designed in tiers. For teachers with weak technical foundations, priority should be given to lowering the operational threshold of platforms, providing simple and easy-to-use tools and one-on-one technical assistance, so that they can build confidence in technology use in a low-pressure environment. For teachers with existing experience, the focus should be on deepening teaching methodology, guiding them from being

able to use technology to being good at using technology in instructional design innovation, and exploring the deep alignment between intelligent media and physical education teaching objectives. At the same time, the instructional application ability of intelligent fitness media should be incorporated into continuing education and teaching assessment systems, forming a continuous cycle of training, practice, feedback, and retraining rather than one-off project training. The key to teacher development is to synchronize the improvement of technical competence with the renewal of teaching concepts, avoiding disconnection between technology training and teaching practice. From the perspective of stage theory in teacher professional development, the growth of technology application ability usually experiences three progressive stages: survival concerns, task concerns, and student impact concerns. Teachers at different stages have essentially different support needs. Teachers at the survival concern stage need to reduce operational anxiety and build basic competence. Teachers at the task concern stage need strategic knowledge to effectively integrate technology into teaching processes. Teachers at the student impact concern stage need research-oriented support to reflect on the effects of technology application based on evidence. Therefore, a tiered support system should match the stage characteristics of teacher professional development, embedding support measures into teachers' learning curves.

4.3 Institutional Provision: Organizational Safeguards from Project-Driven to Normalized Operation

The sustainable use of intelligent fitness media ultimately requires transformation from temporary project-based arrangements to normalized institutions in college teaching management. Specifically, at least three types of institutional provision are needed. First, curriculum management. Credit recognition standards for blended physical education courses, proportional requirements for online and offline teaching, and quality evaluation norms should be clarified so that the instructional use of intelligent fitness media has rules to follow. Second, technical operations and maintenance. Funding guarantees and personnel allocation mechanisms should be established for regular maintenance of intelligent fitness equipment, data security, and platform updates, avoiding teaching interruption caused by equipment failure or platform shutdown. Third, incentives and assessment. The effectiveness of blended teaching reform should be included in departmental teaching evaluation and teacher professional title review as a reference dimension, forming positive incentives at the organizational level [8]. The core function of institutional provision is to transform individual teachers' innovative practices into stable organizational expectations, so that the instructional application of intelligent fitness media no longer depends on individual teachers' conscientiousness but becomes a regular component of the departmental teaching system. From the perspective of institutional change theory, the transition of intelligent fitness media from project-driven to normalized operation is essentially a transition from induced institutional change to mandatory institutional change. Technological innovation initially formed through individual teachers' spontaneous exploration has the characteristics of induced change, and its diffusion speed and sustainability are constrained by both individual rationality and the organizational environment. To transform such innovation achievements into stable departmental practice, formal institutional arrangements such as curriculum management, technical operations, and incentive assessment are needed to confirm and guarantee them, elevating technological innovation from an individual rational choice to an organizational institutional logic.

4.4 Collaborative Logic of the Three Pathways

It should be emphasized that evaluation innovation, teacher development, and institutional provision are not three independent pathways but a mutually nested collaborative system. Evaluation innovation provides the data basis for teaching improvement, teacher development makes the instructional transformation of evaluation data possible, and institutional provision provides organizational conditions for the continuous operation of the first two. Advancing any single dimension alone can hardly produce long-term effects. With only evaluation reform and no follow-up in teacher capacity, data cannot be transformed into teaching action. With only teacher training and no institutional safeguards, capacity

improvement cannot be deposited as stable teaching behavior in daily instruction. With only institutional arrangements and no evaluation feedback, institutions may become formalistic and lack self-correction mechanisms. The collaboration of the three pathways essentially establishes channels for information flow and action coordination among the technical system, teaching system, and organizational system, enabling the teaching effectiveness of intelligent fitness media to be continuously produced and reproduced within an institutionalized framework. From the perspective of complex adaptive systems, blended teaching in college physical education is itself a complex adaptive system composed of multiple elements such as technology, teachers, students, and institutions. Long-term development is not the result of optimizing a single element but the product of benign interaction and coevolution among system elements. Evaluation innovation provides the system's information feedback channel, teacher development enhances the system's core action capacity, and institutional provision optimizes the system's rule structure and resource allocation. The coevolution among the three constitutes the internal mechanism by which the system continuously adapts to external changes and maintains teaching effectiveness. This collaborative logic also suggests that future research should go beyond linear causal analysis frameworks and pay more attention to the nonlinear characteristics of element interaction and system evolution. As shown in Table 1.

Table 1. Dilemma Identification and Pathway Responses for the Long-Term Development of Blended Teaching in College Physical Education Supported by Intelligent Fitness Media

Dilemma dimension	Core manifestation	Pathway response	Key mechanism
Insufficient sustainability of teaching effectiveness	Decay of technological novelty leads to decreased participation; autonomous exercise habits not internalized	Evaluation innovation	Continuous feedback loop driven by process data
Lagging renewal of teacher capabilities	Stratification of technology acceptance; lack of continuity in training	Teacher development	Tiered support system based on TAM patterns
Absence of institutional safeguards	Evaluation system does not incorporate process data; unstable sources of operation and maintenance funding	Institutional provision	Institutionalization of curriculum management, technical operations, and incentive assessment

5. Conclusion

Intelligent fitness media have brought genuine instructional improvement to blended teaching in college physical education, but the long-term realization of technological empowerment is far more complex than the introduction of technology. The core judgment of this article is that the bottleneck of long-term development lies not in technology itself but in whether a dynamic balance has been formed between technological embeddedness and endogenous teaching capacity. Evaluation innovation provides feedback momentum, teacher development provides subjective capacity, and institutional provision provides organizational conditions. The pathway framework formed by the collaboration of the three may offer a systematic direction for moving blended teaching in college physical education supported by intelligent fitness media from short-term effectiveness to sustained effectiveness. The contribution of this framework lies in shifting the analytical focus of long-term development from technological iteration to mechanism building, thereby avoiding the trap of technological determinism. Of course, the pathway framework proposed in this article remains at the level of theoretical construction, and its applicability in different types of colleges and different physical education programs remains to be tested. Future research can build on this foundation by selecting specific programs for action research on pathway implementation, testing and revising the operability of this framework through practical feedback, and further exploring the boundary conditions for deep integration between intelligent fitness media and physical education teaching. From a broader perspective, the long-term development of blended teaching in college physical education supported by

intelligent fitness media is not only a question of technology application but also a process of reconstructing the educational ecosystem. It involves systematic changes in teaching concepts, teacher-student relationships, evaluation culture, and organizational institutions. Only by finding a point of alignment between technological logic and educational logic can intelligent fitness media truly become a lasting driving force for the high-quality development of college physical education.

References

[1] Jiang Yahan. Practice and Effects of Blended Teaching Mode in College Track and Field General Courses [J]. Heilongjiang Science, 2025, 16(13): 96-98.

[2] Yu Jiajun, Zhang Zhiwu, Liu Zhanlu. Construction and Implementation of Blended Teaching Mode in College Physical Education under Artificial Intelligence Empowerment [J]. Journal of Tianjin University of Technology, 2026, 42(3): 70-78.

[3] Tang Rongtao. Research on AI Virtual Coach Empowering Blended Teaching Mode in College Physical Education from the Perspective of Virtual-Real Integration [J]. Sports Goods and Technology, 2025, (15): 99-101.

[4] Wang Junjie. Reconstruction of Flipped Classroom Mode in College Physical Education Assisted by Intelligent Equipment [J]. Sports Goods and Technology, 2025, (18): 161-163.

[5] Sun Yufeng, Ji Dengfeng, Tian Tian. Value Exploration, Practical Dilemmas and Optimization Paths of Blended Teaching in College Physical Education [J]. Sports Teachers and Friends, 2025, 48(6): 9-11.

[6] Zhang Jiashuo. Construction of Evaluation Index System for Online and Offline Blended Physical Education Teaching Process in Colleges and Universities [J]. Bulletin of Sport Science and Technology, 2024, 32(5): 155-158+83.

[7] Li Shuangling, Zhu Baofeng, Li Jianye, et al. College Physical Education Skill Teachers' Acceptance of Blended Teaching and Its Influencing Factors: Based on the TAM Model [J]. Journal of Harbin Sport University, 2024, 42(4): 72-79.

[8] Bai Zhongjiang. Practical Exploration of Blended Teaching in College Football Courses under Digital and Intelligent Empowerment [J]. Contemporary Sports Technology, 2025, 15(28): 50-53.