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Teachers' Perspectives on the Effectiveness of Smart Wearable Devices in 800m Running Instruction

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Abstract

This qualitative study explores physical education (PE) teachers' perspectives on the implementation and effectiveness of a structured 800m running teaching module integrated with smart wearable devices in Chinese middle schools. Semi-structured interviews were conducted with three PE teachers, each representing one of three groups: control (no intervention), reference (module without technology), and experimental (module with wearable devices). Thematic analysis revealed that the use of smart wearable technology significantly enhanced students' pacing accuracy, cardiovascular endurance, engagement, and motivation. Teachers in the experimental group reported that real-time feedback and personalized performance data facilitated more targeted instruction and improved students' self-regulation and confidence. In contrast, teachers in the non-technological groups noted limitations in student progress and instructional precision. Despite some technical and implementation challenges, the overall findings support the educational value and feasibility of integrating wearable technology into PE curricula. The study highlights the potential for data-driven approaches to transform PE instruction and calls for further research on long-term impact, scalability, and teacher readiness.

Keywords: Smart Wearable Devices, Physical Education, Teacher Perspectives, Motivation and Engagement, Technology-Enhanced Learning

Introduction

The integration of smart wearable technologies in physical education (PE) has ushered in new pedagogical possibilities, enabling data-driven instruction that responds to students' physiological metrics in real time. Devices that monitor heart rate, running pace, and lap time provide personalized feedback and support differentiated instruction strategies in PE settings (Toner et al., 2023; Zulkifli & Danis, 2022). While studies have explored the benefits of wearable technologies in improving student engagement and performance (Lee & Lee, 2021), the role of teachers—the facilitators and implementers of such technology—remains underexplored. Given that teachers are instrumental in shaping the learning experience, their

perspectives are critical in evaluating the efficacy and practicality of incorporating wearable technology into PE modules.

In China, the 800m run is a pivotal component of the National Student Physical Fitness and Health Test for female middle school students and forms part of the high-stakes Secondary School Entrance Examination (Zhang & Min, 2020). Despite its significance, traditional teaching practices for middle-distance running are often generic and undifferentiated, failing to cater to individual student needs. Typically, students are instructed to complete a fixed number of laps within a set time, without guidance on pacing or biomechanics (Li et al., 2024). Such an approach can yield inconsistent outcomes, with some students underperforming due to a lack of technical training and real-time feedback (Xu et al., 2021). These limitations underscore the need for a more structured and responsive teaching model.

Middle-distance running, particularly the 800m, holds pedagogical and developmental value for adolescent girls, as it supports cardiovascular development and encourages healthy lifelong exercise habits (Hallam, 2021). However, research indicates that existing PE curricula do not adequately address the technical or motivational needs of female students in this domain (Bessa et al., 2021). The one-size-fits-all approach to PE instruction overlooks students' diverse physical capabilities and learning preferences, leading to disengagement and limited skill acquisition (Weeldenburg et al., 2020). These shortcomings are further compounded by the absence of individualized feedback mechanisms, leaving students unaware of how to improve or adjust their running strategies (Van Hooren et al., 2020).

Smart wearable devices offer a viable solution to these instructional gaps by allowing teachers to deliver personalized, evidence-based training. Real-time feedback enables students to self-regulate and adjust their performance while giving teachers access to longitudinal data that can guide individualized coaching (Almusawi et al., 2021; Wort et al., 2021). Despite the widespread availability of such devices, there remains a paucity of literature and practical models on their integration into structured PE modules, especially for middle-distance events like the 800m. Teachers' firsthand experiences with implementing these technologies in school settings are essential to assess their utility, challenges, and pedagogical alignment.

This study investigates teachers' perspectives on the implementation and effectiveness of an 800m running teaching module enhanced by smart wearable devices in Chinese middle schools. By examining how teachers interpret the benefits, challenges, and overall impact of this instructional innovation, the study aims to generate insights that can inform future curriculum design and professional development in PE. Understanding educators' experiences with wearable technology provides a necessary dimension to the discourse on 21st-century PE pedagogy and contributes to a more holistic framework for integrating technological tools into physical fitness education (Gopinathan, 2022; Jeong et al., 2022).

The motivation for this study arises from the increasing demand to modernize physical education practices through data-driven and student-centered approaches. While wearable technologies have shown promise in improving student outcomes, limited research has

examined how teachers—who serve as the primary implementers of instruction—perceive their effectiveness in real-world classroom settings. This study contributes uniquely by exploring PE teachers' firsthand experiences and professional insights on the integration of smart wearable devices into a structured 800m running module. By capturing teachers' perspectives across control, reference, and experimental settings, the study offers a holistic understanding of how technology reshapes instructional strategies, student engagement, and performance. The findings aim to inform curriculum designers, policymakers, and educators about the pedagogical viability and implementation challenges of wearable technologies in school-based PE programs.

Literature Review

Smart wearable devices have emerged as transformative tools in athletic and educational contexts, offering real-time physiological data and feedback that support personalized learning and performance enhancement. In the realm of sports and exercise science, numerous studies have highlighted their efficacy in boosting motivation, monitoring physical activity, and promoting self-regulation through feedback loops (Del-Valle-Soto et al., 2024; Ross, 2020). These technologies have also been linked to heightened intrinsic motivation and engagement when aligned with self-determination theory (Ryan & Deci, 2000). However, despite growing interest in the affordances of wearable technology, the perspectives and agency of teachers—key actors in facilitating the integration of these tools into pedagogical practice—have often been underrepresented in the literature.

Middle-distance running, particularly the 800m event, poses unique physical and psychological challenges for adolescent students. Effective training for this discipline requires a holistic approach encompassing both aerobic and anaerobic conditioning, strength training, and technical skill development (Hallam, 2021; Haugen et al., 2021; Hickey, 2022). In middle school contexts, where students are still developing physically and mentally, age-appropriate methodologies that prevent injury and support long-term athletic development are essential (Varghese et al., 2022). Beyond physical conditioning, psychological aspects—such as goal setting, resilience, and self-confidence—play a critical role in performance outcomes and must be integrated into comprehensive training frameworks (Jingfu, 2024; Heydari et al., 2018).

Coaching practices for middle-distance events emphasize the need for individualized instruction that adapts to student development stages. Teachers and coaches are encouraged to adopt student-centered methods that promote both performance and enjoyment, creating positive associations with physical activity (Bechter, 2019). However, traditional teaching in physical education often lacks the tools necessary to tailor instruction or monitor individual progress accurately. Wearable technologies can address this gap by offering granular data on metrics such as heart rate, stride length, and pace, which can be analyzed to inform instructional decisions and performance adjustments (Hong et al., 2025; Micheal et al., 2024).

The educational application of wearable smart devices has gained traction across disciplines, with research suggesting promising outcomes for student engagement and personalized learning. In physical education specifically, wearables enable real-time performance tracking, thus supporting more responsive and differentiated instruction (Almusawi et al., 2021; Shi, 2021). However, the effectiveness of such implementations is

closely tied to teacher readiness and contextual appropriateness. AlKasasbeh and Amawi (2024) and Almusawi et al. (2021) argue that successful integration of technology in PE is contingent upon the adaptability of pedagogical practices and the active involvement of educators in both the design and implementation phases.

Despite their potential, wearable technologies in school settings face several implementation barriers. Challenges include concerns about data privacy, the need for teacher training, and the cost of device acquisition and maintenance (Cilliers, 2020; Niknejad et al., 2020). Moreover, Böhm et al. (2019) highlighted that while interventions with wearables showed potential, the evidence for significant improvement in youth physical activity levels remains inconclusive. This calls for context-specific research that accounts for instructional design, user training, and student-teacher dynamics. Teacher perspectives thus offer a vital lens through which to understand the practical implications of wearable technology in school-based PE modules.

In summary, the literature underscores the value of wearable technologies in enhancing the quality and personalization of PE instruction, particularly in middle-distance running. However, to harness this potential, the perspectives and experiences of teachers must be systematically explored. Teachers play a critical role not only in interpreting and applying performance data but also in shaping student motivation and safety practices. This study addresses the gap by focusing on teachers' views regarding the implementation and effectiveness of a smart wearable–supported 800m running module, contributing to a growing body of research that bridges technology, pedagogy, and physical education.

Methodology

This study employed a qualitative research design to explore teachers' perspectives on the effectiveness of smart wearable devices integrated into an 800-meter running module for middle school students. Semi-structured interviews were conducted with three physical education (PE) teachers at Fenghuangcheng Experimental School, a Chinese middle school known for its progressive approach to educational innovation and its infrastructure for implementing technology-enhanced learning. Each teacher represented one of the three research groups: the control group (no module or wearable use), the experimental group (module with wearable devices), and the reference group (module without wearable devices).

Participants were selected purposively based on their direct involvement in the intervention. Teacher 1 (T1) led the control group, Teacher 2 (T2) facilitated the experimental group using the smart wearables in conjunction with the structured module, and Teacher 3 (T3) implemented the module without the aid of technology. All three groups participated in a pre-test and post-test to assess running performance, but only the experimental and reference groups received structured training. The experimental group, in particular, integrated wearable devices that tracked physiological metrics such as heart rate and pace, providing both students and teachers with real-time data throughout the instructional period.

Data collection was conducted using an interview protocol consisting of twelve open-ended questions, designed to capture insights on the module's effectiveness, student engagement, instructional challenges, and perceptions of wearable technology. The

interviews were carried out face-to-face at the school, lasting approximately 30 to 40 minutes each. Teachers' responses were audio-recorded with their consent and subsequently transcribed verbatim. The protocol allowed for a consistent structure across interviews while affording flexibility for participants to elaborate on their individual experiences and reflections.

Thematic analysis was employed to analyze the interview data, following Braun and Clarke's (2006) six-phase approach: familiarization with the data, generation of initial codes, identification of themes, review of themes, definition and naming of themes, and final report production. Manual coding was used to maintain closeness to the data, and emergent themes were cross-examined across cases to identify both shared and contrasting patterns. Ethical approval was obtained from the relevant institutional committee, and informed consent was secured from all participants, who were assured of confidentiality and the voluntary nature of their participation.

Findings

This section presents the qualitative findings from semi-structured interviews conducted with three physical education (PE) teachers, each representing a different instructional group within the study: Teacher 1 (T1) for the control group, Teacher 2 (T2) for the experimental group using smart wearable devices, and Teacher 3 (T3) for the reference group implementing the module without technology. Thematic analysis revealed six major themes concerning the teachers' perspectives on the implementation and effectiveness of the 800m running teaching module.

Improved Pacing and Endurance

Teachers observed that students' ability to pace themselves during running significantly varied across the three groups. T2 highlighted that students in the experimental group benefited greatly from real-time data provided by the wearable devices, which enabled them to adjust their efforts mid-run. She stated, "The wearable data made a huge difference. Students could see exactly when to push and when to hold back. Their pacing improved significantly after just a few sessions because they could adjust their effort in real-time." T3, representing the reference group, noted gradual progress through repeated practice but emphasized the limitations of not having feedback tools: "They were getting better with practice, but it was more trial and error without the data. Some students still struggled with energy distribution." In contrast, T1 reported that students in the control group struggled with pacing and lacked understanding of how to manage their energy: "They would start fast and slow down halfway, but they didn't know why. Without data, it was hard for them to figure out what was going wrong." These findings suggest that real-time data enhances students' pacing strategies, contributing to better endurance outcomes.

Enhanced Motivation and Engagement

Student motivation emerged as a key differentiator among the groups. T2 observed heightened motivation in the experimental group, attributing this to students' access to measurable performance data and peer comparisons: "They were always looking at their data after training. It became a goal for them to improve their heart rate or lap time. The competition aspect also helped—they would push each other to do better when they saw improvements in others' data." T3 remarked that students initially responded well to the

structured approach but later lost interest due to the lack of progress tracking: “At first, they were motivated by the new training structure, but without tracking progress, some lost interest.” T1 reported low engagement among students in the control group, explaining that the lack of tangible progress indicators led to disinterest: “Motivation levels were quite low, to be honest. The students didn’t seem very motivated because they couldn’t see if they were improving or not.” These perspectives underscore the motivational potential of integrating data-driven technologies in PE instruction.

Personalized Learning and Individualized Feedback

The integration of wearable technology in the experimental group allowed T2 to deliver highly personalized coaching. The availability of biometric and performance data enabled targeted feedback on aspects such as stride, breathing, and pacing. T2 elaborated, “One student noticed that his heart rate was too high at the beginning, so we worked on starting slower. His times improved after that. I could also suggest adjustments in stride length and breathing based on what the data showed.” By contrast, T3 acknowledged the limitations of relying on observation alone: “I could only tell them what I saw, but that’s not as accurate as real-time data.” T1 echoed this sentiment, highlighting the challenges of giving effective advice without measurable indicators: “I could tell them to ‘run faster’ or ‘control their breathing,’ but it wasn’t based on anything measurable.” These findings indicate that wearable devices enable more precise and individualized feedback, enhancing the learning experience.

Differences in Performance Across Groups

All three teachers concurred that students in the experimental group exhibited the most pronounced improvements in performance. T2 attributed this to the synergy between structured training and data-informed feedback: “It was obvious that the students with the devices were improving faster. The structured feedback gave them an edge. The experimental group consistently outperformed the other two groups by the final week.” T3 noted moderate progress in the reference group but acknowledged the experimental group’s superior outcomes: “They were progressing, but the experimental group was clearly ahead by the third week.” T1 confirmed that performance gains in the control group were minimal: “The students in the control group just didn’t have the same structure. It was clear that the students with the wearable devices were improving faster.” These observations emphasize the advantage of combining technological tools with structured pedagogical approaches.

Technical and Implementation Challenges

Although the introduction of wearable technology introduced some initial technical barriers, these were generally manageable. T2 reported, “Some students’ devices lost connection during the first session, but we fixed it quickly. After the first week, they understood the data better and started using it to adjust their pace.” T1 and T3, who did not employ wearable devices, experienced no technical issues but noted a lack of actionable performance data. T3 explained, “Some students would plateau because they couldn’t adjust based on data.” Despite the brief troubleshooting phase, the implementation of wearable devices was largely smooth and did not compromise the overall instructional process.

Increased Student Confidence and Understanding

The final theme highlighted the impact of the intervention on students’ confidence and conceptual understanding of running techniques. T2 observed that students in the

experimental group gained self-assurance by tracking their improvements: "They started trusting the data. When they saw their heart rate improving, they knew they were getting better. That gave them confidence in competition." T3 noted that while reference group students exhibited some confidence gains, the effect was not as pronounced: "They were more confident by the end of the module, but not as much as the experimental group." T1 reported that students in the control group often lacked belief in their abilities: "Without data, it's hard for them to know what to work on. Some students just gave up after a few sessions because they didn't know if they were getting better or not." These insights suggest that the use of smart wearable devices not only facilitates skill development but also fosters students' confidence and self-awareness in physical performance.

Discussion

The perspectives of the three PE teachers involved in this study offer valuable insights into the practical application, feasibility, and pedagogical value of integrating smart wearable devices into an 800m running teaching module for middle school students. The findings revealed a consensus among teachers that the structured module—particularly when paired with smart wearable devices—led to noticeable improvements in students' pacing, motivation, engagement, and performance. These insights align with prior studies on technology integration in physical education, which emphasize the transformative potential of wearable technologies in enhancing both teaching efficacy and student learning outcomes (Van Hooren et al., 2024; Jastrow et al., 2022).

A key observation from all three teachers was the enhancement in students' pacing and endurance, particularly within the experimental group that used smart wearable devices. Teacher 2 (T2) attributed this to real-time feedback that helped students monitor their heart rate and adjust their running strategy accordingly. In contrast, Teacher 3 (T3) in the reference group, though implementing the same module, noted slower student progress due to the lack of immediate performance feedback. These findings resonate with Van Hooren et al. (2024), who demonstrated that timely pacing feedback plays a crucial role in middle-distance running by helping athletes better manage energy distribution. Meanwhile, the control group, guided by Teacher 1 (T1), showed minimal improvement, underscoring the limitations of traditional instruction without structured feedback—a point also raised by Cereda (2023) and Casey et al. (2017) in their evaluation of conventional PE practices.

The study further emphasized how wearable technology supported student motivation and engagement. According to T2, students in the experimental group were more enthusiastic and persistent, motivated by the ability to track their performance and compete constructively with peers. This supports the findings of Roure and Pasco (2022), who argued that data-driven feedback systems could stimulate intrinsic motivation in physical education. T3 noted that students in the reference group initially showed high interest, but engagement declined in the absence of measurable progress indicators. Meanwhile, students in the control group remained largely disengaged. These patterns align with Sousa et al. (2023), who posited that continuous, personalized feedback is essential for maintaining student interest and active participation in PE programs.

Another key benefit of the wearable-enhanced module was the opportunity for individualized instruction. T2 reported that access to biometric data allowed for more

accurate and targeted feedback, such as adjusting a student's pace based on heart rate spikes or suggesting improvements in breathing technique. This aligns with Jastrow et al. (2022), who emphasized that wearables enable teachers to shift from generalized to personalized coaching. In contrast, T1 and T3 reported relying on visual assessments, which were often subjective and lacked accuracy—limitations echoed by Marttinen et al. (2019), who critiqued the reliability of traditional observation methods in PE. These findings underscore the value of objective data in refining both assessment and instruction.

Despite these benefits, T2 acknowledged minor technical challenges such as device connectivity issues and initial unfamiliarity with data interpretation. However, these were short-lived and did not hinder the module's effectiveness. This is consistent with the concerns raised by Qu et al. (2021), who warned that successful tech integration requires adequate training and support systems. Yet, once teachers and students became familiar with the devices, the process became smoother and more effective. Importantly, T2 also noted improvements in student confidence and self-awareness, as learners began to trust the feedback and observe measurable progress—echoing the findings of Williams et al. (2022) on the link between biofeedback and self-efficacy. These insights collectively affirm that the integration of smart wearable devices, when thoughtfully implemented, enhances student outcomes and instructional quality in PE settings.

Conclusion

This qualitative study explored the perspectives of physical education teachers on the implementation and effectiveness of an 800m running teaching module integrated with smart wearable devices. The findings revealed a consistent consensus among teachers that the module, particularly when paired with wearable technology, significantly improved student pacing, motivation, and performance. The real-time feedback provided by the devices enabled students to self-monitor and adjust their effort levels, thereby enhancing both learning outcomes and training efficiency. These insights reinforce the pedagogical value of combining structured instruction with technological innovations in physical education.

The integration of smart wearable devices not only supported student learning but also transformed the role of the teacher by enabling personalized and data-informed instruction. Teachers reported that access to performance metrics allowed them to offer precise, individualized feedback rather than relying solely on visual assessments. This shift aligns with broader trends in education emphasizing differentiated instruction and learner-centered approaches. The study underscores the growing importance of digital tools in PE curricula and highlights the need for teacher readiness and systemic support to fully leverage their potential.

In terms of implications, the results suggest that smart wearable devices can serve as effective tools for enhancing student engagement and self-efficacy in physical education. Schools should consider incorporating such technology into their PE programs, particularly for modules focused on endurance, pacing, and cardiovascular development. However, successful implementation requires more than device acquisition; it necessitates teacher training, technical support, and thoughtful integration into existing curricula. These findings also contribute to the ongoing conversation on how digital technologies can bridge gaps in traditional PE instruction by providing objective data and fostering student accountability.

Future initiatives should prioritize scalable, sustainable models for incorporating wearable technologies across different sports and age groups. Teachers should be equipped with continuous professional development opportunities to understand, interpret, and apply data generated by these devices. Furthermore, policy-makers and school administrators should invest in infrastructure that supports the seamless use of such tools, including device maintenance, data security, and classroom integration frameworks. By aligning instructional strategies with technological advancements, educators can create more inclusive, engaging, and outcome-driven physical education environments.

References

AlKasasbeh, W. J., & Amawi, A. T. (2024). Elevating Physical Education Teacher Through Technology Integration. *International Journal of Interactive Mobile Technologies*, *18*(2).

Almusawi, H. A., Durugbo, C. M., & Bugawa, A. M. (2021). Innovation in Physical Education: Teachers' perspectives on readiness for wearable technology integration. *Computers & Education*, *167*, 104185.

Bechter, B. E., Dimmock, J. A., & Jackson, B. (2019). A cluster-randomized controlled trial to improve student experiences in physical education: Results of a student-centered learning intervention with high school teachers. *Psychology of Sport and Exercise*, *45*, 101553.

Bessa, C., Hastie, P., Ramos, A., & Mesquita, I. (2021). What actually differs between traditional teaching and sport education in students' learning outcomes? A critical systematic review. *Journal of Sports Science & Medicine*, *20*(1), 110.

Böhm, B., Karwiese, S. D., Böhm, H., & Oberhoffer, R. (2019). Effects of mobile health including wearable activity trackers to increase physical activity outcomes among healthy children and adolescents: systematic review. *JMIR mHealth and uHealth*, *7*(4), e8298.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, *3*(2), 77-101.

Casey, A., Goodyear, V. A., & Armour, K. M. (2017). Digital technologies and learning in physical education. *Abingdon: Routledge*.

Cereda, F. (2023). A Modern Pedagogical Approach in The Subject of Physical Education. *Physical Education and Sports: Studies and Research*, *2*(2), 126-141.

Cilliers, L. (2020). Wearable devices in healthcare: Privacy and information security issues. *Health information management journal*, *49*(2-3), 150-156.

Del-Valle-Soto, C., López-Pimentel, J. C., Vázquez-Castillo, J., Nolazco-Flores, J. A., Velázquez, R., Varela-Aldás, J., & Visconti, P. (2024). A comprehensive review of behavior change techniques in wearables and IoT: implications for health and well-being. *Sensors*, *24*(8), 2429.

Gopinathan, P. (2022). *Educational technology in physical education and sports*. Sports Educational Technologies.

Hallam, L. C. (2021). Sex Differences in Running Performance: The Role of the Anaerobic Speed Reserve in Female Middle-Distance Running.

Haugen, T., Sandbakk, Ø., Enoksen, E., Seiler, S., & Tønnessen, E. (2021). Crossing the golden training divide: the science and practice of training world-class 800-and 1500-m runners. *Sports Medicine*, *51*(9), 1835-1854.

Heydari, A., Soltani, H., & Mohammadi-Nezhad, M. (2018). The effect of Psychological skills training (goal setting, positive selftalk and Imagery) on self-confidence of adolescent

volleyball players. *Pedagogics, psychology, medical-biological problems of physical training and sports*, (4), 189-194.

Hickey, B. M. (2022). health re-thinking 200 m repeats as a key workout for success in the 800 m run.

Hong, H., Dai, L., & Zheng, X. (2025). Advances in Wearable Sensors for Learning Analytics: Trends, Challenges, and Prospects. *Sensors*, *25*(9), 2714.

Jastrow, F., Greve, S., Thumel, M., Diekhoff, H., & Süßenbach, J. (2022). Digital technology in physical education: a systematic review of research from 2009 to 2020. *German Journal of Exercise and Sport Research*, *52*(4), 504-528.

Jeong, H., Payton, J., Julien, C., & Castelli, D. (2022, October). Integrating computer science and physical education in elementary schools with data science learning modules using wearable microcontrollers. In *2022 IEEE 19th International Conference on Mobile Ad Hoc and Smart Systems (MASS)* (pp. 710-715). IEEE.

Jingfu, L. (2024). Self-Confidence as a Predictor of Academic and Sports Performance among College Students.

Lee, H. S., & Lee, J. (2021). Applying artificial intelligence in physical education and future perspectives. *Sustainability*, *13*(1), 351.

Li, X., Fan, D., Feng, J., Lei, Y., Cheng, C., & Li, X. (2024). Systematic review of motion capture in virtual reality: Enhancing the precision of sports training. *Journal of Ambient Intelligence and Smart Environments*, (Preprint), 1-23.

Marttinen, R., Landi, D., Fredrick, R. N., & Silverman, S. (2019). Wearable digital technology in PE: advantages, barriers, and teachers' ideologies. *Journal of Teaching in Physical Education*, *39*(2), 227-235.

Niknejad, N., Ismail, W. B., Mardani, A., Liao, H., & Ghani, I. (2020). A comprehensive overview of smart wearables: The state of the art literature, recent advances, and future challenges. *Engineering Applications of Artificial Intelligence*, *90*, 103529.

Qu, X., Wang, J., & Miao, R. (2021). Application of wearable technology in education. *Open access library journal*, *8*(11), 1-11.

Ross, I. R. (2020). Self Regulation by Recreational Runners with Wearable Technology: A Literature Review.

Roure, C., & Pasco, D. (2022). Exploring the effects of a context personalization approach in physical education on students' interests and perceived competence. *Journal of Teaching in Physical Education*, *42*(2), 331-340.

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary educational psychology*, *25*(1), 54-67.

Shi, B. (2021). Wearable exercise monitoring equipment for physical exercise teaching process based on wireless sensor. *Microprocessors and Microsystems*, *81*, 103791.

Sousa, A. C., Ferrinho, S. N., & Travassos, B. (2023). The use of wearable technologies in the assessment of physical activity in preschool-and school-age youth: systematic review. *International journal of environmental research and public health*, *20*(4), 3402.

Toner, J., Allen-Collinson, J., Jackman, P. C., Jones, L., & Addrison, J. (2023). 'I like to run to feel': embodiment and wearable mobile tracking devices in distance running. *Qualitative Research in Sport, Exercise and Health*, *15*(6), 805-818.

Van Hooren, B., Goudsmit, J., Restrepo, J., & Vos, S. (2020). Real-time feedback by wearables in running: Current approaches, challenges and suggestions for improvements. *Journal of Sports Sciences*, *38*(2), 214-230.

Van Hooren, B., Plasqui, G., & Meijer, K. (2024). The effect of Wearable-based real-time feedback on running injuries and running performance: a randomized controlled trial. *The American journal of sports medicine*, *52*(3), 750-765.

Varghese, M., Ruparell, S., & LaBella, C. (2022). Youth athlete development models: a narrative review. *Sports Health*, *14*(1), 20-29.

Weeldenburg, G., Borghouts, L. B., Slingerland, M., & Vos, S. (2020). Similar but different: Profiling secondary school students based on their perceived motivational climate and psychological need-based experiences in physical education. *PloS one*, *15*(2), e0228859.

Williams, A. M., Hogg, J. A., Diekfuss, J. A., Kendall, S. B., Jenkins, C. T., Acocello, S. N., ... & Wilkerson, G. B. (2022). Immersive real-time biofeedback optimized with enhanced expectancies improves motor learning: A feasibility study. *Journal of sport rehabilitation*, *31*(8), 1023-1030.

Wort, G. K., Wiltshire, G., Peacock, O., Sebire, S., Daly-Smith, A., & Thompson, D. (2021). Teachers' Perspectives on the Acceptability and Feasibility of Wearable Technology to Inform School-Based Physical Activity Practices. *Frontiers in sports and active living*, *3*, 777105.

Xu, Z., Lin, J., & Xia, S. (2021). Improving quality physical education: Conceptual and practical framework, and barriers to its global implementation. *Beijing International Review of Education*, *3*(2), 296-320.

Zhang, Z., & Min, H. (2020). Analysis on the construction of personalized physical education teaching system based on a cloud computing platform. *Wireless Communications and Mobile Computing*, *2020*, 1-8.

Zulkifli, A. F., & Danis, A. (2022). Technology in physical education: Using movement analysis application to improve feedback on sports skills among undergraduate physical education students. *Social Sciences & Humanities Open*, *6*(1), 100350.