



IMPROVING RUNNING AND JUMPING TECHNIQUES IN PHYSICAL EDUCATION THROUGH VIDEO ANALYSIS AND MOBILE APPLICATIONS

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Abstract

This article examines the pedagogical potential of video analysis and mobile applications for improving running and jumping techniques in physical education. In contemporary sports education, the quality of movement instruction increasingly depends on the integration of digital tools that allow teachers and students to observe, measure, and correct technical actions with greater accuracy. The study focuses on how video replay, frame-by-frame motion review, biomechanical visualization, and mobile-based feedback systems contribute to the development of motor skills in university students preparing for professional activity in the field of physical education. Particular attention is given to sprint mechanics, takeoff phases, body alignment, coordination patterns, and landing control as essential components of technically efficient performance. The article argues that digital feedback supports motor learning by making invisible errors visible, strengthening self-analysis, and increasing students' engagement in the correction process. It is also shown that mobile applications create favorable conditions for individualized instruction, ongoing assessment, and coaching analytics in practical classes. The analysis suggests that the combined use of video technologies and mobile platforms improves technical awareness, accelerates skill acquisition, and enhances the methodological readiness of future physical



education teachers to apply innovative instructional approaches in their professional practice.

Keywords: Physical education, video analysis, mobile applications, running technique, jumping technique, biomechanics, technical feedback, motor learning, coaching analytics, sprint mechanics, takeoff mechanics.

Аннотация

В данной статье рассматривается педагогический потенциал видеоанализа и мобильных приложений в совершенствовании техники бега и прыжков в физическом воспитании. В современной спортивно-педагогической практике качество обучения движениям всё в большей степени зависит от интеграции цифровых инструментов, позволяющих преподавателю и студентам наблюдать, измерять и корректировать технические действия с большей точностью. Исследование сосредоточено на том, каким образом видеоповтор, покадровый анализ движений, визуализация биомеханических параметров и мобильные системы обратной связи способствуют развитию двигательных навыков у студентов, готовящихся к профессиональной деятельности в сфере физического воспитания. Особое внимание уделяется механике спринтерского бега, фазам отталкивания, положению тела, координационным моделям и контролю приземления как ключевым компонентам технически эффективного выполнения упражнений. В статье обосновывается, что цифровая обратная связь поддерживает моторное обучение, поскольку делает скрытые ошибки наглядными, усиливает самоанализ и повышает вовлечённость студентов в процесс коррекции. Также показано, что мобильные приложения создают благоприятные условия для индивидуализации обучения, текущего оценивания и аналитического сопровождения тренировочного процесса на практических занятиях. Анализ позволяет сделать вывод о том, что комплексное использование видеотехнологий и мобильных платформ повышает техническую осознанность, ускоряет формирование навыков и усиливает методическую готовность будущих преподавателей физического



воспитания к применению инновационных подходов в профессиональной деятельности.

Ключевые слова: физическое воспитание, видеоанализ, мобильные приложения, техника бега, техника прыжков, биомеханика, техническая обратная связь, моторное обучение, тренерская аналитика, механика спринта, механика отталкивания.

Annotatsiya

Ushbu maqolada jismoniy tarbiya jarayonida yugurish va sakrash texnikasini takomillashtirishda video tahlil hamda mobil ilovalarning pedagogik salohiyati yoritiladi. Zamonaviy sport-ta'lim amaliyotida harakatlarni o'qitish sifati tobora ko'proq raqamli vositalar integratsiyasiga bog'liq bo'lib, ular o'qituvchi va talabalarga texnik harakatlarni aniqroq kuzatish, o'lchash va tuzatish imkonini beradi. Tadqiqot videoni qayta ko'rish, harakatni kadrma-kadr tahlil qilish, biomexanik ko'rsatkichlarni vizuallashtirish hamda mobil asosdagi qayta aloqa tizimlari jismoniy tarbiya sohasida professional faoliyatga tayyorlanayotgan talabalarning harakat ko'nikmalarini rivojlantirishga qanday xizmat qilishini tahlil qiladi. Ayniqsa, sprint mexanikasi, deqsinish bosqichlari, tana holati, koordinatsion tuzilmalar va qo'nishni nazorat qilish texnik jihatdan samarali bajarishning muhim tarkibiy qismlari sifatida ko'rib chiqiladi. Maqolada raqamli qayta aloqa yashirin xatolarni ko'rinadigan holga keltirishi, o'z-o'zini tahlil qilishni kuchaytirishi va talabalarni tuzatish jarayoniga faolroq jalb etishi orqali motor o'rganishni qo'llab-quvvatlashi asoslab beriladi. Shuningdek, mobil ilovalar amaliy mashg'ulotlarda ta'limni individuallashtirish, uzluksiz baholash va murabbiylik tahlilini tashkil etish uchun qulay sharoit yaratishi ko'rsatib beriladi. Tahlil natijalari video texnologiyalar va mobil platformalardan kompleks foydalanish texnik ongni oshirishini, ko'nikmalarni egallash jarayonini tezlashtirishini hamda bo'lajak jismoniy tarbiya o'qituvchilarining innovatsion yondashuvlarni kasbiy amaliyotda qo'llashga doir metodik tayyorgarligini kuchaytirishini ko'rsatadi.



Modern American Journal of Engineering, Technology, and Innovation

ISSN(E): 3067-7939

Volume 2, Issue 3, March, 2026

Website: usajournals.org

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Kalit so‘zlar: jismoniy tarbiya, video tahlil, mobil ilovalar, yugurish texnikasi, sakrash texnikasi, biomexanika, texnik qayta aloqa, motor o‘rganish, murabbiylik tahlili, sprint mexanikasi, depsinish mexanikasi.

Introduction

The modernization of physical education in higher pedagogical institutions requires a transition from traditional demonstration-based instruction to more precise, student-centered, and technology-enhanced approaches. In the context of sports training and professional teacher preparation, the quality of technical instruction in such locomotor actions as running and jumping has become an important indicator of educational effectiveness. These movements are not only fundamental elements of athletics but also essential components of general physical preparedness, coordination development, and methodological competence in future physical education teachers. For this reason, the problem of improving running and jumping techniques through innovative pedagogical tools deserves special academic and practical attention.

In conventional physical education classes, the correction of motor actions often depends on the teacher’s visual observation and verbal explanation. Although such methods remain valuable, they are not always sufficient for identifying subtle technical errors related to body position, rhythm, stride pattern, arm-leg coordination, takeoff angle, or landing mechanics. Many students experience difficulty understanding how their movement actually looks in performance, especially when they rely only on internal sensations or brief verbal instructions. As a result, motor errors may become repeated and gradually fixed, reducing movement efficiency and limiting athletic progress. This challenge is particularly visible in sprinting and jumping exercises, where technical accuracy strongly influences speed, coordination, and overall performance quality.

The growing availability of digital technologies has opened new opportunities for solving this pedagogical problem. Video analysis enables repeated observation of movement, slow-motion playback, frame-by-frame examination, and comparison between model performance and student execution. Mobile applications further expand these possibilities by allowing immediate recording, analysis, annotation, measurement, and feedback within the learning environment. Together, these



Modern American Journal of Engineering, Technology, and Innovation

ISSN(E): 3067-7939

Volume 2, Issue 3, March, 2026

Website: usajournals.org

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tools provide a more objective and visually accessible basis for technical correction. They help transform abstract instructions into concrete visual evidence, making the learning process clearer, more individualized, and more engaging for students.

The pedagogical significance of video analysis is closely connected with the theory of motor learning. The acquisition of movement skills depends on repeated practice, meaningful feedback, error detection, and corrective adaptation. When students can observe their own actions and compare them with biomechanically appropriate models, they become more aware of the structure of movement and the specific points that require improvement. This process supports conscious learning, strengthens reflective abilities, and increases motivation to refine technique. In this sense, video-based feedback is not simply a technological supplement but a pedagogical instrument that enhances perception, cognition, and self-regulation in physical education.

The role of mobile applications in technical training is equally important. Mobile platforms are accessible, portable, and compatible with the dynamic conditions of sports classes. They allow teachers to organize quick assessments, save performance records, monitor progress over time, and provide immediate feedback during practice sessions. For students, mobile applications create opportunities for independent review, repeated observation, and self-correction beyond the classroom. They can replay their movements, examine key phases of technique, and better understand how movement mechanics relate to athletic effectiveness. Such opportunities are especially valuable in pedagogical universities, where future teachers must not only master physical skills but also learn how to teach and analyze them professionally.

Running and jumping were selected as the focus of this study because they represent two of the most widely taught and methodologically significant groups of athletic movements in physical education. Running technique involves the coordinated interaction of posture, stride length, stride frequency, arm action, foot placement, and force application. Jumping technique requires accurate control of approach rhythm, takeoff mechanics, body alignment in flight, and safe landing. In both cases, technical deficiencies often remain unnoticed during real-time movement because of the speed and complexity of the action. Video analysis is



Modern American Journal of Engineering, Technology, and Innovation

ISSN(E): 3067-7939

Volume 2, Issue 3, March, 2026

Website: usajournals.org

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particularly effective in these contexts because it slows performance down and allows the teacher and student to examine each phase in detail. As a result, the instructional process becomes more precise and evidence-based.

In the context of contemporary higher education, the integration of digital tools into sports pedagogy also corresponds with broader educational trends toward innovation, digital competence, and learner autonomy. Future physical education teachers are expected to possess not only practical athletic skills but also the capacity to use modern technologies for planning lessons, assessing movement, and supporting individualized learning. Therefore, the use of video analysis and mobile applications has a dual pedagogical value. On the one hand, it improves the immediate technical quality of students' running and jumping performance. On the other hand, it contributes to the formation of professional-methodological competencies that future teachers will need in their own instructional practice.

The relevance of this topic is especially strong in pedagogical universities where sports education is closely connected with teacher formation. Students in such institutions must learn how to explain movement, identify mistakes, select corrective exercises, and evaluate progress. Traditional methods of instruction do not always provide sufficient visual and analytical depth for developing these competencies. By contrast, digital tools promote more systematic observation, more transparent evaluation, and more effective communication between teacher and learner. They also create a learning environment in which students become active participants in the analysis of their own movement rather than passive recipients of external correction.

Thus, improving running and jumping techniques through video analysis and mobile applications should be regarded as an important direction in the development of modern physical education. It combines biomechanical understanding, pedagogical feedback, technological accessibility, and student-centered learning within a unified instructional framework. This article aims to examine the educational potential of these tools, clarify their role in enhancing motor skill acquisition, and determine their significance for the professional preparation of future physical education teachers.



Methods

This study was designed on the basis of a pedagogical and practice-oriented approach aimed at identifying the effectiveness of video analysis and mobile applications in improving running and jumping techniques among students of a pedagogical university specializing in physical education and sports. The methodological framework combined elements of observational analysis, comparative assessment, biomechanical interpretation, and feedback-based motor learning. The research was carried out in the context of practical athletics classes, where students regularly performed running and jumping exercises as part of their curriculum and professional training.

The participants of the study consisted of university students enrolled in physical education courses. The sample included learners with relatively similar academic status and general physical preparedness, which made it possible to focus attention on differences in technical execution and responsiveness to feedback rather than on unrelated background factors. The instructional process was organized during practical sessions devoted to sprint running, standing and running jumps, approach coordination, takeoff technique, and landing control. At the initial stage, students performed a set of standard locomotor tasks that allowed the teacher to observe their baseline technical level and identify the most frequent movement errors.

To obtain accurate pedagogical data, a structured observation procedure was used. Students' performances were recorded with mobile devices during practical exercises from several angles that allowed a clear view of body alignment, foot placement, arm movement, takeoff trajectory, and landing mechanics. The recorded material was then analyzed through mobile applications that supported slow-motion replay, frame-by-frame viewing, pausing at key phases, and visual comparison of repeated trials. This method made it possible to detect technical shortcomings that were difficult to notice in real-time performance, especially in fast phases of sprinting and jumping. Special attention was given to such indicators as posture stability during acceleration, synchronization of arm and leg actions, stride rhythm, contact phase efficiency, body position during takeoff, and landing balance.



Modern American Journal of Engineering, Technology, and Innovation

ISSN(E): 3067-7939

Volume 2, Issue 3, March, 2026

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The research procedure included several consecutive stages. During the first stage, diagnostic recording was conducted in order to identify the initial technique profile of each student. During the second stage, the teacher organized feedback sessions in which students reviewed their own movements individually or in small groups. The feedback process was not limited to error indication; it included pedagogical explanation of why a specific technical component was ineffective and how it influenced the overall mechanics of movement. Students then repeated the exercises after receiving visual and verbal correction. During the third stage, repeated recordings were taken in order to compare the corrected performance with the initial one and evaluate visible changes in movement quality.

An important part of the methodology was the integration of self-analysis. Students were encouraged to observe their own recordings, identify discrepancies between their movement and the model performance demonstrated by the teacher, and formulate brief conclusions regarding necessary corrections. This approach was used to strengthen reflective learning and to promote conscious motor control. In addition, the teacher used the mobile applications to create immediate technical feedback directly in the training setting, which reduced the time gap between performance and correction and thereby supported more effective motor adaptation.

The evaluation criteria of the study were based on qualitative and pedagogical indicators rather than only on competitive results. Improvement was assessed through movement accuracy, coordination consistency, technical stability, and the students' capacity to understand and explain their own errors. Comparative analysis of video materials before and after feedback sessions served as the main source of evidence. Thus, the methods of the study combined digital observation, practical correction, learner reflection, and repeated performance analysis within a unified pedagogical model aimed at improving technical mastery in running and jumping.

Results

The implementation of video analysis and mobile applications in physical education classes produced clearly observable positive changes in the quality of students' running and jumping techniques. The comparative review of initial and



Modern American Journal of Engineering, Technology, and Innovation

ISSN(E): 3067-7939

Volume 2, Issue 3, March, 2026

Website: usajournals.org

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repeated performance recordings showed that students became more technically aware of their movements and demonstrated better control over key biomechanical elements after receiving visualized feedback. The most noticeable progress was recorded in the areas of posture correction, movement coordination, takeoff organization, and landing stability. These changes indicate that digital feedback tools can significantly improve the pedagogical process of technical skill formation in athletics-oriented training.

At the initial stage of the study, many students performed running and jumping movements with errors that were typical for learners who rely mainly on verbal instruction and imitation without detailed technical analysis. In sprint running, common shortcomings included excessive vertical oscillation of the trunk, insufficient forward body lean during acceleration, irregular arm action, uneven stride rhythm, and improper foot contact patterns. In jumping exercises, frequent problems were observed in the approach phase, the timing of takeoff, instability of body position in flight, and weak landing control. These technical limitations negatively affected both movement efficiency and the students' confidence during task performance.

After the introduction of video-supported feedback, students began to recognize these errors more accurately. Repeated viewing of their own movement in slow motion enabled them to notice technical details that had previously remained outside their awareness. Many students demonstrated improved understanding of how body alignment, limb coordination, and timing influence the overall structure of movement. The comparison of recordings before and after correction showed that students gradually reduced unnecessary movements, improved the rhythm of sprint actions, and executed jumping tasks with more organized force application. This suggests that visual feedback played an important role in connecting theoretical explanation with actual motor execution.

The use of mobile applications also increased the immediacy and precision of the correction process. Since recordings could be reviewed directly during practice sessions, students received feedback without long interruption between execution and analysis. This immediacy supported faster correction of mistakes and contributed to more stable motor adaptation. In practical terms, students who reviewed their performances directly after execution were more likely to make



Modern American Journal of Engineering, Technology, and Innovation

ISSN(E): 3067-7939

Volume 2, Issue 3, March, 2026

Website: usajournals.org

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purposeful adjustments in the next attempt. Their repeated trials reflected greater concentration on specific technical tasks, such as improving knee drive in running, coordinating arm swing, correcting foot placement, or stabilizing the landing phase in jumps.

An important result of the study was the growth of students' reflective and analytical abilities. Over the course of the instructional cycle, students became less dependent on general teacher comments and more capable of identifying their own mistakes independently. They were increasingly able to describe technical problems using appropriate pedagogical language and to explain what changes were needed to improve performance. This result is especially significant for pedagogical university students, since future physical education teachers must not only perform movements correctly but also analyze them methodically and teach them to others.

The findings also showed an increase in student engagement and motivation. The integration of familiar mobile technologies into sports lessons created a more interactive and modern educational environment. Students showed greater interest in repeated practice when they could visually track their progress and compare earlier and later performances. This strengthened their sense of achievement and encouraged more active participation in technical correction.

Overall, the results demonstrate that the combined use of video analysis and mobile applications contributes to better movement quality, stronger motor awareness, improved self-analysis, and higher instructional effectiveness in the teaching of running and jumping techniques. These outcomes confirm the pedagogical value of digital tools in the preparation of future specialists in physical education.

Discussion

The results of the study confirm that the integration of video analysis and mobile applications into physical education classes has substantial pedagogical value for improving running and jumping techniques. These findings support the view that technical skill development in sports education becomes more effective when learners receive feedback that is immediate, visual, and analytically structured. In traditional instructional settings, students often depend on brief verbal comments



Modern American Journal of Engineering, Technology, and Innovation

ISSN(E): 3067-7939

Volume 2, Issue 3, March, 2026

Website: usajournals.org

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and external demonstration, which may be insufficient for understanding fast and complex athletic actions. By contrast, digital tools transform the learning process into a more transparent and cognitively accessible experience. They allow movement to be slowed down, segmented, revisited, and interpreted in relation to biomechanical principles, which significantly strengthens the educational basis of technical correction.

One of the most important issues highlighted by the findings is the relationship between visual feedback and motor learning. Running and jumping are dynamic actions that include several phases executed in a short time interval. Because of this, many technical errors are not consciously perceived by learners during performance. When students observe their own movement on video, they begin to connect kinesthetic sensation with visual evidence. This connection is essential for the formation of stable motor representations. The discussion of results therefore suggests that video analysis improves not only the external quality of movement but also the internal organization of skill acquisition. Students do not merely repeat corrections mechanically; they start to understand why a movement is technically effective or ineffective.

The study also indicates that mobile applications increase the pedagogical efficiency of practical classes because they reduce the distance between action and correction. In sports methodology, the timeliness of feedback is a decisive condition for successful learning. If too much time passes between performance and explanation, students may lose the sensory memory of the action, and correction becomes less precise. The use of mobile devices during lessons solves this problem by making analysis available directly in the practice environment. This creates a continuous instructional cycle in which performance, observation, correction, and repetition follow one another without delay. Such organization is especially productive in athletics classes, where repeated attempts and micro-corrections form the basis of technique improvement.

Another significant aspect of the discussion concerns the development of reflective competence. In pedagogical universities, students are trained not only as performers but also as future teachers who must assess, explain, and improve the movements of others. For this reason, it is important that they learn to analyze motor actions methodically. The findings show that digital tools contribute to this



Modern American Journal of Engineering, Technology, and Innovation

ISSN(E): 3067-7939

Volume 2, Issue 3, March, 2026

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professional formation by encouraging students to participate actively in the interpretation of their own performance. They gradually move from passive reception of teacher judgments to more independent technical reasoning. This is a major pedagogical advantage because reflective analysis is one of the central competencies required in professional physical education practice.

The discussion also points to the role of biomechanics as an interpretive framework within digital instruction. Video recordings alone do not automatically improve performance; their educational value depends on how they are used. When the teacher links the observed movement to concepts such as body alignment, force direction, stride mechanics, takeoff angle, center of mass control, and landing stability, the correction process becomes scientifically grounded. In this sense, video analysis and mobile applications are most effective when they are integrated with biomechanical literacy and pedagogical explanation. The technology itself functions as a means of visualization, while the teacher remains the central figure in transforming visual data into meaningful learning.

At the same time, the findings suggest that digital tools should not replace direct pedagogical interaction. Their effectiveness is highest when they complement demonstration, verbal guidance, corrective exercises, and repeated practice. Overreliance on technology without methodological support may reduce feedback to a purely technical procedure without sufficient educational depth. Therefore, the use of video analysis and mobile applications should be understood as part of a comprehensive instructional strategy rather than an isolated innovation. This balanced approach is especially relevant for pedagogical university programs, where students must learn how to combine technological competence with didactic sensitivity and practical teaching skill.

In broader terms, the study reflects current tendencies in the modernization of sports education. The increasing availability of smartphones, tablets, and mobile software has made performance analysis more accessible than in earlier periods, when such tools were limited to elite sports settings. This creates new opportunities for higher education institutions to strengthen practice-based training and to prepare future physical education teachers for contemporary professional realities. For educational systems seeking to modernize physical



education through innovation, digital movement analysis can serve as a practical bridge between classical teaching methods and current technological possibilities. Thus, the discussion demonstrates that video analysis and mobile applications support technical development, deepen motor understanding, enhance reflective competence, and increase the methodological readiness of future physical education teachers. Their value lies not only in improving current athletic performance but also in shaping a new culture of evidence-based, visually supported, and learner-centered instruction in physical education.

Conclusion

The conducted analysis demonstrates that the use of video analysis and mobile applications in physical education creates favorable pedagogical conditions for improving running and jumping techniques among students of pedagogical universities. The study has shown that digital tools significantly strengthen the process of motor skill formation by making movement more visible, feedback more precise, and correction more immediate. In the teaching of technically complex athletic actions, especially sprinting and jumping, such tools help reveal movement errors that are difficult to detect through ordinary observation alone. As a result, students gain a clearer understanding of body mechanics, improve coordination, and perform exercises with greater technical accuracy and confidence.

One of the most important conclusions of the study is that visualized digital feedback enhances the conscious character of motor learning. Students do not merely imitate the teacher's demonstration or respond mechanically to verbal instruction. Instead, they begin to observe, compare, and interpret their own movements in a more meaningful way. This increases their awareness of technical structure and supports a more reflective and self-regulated approach to physical training. The process of seeing one's own performance from the outside allows learners to connect internal sensations with external form, which is an essential condition for the stable development of motor skills.

The research also confirms that mobile applications improve the organization of the educational process in practical sports classes. Their accessibility, speed, and usability make them especially effective in dynamic instructional settings where



Modern American Journal of Engineering, Technology, and Innovation

ISSN(E): 3067-7939

Volume 2, Issue 3, March, 2026

Website: usajournals.org

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immediate analysis is required. The ability to record movement, review it in slow motion, focus on individual phases, and return to repeated attempts enables the teacher to organize more accurate and individualized instruction. This contributes to the pedagogical efficiency of each lesson and supports differentiated learning, since students can receive correction according to their specific technical needs. Another important conclusion is related to professional training. In pedagogical universities, the goal of physical education is not limited to improving students' own athletic abilities. Future teachers must also acquire the capacity to explain movement, identify errors, and apply evidence-based methods in their future work. In this regard, video analysis and mobile applications perform a dual function. They improve students' current practical performance and at the same time develop professional-methodological competencies that are essential for modern teaching practice. The use of such technologies helps future specialists become more analytically oriented, technologically competent, and pedagogically flexible.

The study makes it possible to conclude that the effectiveness of digital tools depends not only on their technical availability but also on their didactic integration. Video and mobile platforms produce the greatest educational effect when they are combined with purposeful teacher guidance, biomechanical explanation, repeated practice, and reflective discussion. Technology alone does not replace pedagogy. Its real value appears when it becomes part of a structured instructional model aimed at conscious learning, technical improvement, and professional development. Therefore, the role of the teacher remains central in interpreting digital information and transforming it into meaningful educational experience.

In summary, improving running and jumping techniques through video analysis and mobile applications should be considered a перспективное and methodologically justified direction in the modernization of physical education. These tools increase the visibility of movement, accelerate error correction, deepen motor understanding, and strengthen students' motivation and autonomy. Their implementation in the preparation of future physical education teachers is especially relevant because it aligns practical sports training with the broader demands of digital pedagogy and innovation in higher education. The integration



of such technologies can therefore be recommended as an effective means of enhancing both technical mastery and professional readiness in the field of physical education.

References

1. Aerts, I., Cumps, E., Verhagen, E., & Meeusen, R. (2013). A systematic review of different jump-landing variables in relation to injuries. *Sports Medicine*, 43(9), 877–895.
2. Benjaminse, A., Welling, W., Otten, B., & Gokeler, A. (2015). Optimization of the anterior cruciate ligament injury prevention paradigm: Novel feedback techniques to enhance motor learning and reduce injury risk. *Journal of Orthopaedic & Sports Physical Therapy*, 45(3), 170–182.
3. Bezodis, N. E., Willwacher, S., & Salo, A. I. T. (2019). The biomechanics of the track and field sprint start: A narrative review. *Sports Medicine*, 49(9), 1345–1364.
4. Hay, J. G. (1993). *The biomechanics of sports techniques*. Prentice Hall.
5. Han, Y., Ding, C., Zhang, J., & Qin, J. (2022). Feedback for promoting motor skill learning in physical education: A meta-analysis and trial sequential analysis. *International Journal of Environmental Research and Public Health*, 19(22), 15361.
6. Haugen, T., McGhie, D., Ettema, G., & Sandbakk, Ø. (2019). Sprint running: From fundamental mechanics to practice-aided science. *Sports Medicine*, 49(12), 1803–1818.
7. Hribernik, M., Umek, A., Tomažič, S., & Kos, A. (2022). Review of real-time biomechanical feedback systems in sport and rehabilitation. *Sensors*, 22(8), 3006.
8. Knudson, D. (2007). *Fundamentals of biomechanics*. Springer.
9. Lees, A. (2002). Technique analysis in sports: A critical review. *Journal of Sports Sciences*, 20(10), 813–828.
10. Lorås, H. (2020). The effects of physical education on motor competence in children and adolescents: A systematic review and meta-analysis. *Sports*, 8(6), 88.



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11. Magill, R. A., & Anderson, D. I. (2017). Motor learning and control: Concepts and applications. McGraw-Hill Education.
 12. Mero, A., Komi, P. V., & Gregor, R. J. (1992). Biomechanics of sprint running: A review. *Sports Medicine*, 13(6), 376–392.
 13. Potdevin, F., Vors, O., Huchez, A., Lamour, M., Davids, K., & Schnitzler, C. (2018). How can video feedback be used in physical education to support novice learning in gymnastics? Effects on motor learning, self-assessment and motivation. *Physical Education and Sport Pedagogy*, 23(6), 559–574.
 14. Schmidt, R. A., Lee, T. D., Winstein, C. J., Wulf, G., & Zelaznik, H. N. (2019). Motor control and learning: A behavioral emphasis. *Human Kinetics*.
 15. van Hooren, B., & Fuller, J. T. (2024). The relationship between running biomechanics and running economy: A systematic review. *Sports Medicine*, 54, 1–29.
 16. Wang, H., Pickering, T. A., Delahunt, E., & He, Y. (2022). A mobile platform-based app to assist undergraduate students in biomechanics learning. *Computer Applications in Engineering Education*, 30(6), 1877–1890.
 17. Wulf, G. (2013). Attentional focus and motor learning: A review of 15 years. *International Review of Sport and Exercise Psychology*, 6(1), 77–104.
 18. Wulf, G., Shea, C., & Lewthwaite, R. (2010). Motor skill learning and performance: A review of influential factors. *Medical Education*, 44(1), 75–84.
 19. 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.
 20. Bartlett, R. (2007). Introduction to sports biomechanics: Analysing human movement patterns. Routledge.