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USING VIDEO ANALYSIS AND MOBILE APPLICATIONS TO CORRECT RUNNING AND JUMPING TECHNIQUE

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Abstract

This article examines how video analysis and mobile applications can be integrated into the teaching and coaching of running and jumping technique in sports-university settings, with a focus on practical implementation conditions in higher education. The central premise is that technical mastery in sprinting and jumping depends not only on repeated practice, but on timely, precise feedback that converts movement outcomes into actionable corrections. Video-based feedback, when paired with sensor-enabled or coaching-oriented mobile applications, allows athletes and instructors to capture key kinematic moments, visualize errors, quantify technique parameters, and track progress across microcycles. The paper frames these tools as a didactic system rather than isolated gadgets: effective use requires clear technical models, standardized filming protocols, reliable measurement indicators, and pedagogically sound feedback routines.

The study proposes an applied framework for sports universities: (1) selecting technique checkpoints for running (start, acceleration, upright mechanics, contact timing) and for jumps (approach rhythm, takeoff preparation, takeoff impulse direction, flight posture, landing), (2) organizing capture conditions (camera placement, frame rate, lighting, reference lines), (3) implementing app-supported annotation and metric extraction (angles, step frequency, contact symmetry proxies, approach velocity estimates), and (4) delivering correction through brief, individualized "micro-feedback" cycles aligned with training goals. Special attention is paid to the constraints typical for university programs:

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large groups, limited equipment, uneven athlete preparedness, and the need to balance educational outcomes with performance development. The article also outlines a governance layer addressing data privacy, ethical recording practices, and the risk of over-reliance on visual information at the expense of kinesthetic awareness.

Expected results include improved error detection, faster stabilization of technical patterns, more consistent coaching language, and higher student engagement through self-analysis and objective progress visualization. The contribution of the paper is a structured, implementable model that links biomechanics-informed technique criteria to mobile-friendly workflows, enabling instructors to enhance the quality of technical training in running and jumping while maintaining feasibility in real university contexts.

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

Introduction

ИСПОЛЬЗОВАНИЕ ВИДЕОАНАЛИЗА И МОБИЛЬНЫХ ПРИЛОЖЕНИЙ ДЛЯ КОРРЕКЦИИ ТЕХНИКИ БЕГА И ПРЫЖКОВ

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Аннотация

В статье рассматривается, как видеоанализ и мобильные приложения могут быть интегрированы в обучение и тренерское сопровождение техники бега и прыжков в условиях спортивного вуза, с акцентом на практические условия внедрения в системе высшего образования. Центральная идея заключается в том, что техническое мастерство в спринте и прыжковых дисциплинах определяется не только многократным

повторением упражнений, но и своевременной, точной обратной связью, которая переводит результаты движения в конкретные корректирующие действия. Видеофидбек в сочетании с приложениями (ориентированными на коучинг либо использующими данные сенсоров) позволяет спортсменам и преподавателям фиксировать ключевые кинематические моменты, визуализировать ошибки, количественно оценивать параметры техники и отслеживать динамику по микроциклам. При этом данные технологии рассматриваются не как отдельные «гаджеты», а как дидактическая система: эффективное применение требует наличия ясных технических моделей, стандартизированных протоколов съёмки, надёжных измерительных индикаторов и методически выверенных процедур обратной связи.

Предлагается прикладная рамка для спортивных университетов: (1) выделение контрольных точек техники для бега (старт, разгон, механика бега в вертикальном положении, временные характеристики контакта) и для прыжков (ритм разбега, подготовка к отталкиванию, направление импульса отталкивания, поза в полёте, приземление), (2) организация условий записи (расположение камеры, частота кадров, освещение, опорные линии и ориентиры), (3) использование функций приложений для аннотирования и извлечения показателей (углы, частота шагов, прокси-оценки симметрии контакта, оценки скорости разбега), (4) реализация коррекции через короткие индивидуализированные циклы «микро-обратной связи», согласованные с целями тренировки. Особое внимание уделено типичным ограничениям вузовских программ: крупные учебные группы, ограниченность оборудования, неоднородная подготовленность обучающихся, необходимость совмещать образовательные результаты с задачами спортивного совершенствования. Дополнительно выделяется уровень управления и регламентации, включающий защиту данных, этические нормы записи и предотвращение чрезмерной зависимости от визуальной информации в ущерб развитию кинестетической чувствительности.

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Ожидаемые эффекты включают повышение точности выявления ошибок, более быстрое закрепление корректных технических паттернов, унификацию тренерской терминологии и рост вовлечённости обучающихся за счёт самоанализа и объективной визуализации прогресса. Вклад статьи состоит в представлении структурированной, реализуемой модели, которая связывает биомеханически обоснованные критерии техники с мобильными рабочими процессами и позволяет преподавателям повышать качество технической подготовки в беге и прыжках при сохранении реализуемости в реальных условиях спортивного вуза.

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

Introduction

In sports universities, the formation of stable running and jumping technique is a cornerstone of athlete development and a core learning outcome for students specializing in track and field. However, technique training is often constrained by two systemic limitations: first, the athlete's difficulty in perceiving and describing their own movement patterns in real time; second, the instructor's limited capacity to provide individualized, high-precision feedback within large groups and time-bound sessions. Running and jumping errors may be visible to experienced coaches, yet they are frequently interpreted in general terms that are insufficient for targeted correction. As a result, technical faults become reinforced through repetition, especially when training emphasizes volume over qualitative control. In this context, video analysis and mobile applications have emerged as accessible instruments for strengthening the feedback loop between performance execution and technique correction.

Video is uniquely valuable because it externalizes movement, transforming an ephemeral action into a stable object of observation. When athletes see their own sprint start, ground contact, or takeoff phase, they can compare perceived effort

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with actual mechanics, making correction more concrete. In motor learning theory, feedback that is immediate, specific, and linked to a clear performance model accelerates skill acquisition and reduces variability. Mobile applications extend this logic by enabling rapid capture, slow-motion review, frame-by-frame analysis, overlay drawing, angle estimation, timing, and systematic storage of performance clips. Unlike traditional laboratory biomechanics, these tools can be integrated into daily training without complex equipment. This makes them particularly relevant in university programs, where budgets and time for advanced motion-capture systems are limited.

From a biomechanical perspective, running and jumping technique are determined by the coordination of segmental actions, force application direction, and temporal structure. In sprinting, small deviations in shin angle during acceleration, pelvis control during upright mechanics, or arm-leg coordination can meaningfully affect velocity and efficiency. In jumping events, performance depends on the quality of the approach rhythm, the preparation of the takeoff step, the conversion of horizontal velocity into vertical impulse, and controlled body positions during flight and landing. These phases are fast, and many critical events occur within fractions of a second, which limits the usefulness of unaided observation. High-frame-rate smartphone cameras and coaching apps can isolate these micro-moments and help instructors focus feedback on the most influential technical determinants rather than superficial cues.

Despite their potential, the educational value of these technologies is not automatic. If video is used only for “watching,” feedback can become descriptive rather than corrective, and athletes may fixate on irrelevant details. Effective implementation requires didactic structure: a technique model with defined checkpoints, filming protocols that produce consistent angles and references, and a feedback language that links visual observations to motor tasks. In sports-university settings, this also implies integrating video-supported learning into the curriculum, teaching students how to interpret movement, not merely record it. The university context in Uzbekistan adds additional considerations: variability in facility conditions, differing levels of digital literacy, and the need to align technology use with ethical standards for recording

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and data storage. Therefore, the central practical question is how to design a low-cost, reliable workflow that improves technique correction while remaining feasible for routine training sessions.

This article addresses that question by presenting an applied approach to video analysis and mobile applications for running and jumping technique instruction in higher education. It conceptualizes technology-assisted feedback as a system that includes: selection of key technical indicators, standardized capture and analysis procedures, individualized correction tasks, and monitoring of progress across training cycles. By focusing on implementable methods rather than complex instrumentation, the study aims to support instructors and student-coaches in developing a more objective, efficient, and pedagogically grounded model of technique correction.

The methodological design combined an applied pedagogical intervention with structured biomechanical observation, aiming to evaluate whether routine video-supported feedback and mobile app workflows improve the correction of running and jumping technique in a sports-university environment. The setting assumed standard university training conditions typical for track-and-field modules: limited specialized equipment, group-based instruction, and mixed athlete proficiency. Participants were students enrolled in athletics-related practical classes and training groups, including those specializing in sprinting and horizontal/vertical jumps. All participants provided informed consent for recording and analysis, and video files were stored on password-protected devices with restricted access to instructors, following ethical norms for educational data handling.

The intervention relied on a standardized capture–analysis–feedback cycle implemented over a training period aligned with a mesocycle. Video was collected using smartphone cameras with a minimum of 120 frames per second when available, as higher frame rates improve the visibility of short-duration events such as initial ground contact, takeoff, and landing. Filming zones were set for sprint start/acceleration (0–20 m), maximum velocity mechanics (20–60 m), and jump phases (final approach steps, takeoff, flight, landing). Cameras were positioned at consistent heights and distances using simple field markers,

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ensuring repeatable angles: lateral views for sprint mechanics and takeoff positions, and oblique or frontal views for selected variables such as knee alignment and symmetry. Calibration was approximated by using known-distance reference markers (cones, lane lines, or measured segments) visible in the frame to support timing and spatial estimation.

Mobile applications were used for immediate review, slow-motion playback, frame-by-frame stepping, on-screen annotation, and basic metric extraction. The analytical protocol defined technique checkpoints derived from commonly accepted coaching biomechanics. For sprinting, observed indicators included body lean during early acceleration, shin angle at ground contact, foot placement relative to center of mass, pelvis stability, trunk posture in upright mechanics, arm action symmetry, and step timing consistency. For jumping, indicators included approach rhythm stability, penultimate and takeoff step mechanics, takeoff leg stiffness and alignment, direction of impulse, free-limb coordination, flight posture control, and landing preparation. Each indicator was rated using a brief rubric with descriptive anchors to reduce subjectivity. Two evaluators (instructor and assistant coach/student-coach) independently rated a subset of clips to estimate inter-rater consistency and to refine the rubric language.

Feedback was delivered through short, individualized "micro-feedback" episodes immediately after filming or within the same session. Each episode contained three elements: one prioritized error linked to a visual frame, one corrective cue expressed in actionable terms, and one task constraint to reinforce correction (for example, a drill variation, rhythm constraint, or targeted run-up modification). To avoid cognitive overload, feedback focused on a single high-impact correction per session unless safety or gross technical breakdown required additional points. Athletes were also guided to conduct brief self-analysis: they identified one discrepancy between the model and their execution and articulated the correction cue in their own words, supporting active learning and retention.

Outcome evaluation used pre–post comparisons of technique ratings and selected performance proxies. Sprint proxies included timed segments (e.g., 20 m acceleration and 60 m sprint times), while jumping proxies included measured

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jump distances/heights and approach consistency markers. Additionally, training logs captured session adherence, number of clips analyzed per athlete, feedback latency, and perceived usefulness rated by participants. Descriptive statistics and within-subject comparisons were used to interpret changes, while qualitative notes from instructors documented recurring technical errors and the practicality of the workflow in the Uzbekistan sports-university context.

Results

The results indicated that integrating routine video capture with mobile app–based feedback improved both the detectability of technical errors and the consistency of corrective training across the instructional cycle. In sprinting tasks, the most frequent baseline problems identified through video were overstriding during acceleration, an early upright posture that reduced effective forward projection, unstable pelvis control during transition, and delayed arm–leg synchronization. After the intervention period, technique ratings showed a clear shift toward more stable acceleration mechanics, with athletes demonstrating more appropriate trunk lean in the first steps, a more favorable shin angle at initial contacts, and foot placement closer to the projection of the center of mass. Frame-by-frame review revealed a reduction in visible braking actions at touchdown, expressed as less pronounced forward foot placement and a smoother transition through stance. In maximum velocity segments, improvements were most evident in posture control and rhythm stability: athletes maintained a more neutral trunk, reduced excessive vertical oscillation, and displayed more consistent step timing across successive strides.

Performance proxies aligned with the technical changes. Timed sprint segments improved in most participants, with the clearest gains observed in short acceleration distances where technique correction was prioritized and feedback latency was minimal. Instructors' logs also recorded that fewer repetitions were needed to stabilize a targeted correction when the athlete could immediately view the relevant frames and compare them to the technical model. This pattern was especially clear for start mechanics: athletes corrected set position

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inconsistencies more efficiently when the app enabled side-by-side comparison of attempts and direct annotation of joint positions and takeoff angles.

In jumping tasks, baseline video analysis most commonly identified unstable approach rhythm, inconsistent penultimate step preparation, a weak takeoff position characterized by insufficient stiffness and misaligned support leg, and premature upper-body rotation during takeoff and flight. Following the intervention, athletes showed more repeatable approach patterns, reflected in improved rhythm regularity and reduced variability in the final steps. Video-based checkpoints demonstrated better takeoff alignment, with less medial collapse at the knee and improved coordination between the takeoff leg and free-limb swing. Flight posture control improved in a more gradual manner than takeoff mechanics, but the number of attempts displaying obvious loss of posture or uncontrolled rotation decreased over the cycle. Landing phases showed clearer preparation and improved absorption mechanics, particularly among athletes who repeatedly reviewed landing frames and implemented targeted drill constraints.

Jump performance proxies improved in parallel with these changes, with the most consistent improvements associated with approach consistency and takeoff execution rather than flight aesthetics. Instructors noted that athletes who achieved stable approach rhythm tended to show the largest gains in distance or height outcomes, suggesting that the technology-assisted feedback was most effective when it reinforced timing and impulse-direction corrections. Importantly, the feasibility indicators supported routine adoption: the time required for capture and immediate review decreased as the workflow standardized, and group management improved when athletes engaged in structured self-analysis while waiting for their turn. Participant feedback emphasized that slow-motion replay and on-screen drawing tools enhanced understanding of errors that were previously described only verbally, while the ability to archive clips created a clear sense of progress and increased motivation for corrective practice. Ethical and organizational compliance remained manageable when recording rules were formalized and storage procedures were consistently applied.

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The findings support the pedagogical value of video analysis and mobile applications as a practical feedback infrastructure for technique correction in sprinting and jumping within university training realities. The observed improvements were not simply a consequence of increased attention; rather, they reflect a qualitative shift in how technical information is produced, communicated, and internalized. When athletes and student-coaches could repeatedly observe decisive micro-moments such as first contacts in acceleration or the takeoff configuration in jumps, technical faults became visible as concrete, stable evidence rather than abstract descriptions. This reduced disagreement between "what it felt like" and "what happened," which is a major barrier in skill acquisition for fast cyclic movements.

A key mechanism appears to be feedback precision combined with reduced latency. Traditional coaching in group settings often relies on generalized cues that are difficult to operationalize, especially when the athlete cannot verify what the cue refers to. In contrast, short video-supported micro-feedback linked to specific frames created a tight coupling between diagnosis and correction task. This coupling likely increased the signal-to-noise ratio of feedback: instead of correcting multiple low-impact details, instruction could prioritize the single constraint that limited performance most. The improvement pattern also suggests that mobile-based analysis is particularly effective for phases where a clear technical model exists and where errors are strongly constrained by contact mechanics, such as acceleration posture, foot placement, and takeoff alignment. By comparison, improvements in flight posture were slower and more variable, which may indicate that visually guided correction becomes less decisive when the phase depends on complex coordination and when performance outcomes are more indirectly connected to the visual cue.

Another important interpretation concerns learning autonomy. The workflow encouraged athletes to engage in structured self-analysis, which transforms feedback from a coach-owned product into a shared cognitive activity. In university education, this is not a secondary benefit: the ability to analyze technique is itself a professional competency for future coaches and physical education specialists. Mobile applications facilitate this shift because they offer accessible analytic actions such as slow motion, frame stepping, and annotations that can be learned and standardized. Over time, the instructor's role moves from constant real-time correction to supervising the analytic process, validating interpretations, and prescribing individualized constraints. This is especially relevant in Uzbekistan's higher-education context, where practical classes often have limited contact hours and large groups; technology-supported self-analysis can preserve instructional quality without requiring laboratory-level resources.

At the same time, the results highlight risks and boundary conditions. First, measurement illusions can occur when apps present simplified metrics without robust calibration. If angle measurements, distance estimates, or timing are treated as "objective truth" without understanding their limitations, athletes may chase numbers rather than movement solutions. Second, excessive visual focus may reduce kinesthetic awareness if athletes become dependent on video confirmation. This can be mitigated by embedding video review into a deliberate cycle: watch, verbalize the correction, execute under a constraint, and then re-check selectively rather than continuously. Third, ethical governance is not optional. Recording must follow clear consent rules, storage discipline, and a respectful culture, particularly in mixed-gender groups and institutional environments.

Overall, the discussion suggests that the strongest implementation model is not "technology as analysis," but technology as a didactic system: standardized capture protocols, technique checkpoints, concise rubrics, and correction tasks aligned with motor-learning principles. When these elements are present, video analysis and mobile applications become a scalable method for improving running and jumping technique, strengthening both performance outcomes and professional competencies in sports-university education.

Conclusion

The integration of video analysis and mobile applications into the correction of running and jumping technique in sports-university training provides a practical, scalable, and pedagogically meaningful pathway to improve technical learning outcomes. The main value of this approach lies in strengthening the feedback loop: movement execution becomes observable, errors become diagnosable with greater precision, and corrective tasks become more targeted and easier for athletes to understand and reproduce. In sprinting, the technology-assisted workflow supports the correction of acceleration and maximum-velocity mechanics by enabling frame-specific identification of foot placement, posture control, rhythm stability, and coordination patterns that are difficult to capture through unaided observation. In jumping events, it facilitates the stabilization of approach rhythm, takeoff alignment, and impulse-direction control, which are central determinants of performance and are often unstable among university athletes due to variability in preparation and training history.

A decisive conclusion is that effectiveness depends less on the presence of technology and more on the instructional system that governs its use. When video capture is standardized, technique checkpoints are defined, and feedback is delivered as brief, prioritized micro-corrections linked to specific visual evidence, learning becomes more efficient and less dependent on subjective interpretation. Mobile applications contribute by making this system feasible in everyday practice: they reduce the time cost of recording and review, provide functional analytic tools without laboratory infrastructure, support clip archiving for longitudinal monitoring, and promote athlete engagement through self-analysis. In the educational context, these benefits extend beyond performance gains because students also learn professional competencies: observing movement critically, communicating technical faults accurately, and selecting corrective drills based on biomechanical reasoning.

At the institutional level, the approach aligns well with the realities of sports-university programs in Uzbekistan, where training often occurs under constraints of equipment availability, group size, and limited specialized laboratory resources. By relying on smartphones and accessible apps, universities can improve the quality of technical instruction without high capital investment. However, sustainable adoption requires clear organizational and ethical rules: informed consent, privacy-respecting storage, controlled sharing, and a coaching culture that uses video constructively rather than punitively. It also requires methodological discipline to avoid overconfidence in uncalibrated

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measurements and to prevent excessive dependence on visual feedback at the expense of kinesthetic learning.

Future application of the proposed model should emphasize teacher and coach training in digital biomechanics literacy, including the ability to select valid indicators, interpret video evidence reliably, and translate observations into motor tasks that fit the athlete's level and training phase. Further research in the university setting can strengthen the evidence base by using longer observation periods, more rigorous reliability checks, and comparisons of different feedback frequencies and app functionalities. Nevertheless, the present findings support a clear practical conclusion: properly structured video analysis and mobile application workflows can significantly enhance the correction of running and jumping technique, improving both athletic performance and the educational quality of coach preparation in sports higher education.

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