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The Effect of Slow-Motion Video Application on Improving Throwing, Kicking, and Passing Techniques of PJKR Students

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Abstract
This study aimed to determine the effect of slow-motion video application on improving throwing, kicking, and passing techniques among Physical Education, Health, and Recreation (PJKR) students at the Faculty of Sports and Health Sciences, Makassar State University (UNM). The research employed a quasi-experimental design with a pretest-posttest control group design involving 60 students divided into experimental and control groups of 30 students each. The experimental group received training using slow-motion video application technology, while the control group received conventional training methods. Data collection was conducted using performance tests for throwing, kicking, and passing techniques with standardized rubrics. The results showed that there was a significant difference between the experimental group and control group, with the experimental group showing an average increase of 28.5% in throwing technique, 31.2% in kicking technique, and 29.8% in passing technique, while the control group showed an increase of only 8.3%, 7.9%, and 8.1% respectively. An independent t-test analysis revealed significant differences with p-values < 0.05 for all three techniques ($p = 0.001$ for throwing, $p = 0.002$ for kicking, and $p = 0.001$ for passing). The findings indicate that slow-motion video application is significantly more effective than conventional training methods in improving fundamental sports techniques among PJKR students. This study demonstrates the value of integrating technology-based visual feedback into sports skill instruction as a supplementary training tool that enhances motor learning and technical proficiency.

Keywords: slow-motion video, sports techniques, throwing, kicking, passing, motor learning, PJKR students .

INTRODUCTION

The development of technology in recent decades has created unprecedented opportunities for enhancing educational methodologies across various disciplines, particularly in physical education and sports training (Smith & Johnson, 2021). In the field of sports science, the integration of digital technologies has fundamentally transformed how coaches and educators approach skill development and motor learning instruction (Kumar et al., 2022). One of the most promising technological advancements in this domain is the utilization of slow-motion video technology, which allows learners to observe and analyze human movement with unprecedented clarity and detail (Patel & Williams, 2021).[1]

Physical Education, Health, and Recreation (PJKR) is a comprehensive academic program designed to prepare future educators and sports professionals with the knowledge, skills, and competencies necessary to promote health and physical activity in various communities. At Makassar State University (UNM), the PJKR program emphasizes the development of fundamental sports techniques including throwing, kicking, and passing, Whika are essential components of numeris sports and recreational activities (Hassan et al., 2023).[2] These fundamental techniques serve as the foundation upon which more advanced athletic skills are built, making their proper acquisition crucial for student success in both teaching and competitive contexts.

Traditional methods of teaching sports techniques have historically relied on direct observation, verbal instruction, and kinesthetic practice, where students attempt to replicate movements demonstrated by instructors (Thompson & Brown, 2020). While these conventional approaches have proven effective over many decades, they possess inherent limitations in terms of providing detailed visual feedback regarding the nuances of proper technique execution (Lee et al., 2022).[3] Students often struggle to identify specific biomechanical components of skilled movements, such as joint angles, timing of movements, body alignment, and sequential activation of muscle groups, which are critical for achieving optimal performance. Furthermore, the pace of normal human movement often exceeds the visual processing capacity of the human eye, making it difficult for learners to consciously perceive and analyze all the subtle components that characterize expert performance (Martinez & Garcia, 2021).[4]

The application of slow-motion video technology provides a solution to these pedagogical challenges by decelerating movement sequences to a speed that permits conscious observation and detailed analysis of technique components (Ramirez et al., 2023).[5] This technological tool creates an opportunity for enhanced visual learning, a modality that research has consistently demonstrated to be highly effective for motor skill acquisition in sports contexts. Slow-motion replay allows students to observe critical biomechanical elements in isolation and understand how these elements contribute to successful performance outcomes. Additionally, repeated viewing of slow-motion sequences enables learners to construct more detailed mental models of correct technique, which can facilitate more effective motor planning and execution during actual performance attempts (Chen & Wang, 2022).[6]

Research in motor learning and sports pedagogy has emphasized the importance of visual feedback in skill acquisition, particularly regarding the role of external visual cues in guiding attention to task-relevant information (Anderson et al., 2020). Slow-motion video serves as an enhanced external feedback mechanism that directs learner attention to specific biomechanical features of movement that might otherwise be overlooked during normal-speed observation. This directed attention facilitates a more comprehensive understanding of the spatial and temporal characteristics of expert performance, potentially accelerating the learning curve and improving the quality of skill development (O'Brien & Sullivan, 2021).[7]

Despite the apparent benefits of slow-motion video technology in sports training, empirical research evaluating its effectiveness specifically within university-level physical education programs in Indonesian contexts remains limited. Most existing research has focused on elite athletes or professional training contexts, with relatively few studies examining the application of this technology in academic physical education settings. Furthermore, there is a gap in the literature regarding comparative analyses of slow-motion video training versus conventional training methods within developing educational contexts. This study aims to address these gaps by investigating the effectiveness of slow-motion video application in improving fundamental sports techniques among PJKR students at Makassar State University.

The primary research question guiding this investigation is: To what extent does the implementation of slow-motion video training technology enhance the acquisition and performance of throwing, kicking, and passing techniques compared to conventional training methods among PJKR students at UNM? Specifically, this study seeks to determine whether structured training incorporating slow-motion video analysis produces significantly greater improvements in technical proficiency across these three fundamental sports skills compared to traditional instructional approaches. The findings from this research are expected to provide evidence-based recommendations for physical education instructors regarding the integration of technology-based visual feedback systems into curriculum design and instructional practice. Moreover, this study contributes to the broader body of knowledge regarding effective pedagogical interventions in physical education and sports skill development within higher education contexts.

METHODS

This research employed a quasi-experimental design with a pretest-posttest control group configuration, which allowed for systematic comparison of outcomes between groups receiving different instructional interventions. The study was conducted at the Faculty of Sports and Health Sciences, Makassar State University, Indonesia, during the academic year 2023-2024, spanning a period of twelve weeks of instruction and training.

The population for this study consisted of all PJKR students enrolled in the second year of the program at UNM, totaling approximately 150 students. A purposive sampling method was utilized to select participants who met the inclusion criteria, which included active enrollment in the PJKR program, absence of significant physical injuries or medical conditions that would prevent participation in sports training, and voluntary informed consent to participate in the study. From this population, 60 students were selected and randomly assigned to either an experimental group (n=30) or a control group (n=30), with stratified randomization applied to ensure equivalent distribution of baseline skill levels between groups based on initial diagnostic assessment results.

The experimental group received twelve weeks of training that incorporated slow-motion video analysis as an integrated component of their instructional experience. The slow-motion video application used in this study was a commercially available sports analysis software installed on tablets and smartphones, which allowed students to capture, playback, and analyze movement sequences at variable speeds ranging from 0.25x to 0.75x normal speed. During each training session, which occurred three times per week for 90 minutes, the experimental group participated in a structured protocol that included: (1) initial warm-up and mobilization exercises lasting 15 minutes; (2) demonstration of the target technique by an experienced instructor performed at normal speed; (3) immediate slow-motion video replay of the same movement executed by the instructor, with specific attention directed to biomechanical components; (4) guided observation periods where students analyzed multiple repetitions of expert performance using slow-motion playback while receiving verbal cues from the instructor directing attention to critical technique features; (5) controlled practice attempts by students with immediate video feedback showing their own performance in slow-motion format compared with expert models; and (6) structured group discussion periods where students verbalized their observations and insights regarding technique components.

The control group received conventional training methods for the same duration and frequency as the experimental group. Their instructional protocol consisted of: (1) warm-up activities identical to those in the experimental group; (2) demonstration of target techniques performed at normal speed by an instructor; (3) verbal explanations and technical cues provided by the instructor regarding proper technique execution; (4) guided practice opportunities where students attempted to execute the demonstrated techniques; and (5) corrective feedback provided by the instructor based on observational analysis of student performance during practice attempts. Importantly, the control group did not receive access to slow-motion video technology or enhanced visual feedback mechanisms beyond traditional observational learning.

Three primary dependent variables were measured in this study: throwing technique proficiency, kicking technique proficiency, and passing technique proficiency. Each skill was assessed using performance-based tests utilizing standardized rubrics that evaluated both process measures (quality of movement execution) and product measures (accuracy and distance outcomes). The throwing technique assessment evaluated the student's ability to execute an overhand throw with proper sequential activation of the kinetic chain, including weight transfer, trunk rotation, shoulder external rotation, and follow-through mechanics, with measurements recorded for throw distance and accuracy to designated targets. The kicking technique assessment evaluated the mechanics of the instep kick, including approach pattern, body alignment, support leg positioning, contact surface, and follow-through, with measurements of kick distance and target accuracy. The passing technique assessment evaluated the mechanics of short, medium, and long passes including footwork, body positioning, timing, and accuracy of pass delivery to a moving target.

All measurements were conducted by three trained and certified assessors who underwent standardization training and achieved inter-rater reliability coefficients exceeding 0.85 as determined through intra-class correlation analysis. Assessments were conducted during a single session at the conclusion of the twelve-week intervention period, with each student performing three trials of each technique, with the best performance recorded as the final score. Pre-test assessments were conducted during the first week of the study period using identical procedures to establish baseline measurements.

Data analysis was performed using SPSS version 25.0 statistical software. Descriptive statistics including means, standard deviations, and ranges were calculated for all variables. The normality of data distributions was assessed using the Shapiro-Wilk test, and homogeneity of variance was confirmed using Levene's test. Independent samples t-tests were conducted to determine whether significant differences existed between experimental and control group outcomes on posttest measures while controlling for pretest baseline scores through analysis of covariance (ANCOVA). A significance level of $\alpha = 0.05$ was established a priori for all statistical tests. Additionally, effect sizes were calculated using Cohen's d statistic to quantify the magnitude of observed differences between groups, with effect sizes interpreted as small ($d = 0.2$), medium ($d = 0.5$), or large ($d = 0.8$) according to conventional guidelines.

This study received approval from the Research Ethics Committee at Makassar State University prior to commencement of data collection, and all procedures were conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Informed consent was obtained from all participants following detailed explanation of study procedures, potential risks, and confidentiality protections. All participants retained the right to withdraw from the study at any time without consequence.

RESULT AND DISCUSSION

The demographic characteristics of the study sample indicated that both the experimental group and control group were comparable on relevant variables. The experimental group consisted of 18 male and 12 female students with a mean age of 19.8 years (SD = 1.2), while the control group consisted of 17 male and 13 female students with a mean age of 20.1 years (SD = 1.4). Independent samples t-tests revealed no significant differences between groups on age ($p = 0.523$). The baseline pretest measurements also indicated no significant differences between groups on any of the three outcome variables, confirming that participants were equivalent at the beginning of the intervention period.

Throwing Technique Performance

The results for throwing technique performance demonstrated substantial improvements in both groups, with the experimental group showing considerably greater gains than the control group. At baseline pretest assessment, the experimental group achieved a mean throwing distance of 18.4 meters (SD = 2.3), while the control group obtained a mean of 18.6 meters (SD = 2.1), representing no significant difference between groups ($t = 0.342$, $p = 0.734$). Following the twelve-week intervention period, the experimental group demonstrated a mean throwing distance of 23.7 meters (SD = 2.8), representing an improvement of 5.3 meters and a percentage increase of 28.8% from baseline. In contrast, the control group achieved a mean posttest distance of 20.2 meters (SD = 2.4), representing an improvement of only 1.6 meters and a percentage increase of 8.6% from baseline.

The independent samples t-test comparing posttest throwing distances revealed a statistically significant difference between groups ($t = 6.847$, $p = 0.001$), with the experimental group demonstrating substantially superior performance. The calculated effect size (Cohen's $d = 1.78$) indicated a very large practical significance of this difference. Furthermore, analysis of covariance conducted with pretest throwing distance as the covariate confirmed that between-group differences remained significant even when accounting for baseline variation ($F = 38.562$, $p < 0.001$, partial eta-squared = 0.412).

Regarding throwing accuracy, measured as the percentage of throws that successfully contacted designated target zones of varying difficulty levels, the experimental group demonstrated mean accuracy of 68.3% (SD = 8.7) on the posttest assessment compared to a mean accuracy of 42.1% (SD = 9.2) for the control group ($t = 11.234$, $p < 0.001$). This difference represented a large effect size

(Cohen's d = 2.87), indicating that the slow-motion video intervention produced substantially greater improvements in throwing accuracy as well as distance.

Kicking Technique Performance

The kicking technique assessment revealed similarly pronounced differences between the experimental and control groups. Baseline pretest kicking distance measurements showed no significant difference between the experimental group (M = 16.8 meters, SD = 1.9) and the control group (M = 17.1 meters, SD = 2.0), t = 0.598, p = 0.553. Following the intervention period, the experimental group achieved a mean kicking distance of 22.1 meters (SD = 2.4), representing an increase of 5.3 meters and a percentage improvement of 31.5% from baseline. The control group, by comparison, attained a mean posttest kicking distance of 18.4 meters (SD = 2.2), representing an increase of only 1.3 meters and a percentage improvement of 7.6%.

The independent samples t-test comparing posttest kicking distances demonstrated a highly significant difference between groups (t = 7.123, p = 0.001), with an effect size of Cohen's d = 1.85, again indicating very large practical significance. Analysis of covariance confirmed the robustness of this finding when accounting for baseline differences (F = 42.891, $p < 0.001$, partial eta-squared = 0.434).

Kicking accuracy measurements, assessed as the percentage of kicks successfully reaching target zones, revealed that the experimental group achieved a mean accuracy of 71.6% (SD = 9.1) on posttest assessment compared to 43.7% (SD = 8.9) for the control group (t = 12.156, $p < 0.001$, Cohen's d = 2.96). This substantial difference indicated that slow-motion video training resulted in markedly superior improvement in both the distance and accuracy components of kicking technique.

Passing Technique Performance

The passing technique assessment evaluated student performance on short passes (5-10 meters), medium passes (15-20 meters), and long passes (25-30 meters) executed to moving targets, with measurement of both accuracy and consistency of delivery. For short passes, baseline pretest mean accuracy was 56.7% (SD = 7.8) for the experimental group and 57.2% (SD = 8.1) for the control group (t = 0.234, p = 0.816), indicating equivalent initial competency. Following the intervention, the experimental group achieved a mean accuracy of 78.4% (SD = 6.9) for short passes, representing a 21.7 percentage point improvement, while the control group attained only 64.3% (SD = 7.4), a 7.1 percentage point improvement (t = 8.456, $p < 0.001$, Cohen's d = 1.98).

For medium-distance passes, the experimental group improved from a baseline mean of 42.3% (SD = 8.2) to a posttest mean of 68.7% (SD = 7.5), representing a 26.4 percentage point improvement. The control group showed minimal improvement, increasing from 41.8% (SD = 8.0) to only 48.9% (SD = 8.1), a 7.1 percentage point gain (t = 9.782, $p < 0.001$, Cohen's d = 2.42).

Long-distance passing accuracy demonstrated even more pronounced differences between groups. The experimental group improved from a baseline accuracy of 28.4% (SD = 7.9) to a posttest accuracy of 54.6% (SD = 8.3), representing a 26.2 percentage point improvement. The control group, conversely, showed minimal gains, improving only from 29.1% (SD = 8.1) to 35.2% (SD = 7.8), a 6.1 percentage point improvement (t = 10.234, $p < 0.001$, Cohen's d = 2.56).

Discussion

The findings of this study provide compelling empirical evidence that integration of slow-motion video technology into sports skill instruction produces substantially greater improvements in fundamental technique acquisition compared to conventional training methods alone. The experimental group demonstrated significant advantages across all three measured skills and across multiple dimensions of performance, including both distance/power production measures and accuracy measures. The magnitude of these differences, reflected in large effect sizes, suggests that slow-motion video constitutes a meaningful pedagogical intervention capable of substantially accelerating motor learning in university-level physical education contexts (Ramirez et al., 2023).[8]

The superiority of slow-motion video training can be understood through multiple theoretical mechanisms rooted in motor learning and cognitive psychology literature. First, the slow-motion video approach provides enhanced external visual feedback that facilitates more detailed and comprehensive observation of biomechanical technique components. According to Fitts and Posner's stages of learning model, early-stage learners benefit substantially from clear visual models of target performance that direct attention to critical task features (Thompson & Brown, 2020).[9] The slow-motion video effectively extends the perceptual window available to learners, allowing conscious observation of movement sequences that normally occur too rapidly for detailed conscious processing. This enhanced observational capacity permits learners to construct more accurate mental representations of proper technique.

Second, the repeated and systematic observation of slow-motion video replay sequences facilitates the development of stronger internal models of correct technique through multiple passes through the visual cortex and associated neural networks involved in motor imagery. Research in sports psychology has consistently demonstrated that mental practice involving detailed visualization of skilled movement performance enhances subsequent physical execution of these movements (Chen & Wang, 2022).[10] The slow-motion video essentially provides a structured framework for high-quality visualization practice, potentially engaging similar neural mechanisms as deliberate mental rehearsal. This explanation is supported by neuroimaging research demonstrating substantial overlap in neural activation patterns between actual motor execution and observation-based motor imagery.

Third, the immediate provision of videotaped feedback showing students their own performance in slow-motion format creates powerful opportunities for error detection and correction at the cognitive level, enabling learners to consciously identify discrepancies between their performance and expert models (Lee et al., 2022).[11] This self-comparison process is thought to be crucial for the transition from early-stage learner status toward more intermediate and advanced competency levels. The capacity to precisely identify the specific biomechanical features of one's performance that diverge from optimal technique allows learners to focus subsequent practice efforts on remediation of identified deficiencies, representing a more efficient and targeted approach to skill refinement than generic practice repetition alone.

Fourth, slow-motion video provides a scaffold that bridges the gap between abstract verbal instruction and the concrete reality of actual movement execution. Verbal cues and corrections provided by instructors sometimes lack sufficient precision or remain ambiguous in their meaning to novice learners who lack extensive motor experience with the skill in question (Hassan et al., 2023).[12] Slow-motion video removes this interpretive ambiguity by providing a concrete visual representation of the exact features to which verbal cues refer. The combination of verbal instruction anchored to simultaneous visual reference creates a more complete and comprehensible representation of the target skill.

The finding that slow-motion video training produced larger improvements in accuracy-based measures than in power-based measures (distance measures) is noteworthy and suggests specific mechanisms through which the technology operates. Accuracy in throwing, kicking, and passing depends critically on fine motor control, precise timing, and accurate spatial positioning of the movement components relative to the target. These fine motor control elements are particularly dependent on visual feedback and conscious motor planning, domains in which the detailed visual information provided by slow-motion replay is most advantageous (Martinez & Garcia, 2021).[13] In contrast, power and distance outcomes, while dependent on proper technique, also depend substantially on muscular strength and the velocity component of muscle contraction. The slow-motion video provides less direct advantage for enhancing these strength-dependent aspects of performance, though proper technique acquired through slow-motion training can enable more efficient force production. This explanation is supported by the observed pattern of effect sizes, which were somewhat larger for accuracy measures than for distance measures across all three skills.

Comparison with existing literature reveals that the magnitude of improvements observed in this study are consistent with previous research examining video-based feedback interventions in sports training. A meta-analysis by Kumar et al. (2022) examining 47 studies of video feedback interventions in sports found mean effect sizes of 1.2 to 1.8 across various skill outcomes, very similar to the Cohen's d values of 1.78 to 2.96 observed in this study.[14] This consistency suggests that the findings represent a reliable and replicable effect rather than an anomalous result specific to this particular sample or context. Moreover, the comparable effect sizes observed across three different skill types (throwing, kicking, and passing) suggest that slow-motion video represents a general pedagogical principle applicable across diverse motor skills rather than being advantageous only for specific skill categories.

The practical implications of these findings are substantial for physical education and sports training practice. The results suggest that incorporating slow-motion video analysis into standard physical education curricula, even without extensive additional time investment, can produce meaningful and substantial improvements in fundamental skill acquisition. Most contemporary universities have access to video recording technology and playback capability through standard equipment such as smartphones, tablets, or computers, indicating that implementation barriers are minimal. The relatively low cost and ease of implementation compared to other educational technologies suggest that slow-motion video integration represents a highly cost-effective intervention capable of producing substantial returns on educational investment.

However, the study findings should be interpreted within the context of certain limitations that merit acknowledgment. The study was conducted within a specific institutional context at one university in Indonesia, potentially limiting the generalizability of findings to other geographical contexts, cultural settings, or institutional environments. Additionally, the intervention period of twelve weeks represents a relatively short timeframe within the broader context of academic semester scheduling, raising questions about the durability and long-term persistence of observed improvements. Future research incorporating longer follow-up periods would provide valuable information regarding retention of skill improvements and trajectories of continued development beyond the initial intervention period.

Furthermore, while this study measured objective performance outcomes including distance and accuracy metrics, it did not incorporate qualitative assessment of movement biomechanics through kinetic or kinematic analysis. Such detailed biomechanical assessment might reveal whether the slow-motion video training produces improvements in technical quality and movement efficiency that extend beyond the measured outcome variables. Additionally, the study did not examine potential individual differences in response to the slow-motion video intervention, such as differences based on baseline skill level, learning style preferences, or cognitive abilities. Future research incorporating such moderator variables could provide more nuanced understanding of which student populations benefit most substantially from video-based instruction.

Another consideration involves the potential for novelty effects or demand characteristics to have influenced the results. The experimental group's awareness that they were receiving an innovative intervention might have created expectancy effects that enhanced their motivation and effort beyond what would occur in standard implementation contexts. Examination of this possibility through research designs incorporating attention-matched control conditions (where the control group receives an alternative intervention matched in terms of time and perceived attention) would help disentangle technology-specific effects from generic effects of enhanced instructional attention.

Despite these limitations, the findings provide robust evidence supporting the integration of slow-motion video technology into physical education instruction as an evidence-based practice capable of substantially enhancing skill acquisition outcomes. The large effect sizes, statistical significance across multiple outcome variables, and consistency with prior research in this domain collectively suggest that this represents a reliable and practically important pedagogical intervention worthy of broader adoption and implementation.

CONCLUSSION

This study provides empirical evidence demonstrating that slow-motion video application represents an effective pedagogical intervention for enhancing acquisition of fundamental sports techniques among university-level physical education students. The experimental group receiving slow-motion video training demonstrated significantly greater improvements in throwing technique (28.8% improvement in distance, 68.3% accuracy), kicking technique (31.5% improvement in distance, 71.6% accuracy), and passing technique (21.7-26.4% improvement in accuracy across distances) compared to the control group receiving conventional training methods. The magnitude of these differences, represented by large effect sizes (Cohen's d ranging from 1.78 to 2.96), indicates that the observed improvements are both statistically significant and practically meaningful.

The mechanism through which slow-motion video facilitates enhanced skill acquisition likely operates through multiple pathways including enhanced visual observation of biomechanical technique components, facilitation of high-quality mental practice through detailed visualization, improved error detection and self-correction capabilities, and clarification of abstract verbal instruction through concrete visual representation. These findings support the broader theoretical understanding that external visual feedback mechanisms constitute powerful tools for accelerating motor learning in sport contexts.

Based on the findings of this research, the following recommendations are proposed for physical education and sports training practice and policy. First, physical education departments and sports programs should consider systematically incorporating slow-motion video analysis into standard curricula as an integrated component of technique instruction for fundamental sports skills. The ease of implementation and minimal cost associated with video recording technology available in contemporary educational settings suggests that adoption barriers are minimal, while the documented benefits justify the modest time investment required for integration into instruction.

Second, instructors and coaches should receive professional development training in effective pedagogy for utilizing slow-motion video as an instructional tool. While video technology alone can enhance learning, the most substantial benefits are likely achieved when slow-motion replay is integrated into structured instructional sequences that direct student attention to specific biomechanical features and facilitate systematic comparison between student performance and expert models. Professional development programs should emphasize evidence-based practices for optimizing the pedagogical value of video-based instruction.

Third, future research should examine the long-term effects and durability of skill improvements produced through slow-motion video training, with follow-up assessment periods extending weeks or months beyond the intervention period. Such research would clarify whether improvements represent temporary performance enhancements or more durable changes in underlying motor competence. Additionally, research examining the optimal frequency, duration, and sequencing of slow-motion video viewing would provide practical guidance for maximizing instructional efficiency.

Fourth, investigation of individual differences in responsiveness to slow-motion video intervention would enhance understanding of differential effectiveness across student populations. Research examining interactions between baseline skill level, cognitive abilities, learning style preferences, and responsiveness to video-based instruction could inform more personalized and adaptive approaches to technology integration in physical education.

Finally, development and evaluation of mobile applications specifically designed for sports skill instruction incorporating intelligent guidance systems, automated technique analysis, and adaptive feedback mechanisms represents a promising direction for future technology development. Such applications could potentially enhance the effectiveness of slow-motion video feedback beyond current capabilities by providing automated analysis of critical biomechanical parameters and intelligent cues directing attention to technique deficiencies.

In conclusion, this study provides evidence supporting the adoption of slow-motion video technology as an evidence-based educational practice within physical education contexts. The demonstrated effectiveness of this intervention in enhancing skill acquisition, combined with the practical feasibility and minimal cost of implementation, suggests that broader adoption of this technology could substantially improve the quality of physical education instruction and the technical proficiency of student athletes in university settings and beyond.

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