Research Article

The Effectiveness of Video Feedback in Improving Handball Passing Skills Among Students At Muhammadiyah University of Indonesia

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ABSTRACT:

This study aimed to investigate the effect of video feedback on improving passing skills in handball among students at Muhammadiyah University of Indonesia. A quasi-experimental design with pre-test and post-test control groups was employed. Forty students (aged 16–17 years) were randomly assigned to experimental (n = 20) and control (n = 20) groups. The experimental group received conventional passing drills supported by video feedback using smartphone recordings and analysis with Kinovea software, while the control group practiced conventional drills without technological support. Passing accuracy was assessed using a standardized handball passing test. Data analysis involved paired and independent t-tests, with effect sizes calculated using Cohen's d. The results indicated significant improvement in both groups; however, the experimental group exhibited greater gains (pre-test = 12.4 ± 3.1; post-test = 20.8 ± 2.7, t = 9.85, $p < 0.001$, d = 1.56) compared to the control group (pre-test = 11.9 ± 3.3; post-test = 15.2 ± 3.5, t = 4.21, p = 0.002, d = 0.68). Independent t-test further confirmed a significant advantage for the experimental group (t = 3.72, p = 0.001, d = 0.82). These findings suggest that video feedback is an effective and accessible for enhancing handball passing skills in university settings, with practical implications for physical education teachers to improve technical performance.

Keywords: handball, video feedback, passing skills, motor learning, physical education.

1. INTRODUCTION

Handball is a dynamic and fast-paced sport that requires athletes to master a wide range of technical and tactical skills. Among these, passing is considered the most fundamental element in facilitating team coordination, sustaining offensive flow, and creating scoring opportunities (Almeida et al., 2020; Font et al., 2022). Accurate passing allows players to maintain possession under pressure and to exploit defensive weaknesses, making it a cornerstone of successful performance in both youth and elite competitions (Øydna & Bjørndal, 2023).

However, many high school students often struggle with passing skills, particularly in physical education (PE) contexts where large class sizes and limited time prevent teachers from delivering individualized corrective guidance (Renshaw & Chow, 2019; Zhou et al., 2021). These instructional constraints frequently result in technical errors, such as poor body positioning, inaccurate release angles, and insufficient timing of the ball, which compromise overall game performance (Øydna & Bjørndal, 2023). Therefore, there is a growing need for innovative instructional strategies that can support effective and individualized skill learning in university-based sport programs.

In this regard, the use of technology-enhanced instruction has gained increasing popularity. Video feedback (VF), in particular, has emerged as a powerful pedagogical tool that enables learners to observe, analyze, and correct their movements through visual comparison with technical models (Mödinger & Wagner, 2022; Petancevski, et al., 2022). VF supports learners' self-regulation by facilitating awareness of performance errors and reinforcing correct motor patterns (Moinuddin et al., 2021; Wang et al., 2023). Compared with traditional verbal feedback, VF provides richer sensory input and has been consistently associated with improved skill acquisition (Potdevin et al., 2018; Chu, 2017).

The effectiveness of VF can be theoretically explained through motor learning constructs, specifically the provision of knowledge of performance (KP) and knowledge of results (KR). Studies have shown that immediate and visual feedback accelerates the refinement of movement patterns, improves retention, and enhances transfer of skills to competitive contexts (Sigrist et al., 2013; Mödinger & Wagner, 2022). Moreover, neurocognitive research highlights that observing one's own movement on video facilitates neural encoding of motor schemas, leading to more efficient error correction and automatization (Kok et al., 2020; Petancevski et al, 2022).

Empirical evidence from team sports supports the benefits of VF. For example, Hadiana et al. (2020) reported significant improvements in dribbling accuracy among futsal players who received systematic VF. Wahidi et al. (2021)

and Martinez et al. (2024) demonstrated that youth soccer players enhanced their passing and ball control skills when trained with video feedback compared to traditional instruction. These findings highlight the capacity of VF to improve ball-handling skills that require precision and speed under time pressure, characteristics closely related to passing in handball.

Comparable outcomes have also been observed in net and invasion games. In volleyball, Moreno et al. (2016) found that combining VF with tactical questioning significantly improved players' decision-making and tactical awareness. Conejero et al. (2020) confirmed that augmented feedback enhanced players' ability to make optimal choices under competitive conditions. Similarly, in basketball, studies show that video-based analysis can facilitate understanding of game patterns and improve players' technical execution (Basri et al., 2024). Such evidence suggests that VF is effective not only in refining isolated technical skills but also in enhancing the cognitive-tactical dimensions of performance.

Research in individual sports has further demonstrated the efficacy of VF. Post et al. (2016) found that self-controlled VF in shot put training led to greater improvements in throwing distance and self-efficacy compared to traditional feedback. Potdevin et al. (2018) reported similar benefits in long jump, where athletes receiving VF showed superior performance and greater retention. In gymnastics, peer-assisted video feedback was shown to improve technical scores and motivation (Roure et al., 2019; Hutcheon, 2021). Collectively, these studies reinforce the versatility of VF across different movement contexts.

Beyond motor performance, VF has been linked to positive psychological outcomes. Learners exposed to video feedback often report higher levels of motivation, confidence, and self-regulation compared with those who rely solely on verbal instruction (Potdevin et al., 2018; Chu, 2017). These psychological factors are critical in youth sports, where sustaining engagement and enjoyment is as important as technical mastery (Paloo et al., 2015). The dual impact of VF on both skill and motivation underscores its value as a holistic teaching approach in PE settings.

Despite the growing body of evidence across multiple sports, the application of VF in handball, particularly within school contexts, remains underexplored. Given the centrality of passing to game performance and the frequent occurrence of technical errors among youth players, it is crucial to investigate whether VF can provide measurable benefits in this area (Almeida et al., 2020; Krawczyk, 2015). The lack of targeted research in handball represents both a theoretical and practical gap in the literature.

Therefore, the present study aims to evaluate the effectiveness of video feedback in enhancing passing skills among students at Muhammadiyah university of Indonesia in handball. Specifically, it seeks to compare the outcomes of VF-based training with conventional teaching methods. Based on existing literature, it is hypothesized that students who receive video feedback will demonstrate significantly greater improvements in passing accuracy and technical execution than those taught using traditional approaches.

2. METHODOLOGY

2.1 Research Design

This study employed a quasi-experimental design using a pre-test–post-test control group. Such a design is widely applied in sports science research to measure the effect of interventions on motor learning outcomes while maintaining ecological validity (Fredenburg & Solmon., 2021).

2.2 Participants

The participants consisted of 40 high school students aged 16–17 years, recruited through purposive sampling. Students were randomly assigned into two groups: the experimental group (n = 20), which received video feedback-based training, and the control group (n = 20), which received conventional training without technological support. All participants were physically healthy and had no prior competitive handball experience.

2.3 Instrument

Handball passing accuracy was assessed using a standardized passing accuracy test, which measured the number of successful passes made to a marked target within one minute. Previous studies have established the validity and reliability of this type of skill assessment for evaluating ball-handling proficiency (Saavedra et al., 2020).

2.4 Procedure

The study was conducted over four weeks, with three training sessions per week. The procedure followed three stages:

1. Pre-test: Both groups completed the passing accuracy test.

2. Intervention:
   a) Experimental group: Participated in conventional passing drills combined with video feedback. Performances were recorded using a smartphone and analyzed with Kinovea, an open-source motion analysis software.
   b) Control group: Participated in conventional passing drills without video feedback.
3. Post-test: Both groups repeated the passing accuracy test after the intervention.

Video feedback was provided immediately after each session to enable learners to observe their performance, identify errors, and make corrections, consistent with principles of augmented feedback in motor learning (Potdevin et al., 2021).

2.5 Data Analysis

Data were analyzed using paired sample t-tests to examine within-group improvements and independent sample t-tests to compare between-group differences. Statistical significance was set at $p < 0.05$. This approach has been recommended in sports pedagogy research to evaluate intervention effectiveness with relatively small sample sizes (Kok et al., 2020).

3. RESULTS

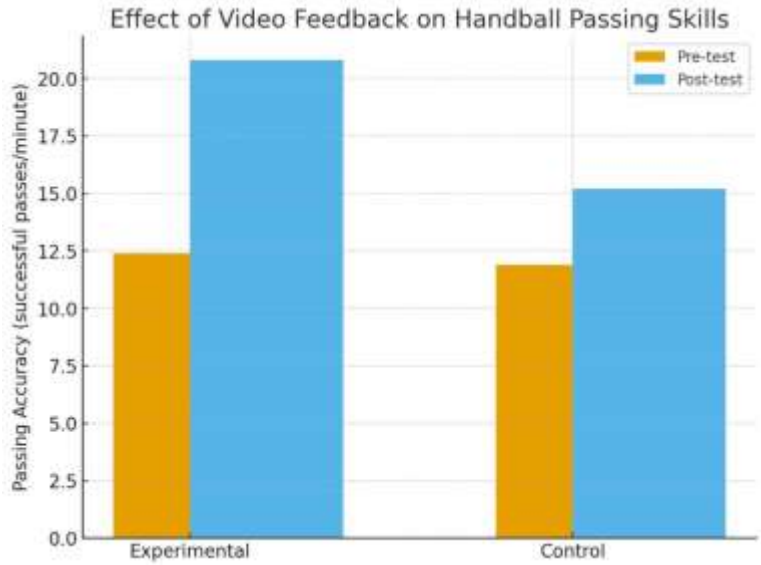
3.1 Descriptive Statistics

Table 1 presents the descriptive statistics of the pre-test and post-test handball passing scores for both the experimental and control groups.

Table 1. Descriptive statistics of handball passing performance (successful passes/minute).

Group	Pre-test Mean ± SD	Post-test Mean ± SD	Improvement
Experimental	12.4 ± 3.1	20.8 ± 2.7	+8.4
Control	11.9 ± 3.3	15.2 ± 3.5	+3.3

The results indicate that both groups improved their passing accuracy after the intervention period. However, the experimental group, which received video feedback, showed a greater improvement compared to the control group, as shown in the graph below.



Graph showing improvement in post-test handball passing

3.2 Inferential Statistics

Paired sample t-tests were conducted to evaluate within-group improvements from pre-test to post-test, and an independent sample t-test was used to compare the post-test results between the two groups. The outcomes are summarized in Table 2.

Table 2. Results of paired and independent t-tests.

Test	t-value	p-value	Effect Size Cohen's d	Interpretation
Paired t-test (Experimental)	9.85	<0.001	1.56	Significant improvement within experimental group
Paired t-test (Control)	4.21	0.002	0.68	Significant improvement within control group
Independent t-test (Post-test)	3.72	0.001	-	Experimental group improved significantly more than control group

3.3 Interpretation of Findings

The paired sample t-test revealed a statistically significant improvement in passing skills for both the experimental and control groups. This indicates that even conventional training alone contributed to enhancing students' passing abilities. However, the magnitude of improvement differed notably between the groups. The experimental group showed a substantial increase in performance, with an average improvement of +8.4 successful passes (Cohen's d = 1.56), which represents a very large effect size. In contrast, the control group improved by +3.3 passes (Cohen's d = 0.68), which corresponds to a medium effect size. These findings suggest that while both training methods were effective, the intervention applied in the experimental group yielded significantly greater gains in students' passing skills.

The independent sample t-test confirmed that the post-test scores of the experimental group were significantly higher than those of the control group ($t = 3.72$, $p = 0.001$), indicating a meaningful difference in skill acquisition between the two groups. This result highlights the effectiveness of the intervention—specifically, the use of video feedback—in enhancing students' performance beyond what was achieved through conventional training alone. The substantial difference in outcomes reinforces the pedagogical value of integrating technological tools, such as video analysis, into physical education and sports training. By enabling learners to visually reflect on their performance and receive targeted corrections, video feedback enhances motor learning, self-awareness, and technical precision, thus offering a more impactful and modern approach to skill development.

4. DISCUSSION

The present study investigated the effect of video feedback on handball passing skills among students at Muhammadiyah university of Indonesia. The results demonstrated that while both groups improved post-intervention, the experimental group receiving video feedback exhibited significantly greater gains in passing accuracy compared to the control group. This confirms that integrating video feedback into practical training can enhance motor learning effectiveness beyond traditional methods.

These findings align with systematic reviews showing that video-based visual feedback enhances motor skill acquisition in physical education settings more effectively than verbal feedback alone (Mödinger et al., 2022). Similarly, studies in sports such as futsal and soccer have shown that video feedback supports improved ball handling and technical precision (Martínez-Patiño et al., 2021; O'Connor et al., 2020) .

From a motor learning perspective, video feedback functions as augmented feedback—specifically, providing knowledge of performance (KP) and results (KR). This form of visual feedback aids learners in error detection and enables adjustments to movement patterns, leading to better retention and execution (Otte et al., 2020; Mödinger et al., 2022; Petancevski et al., 2022)

Beyond technical improvement, video feedback can also enhance learners' motivation and self-regulation. In acrobatic gymnastics, for example, students receiving video feedback not only improved performance substantially but also showed increased motivation (Bouzid et al., 2025) The visual nature of video feedback likely amplifies learner engagement—something verbal instruction alone may not achieve as effectively.

Though many studies support VF in other disciplines, its application in handball—especially in school contexts—remains sparse. However, preliminary evidence in elite handball shows video-overlay feedback can modify landing

technique and potentially reduce injury risk (Benjaminse et al., 2017). Our study addresses this gap, showing the feasibility and impact of low-cost video feedback in a PE environment with minimal technology.

These results suggest that PE teachers can feasibly implement smartphone-based video feedback using tools like Kinovea to provide individualized, visual feedback—even in large classes. This approach may be scalable and accessible, offering a practical strategy to improve skill acquisition in school sports programs.

This study had limitations: it was limited to one university, had a relatively short duration (4 weeks), and did not evaluate long-term retention or in-game transfer. Future research should employ larger, diverse samples, extend the intervention period, and assess retention as well as transfer to match performance.

Future studies may explore advanced implementations, such as real-time augmented feedback via AR or integrating performance tagging with AI-driven video analysis (Naik et al., 2022). These technologies could further enhance feedback immediacy and precision in skill development.

Overall, the integration of video feedback in passing drills provides both technical and motivational advantages over conventional methods in university-based handball training. The findings underscore VF's potential to transform sport pedagogy and advocate for broader adoption in physical education.

5. CONCLUSION

This study demonstrated that video feedback significantly enhances handball passing skills among students at Muhammadiyah university of indonesia compared to conventional training methods. While both groups improved, the experimental group receiving video-based feedback showed superior gains in passing accuracy, underscoring the potential of technology as a practical and cost-effective tool in physical education. These findings suggest that incorporating smartphone-based video analysis into regular practice can improve not only technical performance but also learner engagement and motivation. As university increasingly integrate digital tools into teaching, video feedback provides an accessible strategy to support motor learning and sports education. Future studies should expand on these results by exploring other handball skills, examining long-term retention, and employing larger, more diverse samples.

6. LIMITATIONS

Although the present study provides valuable insights into the role of video feedback in improving handball passing skills, several limitations should be acknowledged. First, the study involved a relatively small sample (N = 40) from a students at Muhammadiyah university of Indonesia, which may limit the generalizability of the findings. Second, the intervention period was short (four weeks), and thus, the long-term retention and transfer of skills to real match play were not assessed. Third, the study focused solely on passing skills, leaving other essential handball techniques such as dribbling, shooting, or defensive maneuvers unexplored. Finally, the video feedback was provided after the performance rather than in real-time; future studies could investigate the effectiveness of real-time augmented reality or AI-assisted feedback systems. Addressing these limitations in future research will provide a more comprehensive understanding of how technology can enhance motor learning in handball.

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