

Boosting Boundaries: How Feedback Methods Enhance Student Self-Efficacy in Long Jump?

Norliza Mohamed Nor¹, Mohamad Nizam Nazarudin¹, Zakiah Noordin², Mohd Firdaus Abdullah³

¹Center for the Education and Community Wellbeing Study, Faculty of Education, Universiti Kebangsaan Malaysia 43500 Bangi, Selangor, Malaysia, ²IPG Kampus Pendidikan Islam, 43657 Bandar Baru Bangi, Selangor, Malaysia, ³Faculty of Sports and Exercise Sciences, Universiti Malaya, 50603 Kuala Lumpur, Malaysia
Corresponding Authors Email: mohdnizam@ukm.edu.my

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Abstract

The transition from traditional teaching methods to modern technology-based feedback systems in physical education (PE) represents a significant advancement in educational practices. This research investigates the comparative effectiveness of Self-Controlled Video Feedback (SC-VF), Externally Controlled Video Feedback (EC-VF), Peer Review Video Feedback (PR-VF), and Teacher-Guided Instruction (TG) in enhancing students' self-efficacy in long jump performance. Employing a Randomised Controlled Trial (RCT) design to ensure scientific rigor and validity, the study involves 180 secondary school students, comprising 96 males and 84 females, with an average age of 14.0 years (SD = 0.82 months). None of the participants had prior experience in the long jump, and all were instructed by the same physical education teacher with eight years of experience. The eight-week training program focused on the long jump, with assessments conducted at the Post-Test 1, Post-Test 2 and during a follow-up retention test two weeks post-intervention. The Self-Efficacy Scale (Kok et al., 2020) was utilised for measurements, which were analysed using One-Way ANOVA. The results showed no significant difference in self-efficacy scores at the mid-test stage among the groups. However, in subsequent tests, the SC-VF and PR-VF groups demonstrated higher self-efficacy scores compared to the EC-VF and TG groups. Retention test scores further highlighted the benefits of self-controlled and peer-reviewed feedback in sustaining skill improvement and self-confidence. These findings suggest that incorporating these feedback methods into PE curriculums can strategically enhance the development of sports skills in adolescents. Future research should consider a qualitative approach to further evaluate self-efficacy.

Keywords: Long Jump, Self-Efficacy, Technology, Feedback, Physical Education

Introduction

Video feedback provides a unique opportunity for students to visually analyse their performance, understand their mistakes, and make necessary corrections. Research has consistently shown that video feedback can lead to significant improvements in skill

acquisition and performance in PE settings. For instance, a study by Langan et al (2019), demonstrated that video feedback led to substantial improvements in dance performance. The study highlighted that visual evidence of performance allowed students to better understand and correct their movements. This is particularly crucial in activities requiring precise techniques, such as the long jump, where video feedback can help students identify and correct technical flaws like take-off angles or landing positions. By allowing students to

see their movements in slow motion, video feedback enhances their comprehension of the mechanics involved in their performance, leading to more effective learning and improvement. A study by Bird et al (2019), found that video feedback led to improved performance in gymnastics by helping students better understand and correct their movements. Similarly, in long jump, video feedback can help students identify flaws in their technique, such as improper take-off angles or landing positions, and make the necessary adjustments. By allowing students to see their movements in slow motion, video feedback helps them better understand the mechanics of their performance, leading to more effective learning and improvement.

Video feedback can enhance self-efficacy through several mechanisms such as Mastery experiences are the most influential source of self-efficacy. Successfully performing a task reinforces the belief in one's abilities. Video feedback allows students to visually capture and review their successful attempts, reinforcing their belief in their abilities. Lindgren and Barker (2019), found that students who reviewed videos of their successful performances reported higher self-efficacy, highlighting the powerful impact of visual reinforcement on confidence. Vicarious experiences by serving others to perform a task successfully can boost self-efficacy, especially when the observed individuals are perceived as similar to the observer. Moreno et al (2020), found that students who watched video demonstrations of their peers performing physical tasks exhibited increased confidence in their abilities. Vicarious experiences through video feedback provide students with models to emulate, enhancing their belief in their capacity to achieve similar success.

Verbal persuasion involves convincing individuals that they possess the capabilities to succeed. Video feedback sessions often include verbal encouragement from teachers, further reinforcing students' belief in their capabilities. According to Wulf et al (2010), combining verbal feedback with video feedback can significantly enhance students' self-efficacy and performance. Emotional states such as stress, anxiety, and mood can influence self-efficacy. Positive emotional states generally enhance self-efficacy, while negative emotional states can undermine it. Viewing progress through video feedback can reduce anxiety and enhance motivation, creating a positive emotional state conducive to learning and performance (Ferris et al., 2018). Studies have consistently shown that video feedback improves motor skill development. A meta-analysis by Post et al (2020), found that video feedback significantly enhances motor skill learning and performance in various sports and physical activities. The immediate and detailed nature of video feedback allows students to see exactly where they need to improve and how they can make those improvements.

This precise and detailed feedback is crucial for the development of complex motor skills, such as those required in the long jump. In the long jump, for example, video feedback allows for the analysis of each phase of the jump — the approach, take-off, flight, and landing. This

comprehensive analysis helps students understand and correct their technique, leading to more effective practice sessions and improved performance. Research by Smith and Morgan (2019), indicates that video feedback increases student engagement and motivation in PE classes. The ability to see their progress and understand their mistakes visually keeps students more involved in the learning process. Video feedback provides a concrete and objective basis for self-assessment, which can be more motivating than abstract or verbal feedback alone. The visual evidence of improvement can be highly motivating for students, encouraging them to continue working hard and striving for further progress. Moreover, video feedback can make PE classes more interactive and engaging. Instead of passively listening to feedback, students actively participate in analysing their performance and setting goals for improvement. This active participation can enhance students' intrinsic motivation and foster a more positive attitude towards physical activity.

While video feedback offers numerous benefits, it also presents challenges. Technical issues such as equipment malfunctions and difficulties in recording and playback can hinder the effective use of video feedback. Additionally, students may become overly critical of themselves when reviewing their performances on video, which can negatively impact their self-efficacy. Teachers need to be proficient in using video technology and skilled in providing constructive feedback to mitigate these issues. Lieberman et al (2021), emphasize the importance of training teachers to use video feedback effectively and to balance criticism with positive reinforcement. Furthermore, the effectiveness of video feedback depends on how it is implemented. Simply showing students their performance on video is not enough; it must be accompanied by clear, constructive feedback and guidance. Teachers need to help students interpret the video, understand their mistakes, and develop strategies for improvement. This requires a thoughtful and structured approach to video feedback, where teachers plan and execute feedback sessions effectively.

Self-efficacy, a concept rooted in Bandura's Social Cognitive Theory (Bandura, 1977), refers to an individual's belief in their capacity to execute behaviors necessary to produce specific performance attainments. It plays a critical role in how goals, tasks, and challenges are approached. In PE, self-efficacy influences students' motivation, persistence, and performance. According to Schunk and DiBenedetto (2020), high self-efficacy can lead to greater effort, persistence, and resilience, especially when faced with challenges. Feedback Models Hattie and Timperley's (2007), model of feedback outlines four levels: task, process, self-regulation, and self. Effective feedback should address all these levels to enhance learning. Task feedback focuses on providing information about how well a task is being performed. Process feedback gives insights into the processes underlying a task. Self-regulation feedback helps learners develop strategies to monitor and regulate their learning. Self-feedback involves personal evaluations and affective reactions to learning. Video feedback, by providing visual and immediate information, can impact these levels, especially self-regulation and self, where students reflect on their performance and develop strategies for improvement.

Research Objectives

This study aims to fill these gaps by comparing these modalities to determine which most significantly impacts self-efficacy concerning long jump performance in PE classes.

Hypothesis

- H1 There is a significant difference in the self-efficacy concerning long jump performance among students aged 13-15 receiving SC-VF, EC-VF, PR-VF, and TG in mid-test
- H2 There is a significant difference in the self-efficacy concerning long jump performance among students aged 13-15 receiving SC-VF, EC-VF, PR-VF, and TG in post-test 2
- H3 There is a significant difference in the self-efficacy concerning long jump performance among students aged 13-15 receiving SC-VF, EC-VF, PR-VF, and TG in the retention test

This study has significant implications for sports education policymakers and instructors. To enhance student learning and engagement through the integration of technology in the physical education (PE) curriculum, it is crucial to first understand the

impact of various feedback modalities on learning outcomes. By comprehending the importance of self-efficacy in athletic performance, educators can better create safe environments where students feel encouraged to try new activities and develop their athletic skills. Incorporating new technology into PE classes has the potential to transform student learning and classroom outcomes. This research aims to provide valuable insights into the effective use of technology in PE by examining the effects of different video feedback modalities on self-efficacy. These findings can guide future educational policies and practices, ultimately improving the accessibility, effectiveness, and engagement of sports education for all students.

Methodology

The use of a Randomised Controlled Trial (RCT) was employed to guarantee the scientific rigour and validity of the findings. Randomised controlled trials (RCTs) are specifically intended to minimise any possible biases that may arise while assessing the effectiveness of novel therapies. The power analysis conducted using G*Power 3.1 determined that a minimum of 178 participants were needed to reach satisfactory statistical power. This calculation was based on an expected moderate effect size, an alpha level of 0.05, a beta level of 0.80, and an effect size of 0.25, taking into account all groups together. The research included a total of 180 secondary school students, with 96 male and 84 females. The average age of the students was 14.0 years, with a standard deviation of 0.82 months. All the pupils were inexperienced in the long jump. The teacher for all four PE classes was a 35-year-old guy with 8 years of teaching experience. Before data collection, informed permission was sought from all students and their parents, following approval from the local faculty's ethics committee. To ensure ideal balance, the sample was split into groups of around 45 people each. The chosen sample size guarantees that the research has the statistical power to identify significant variations in the efficiency of different feedback systems on self-efficacy, especially those of moderate size.

Self-Controlled Video Feedback (SC-VF)

The Self-Controlled Video Feedback (SC-VF) group in a physical education setting utilizes a technique where students take full control of their learning process through video technology. In this approach, students independently record their performances during activities, such as the long jump, using smartphones or similar devices equipped with video cameras. After recording, they analyse their performance at their own pace and frequency, focusing on specific aspects they wish to improve. This self-regulated feedback allows students

to pause, rewind, and closely examine the video to better understand their technique and make necessary adjustments. This methodology is based on the concept of self-regulation in learning, encouraging learners to actively observe, assess, and respond to their activities.

Externally Controlled Video Feedback (EC-VF)

Students' performances are recorded using smartphones and evaluated similarly to the SC-VF group. However, the teacher controls when and how the video feedback is provided. This structure means that the timing and frequency of feedback are pre-determined by the instructor, based on their assessment of what is most appropriate for the student's learning progression. This strategy aims to create a well-organized learning environment that maximizes the effectiveness of feedback, as evaluated by an external observer.

Peer Review Video Feedback (PR-VF)

Students documented and assessed each other's performances, offering peer evaluations based on predetermined criteria. This group actively engages students in the feedback process, where they not only participate but also take on the role of observers for their classmates. This approach leverages peer-to-peer interaction and fosters a culture where students evaluate and learn from one another's performances.

Teacher-Guided Instruction (TG)

Traditional teaching methods typically involve instructors providing direct instruction, demonstrating techniques, and personally correcting students, without the aid of modern technological tools.

These groups participated in an 8-week training program focused on the long jump, with assessments conducted at three stages: Pre-Test 1, Post-Test 2, and a follow-up retention test (Retention Test) two weeks after the intervention.

Table 1
8-Week Training Program

Activity	Week
Practice sessions consisted of 3 sessions with 10 trials each.	1-3
Post-Test 1 (Week 4): Evaluation to gauge changes in self-efficacy	4
Practice sessions consisted of 3 sessions with 10 trials each.	5-7
Post-Test 2 (Week 8)	8
Final evaluation to assess changes in self-efficacy	
Retention Test (Week 10)	10
Two weeks after the intervention, a retention test is administered to assess changes in self-efficacy without further intervention.	

Self-Efficacy Scale

Students completed a self-efficacy scale (Kok et al., 2020) specifically designed to measure their confidence in long jump performance. This scale assesses individuals' self-assurance in their ability to perform the long jump proficiently, considering both their perceived skill level and enjoyment of the activity. The scale was administered at multiple intervals during the

trial to track changes and trends in self-efficacy, enjoyment, and perceived learning. Analysing the responses will allow us to calculate average scores for each group, providing valuable insights into how different feedback systems affect students' perceptions of enjoyment and learning.

Each question related to feedback was evaluated using a standardized scale ranging from 0 to 10. Higher scores on feedback-specific questions may indicate a more effective feedback system, while changes in overall satisfaction and perception of learning can help understand the motivational aspects of each type of feedback. This scale enabled a comprehensive evaluation of both the pedagogical impact of each feedback category and the extent to which students perceive and derive satisfaction from different instructional approaches.

Statistical Analysis

The self-efficacy scale used in this study is designed particularly to evaluate an individual's confidence in their ability to do sports activities. The data will be examined using One-Way ANOVA. One-way ANOVA is used to assess if there are any statistically significant disparities between the means of four distinct groups. For this hypothesis, One-Way ANOVA is suitable since it enables the analysis of variations in self-efficacy among the four distinct feedback modalities (SC-VF, EC-VF, PR-VF, and TG) at a single time point (Pre-Test, Mid-Test, Post-Test 2, and Retention Test).

Result and Discussion

The reliability coefficients, Cronbach's alpha, for the self-efficacy instrument, are .88 and .79, respectively, which are impressively high. These values demonstrate that both instruments are reliable and valid for use in this research context. In terms of the score distribution, skewness ranges from -.16 to .36, and kurtosis which indicates the distribution's peakiness ranges from -.99 to .10. These distribution statistics suggest that the data are predominantly symmetrical and free from problematic extreme values. This symmetry supports the appropriateness of the data for standard parametric analyses, which typically assume that the data are normally distributed.

H₁ There is a Significant Difference in the Self-Efficacy Concerning Long Jump Performance among Students aged 13-15 Receiving SC-VF, EC-VF, PR-VF, and TG in Mid-Test

The ANOVA results $F(df = 3, 176, p = 0.943) = 0.128$ indicate that the differences in the mean self-efficacy between the four groups are not statistically significant at the mid-test ($p = 0.943$) and H₅ is rejected. Bandura's Self-Efficacy Theory (1977) posits that self-efficacy, or the belief in one's ability to succeed, is influenced by four main sources: mastery experiences, vicarious experiences, verbal persuasion, and physiological states. Given that the mid-test may not have provided sufficient mastery experiences to differentiate the impact of each feedback type, it's plausible that students did not perceive their capability in the long jump to have improved significantly due to any specific feedback modality.

Vygotsky's Zone of Proximal Development (1978), could also provide a lens through which to view these findings. If all feedback types were effectively tailored to help students perform within this zone, then it's likely that improvements in self-efficacy would be uniformly

distributed across the groups, as each type of feedback helped learners equally in overcoming challenges. Magill and Anderson (2014), discuss how feedback should ideally be tailored to the individual's stage of learning. Early in the learning process, feedback might be

more about correcting gross errors, and later about refining skills. If the mid-test still falls within an early or middle stage, the subtleties of different feedback types may not yet influence self-efficacy significantly.

Studies such as Chiviacowsky and Wulf (2007), which explored the effects of self-controlled feedback on motivation and performance, suggest that self-efficacy enhancements from feedback are more pronounced when learners can engage deeply with the feedback process, something that might not have fully developed by the mid-test. Research by Deci and Ryan (2000), the proponents of Self-Determination Theory, indicates that autonomy (a key component of SC-VF) supports motivation and self-efficacy. However, the mid-point of the intervention may be too early for significant differences in perceived autonomy to translate into differential self-efficacy outcomes across feedback modalities.

The integration of feedback in sports training and its effect on psychological outcomes such as self-efficacy involves a complex interplay of learning, perception, and performance. As Wulf et al (2010), noted, the perceived relevance and timing of feedback can significantly impact its effectiveness. If students do not yet perceive the feedback as relevant or if they have not had sufficient time to internalize and act upon the feedback, then significant differences in self-efficacy are unlikely to be observed. For practitioners in educational and sports environments, these findings emphasize the importance of patience and a longitudinal perspective when applying and evaluating different feedback modalities. It also highlights the necessity to consider the developmental stages of learners when designing feedback interventions to enhance self-efficacy.

In summary, the finding that there are no significant differences in self-efficacy among the different feedback groups at the mid-test stage supports the notion that the development of self-efficacy is a complex and gradual process, influenced by multiple factors beyond immediate feedback. This underscores the importance of a well-rounded approach that considers the psychological, cognitive, and physical aspects of sports training. Such an approach should aim not just to modify behavior but to foster an environment where self-efficacy can grow over time, supported by consistent, tailored, and meaningful feedback.

H₂ There is a significant difference in the self-efficacy concerning long jump performance among students aged 13-15 receiving SC-VF, EC-VF, PR-VF, and TG in post-test

The ANOVA results $F(df = 3,176, p = 0.000) = 12.29$ indicate that the differences in the mean of self-efficacy between the four groups are statistically significant at the post-test and H_{a6} failed to be rejected. Post Hoc Multiple Comparison tests showed there is significant self-efficacy between the SC-VF group with EC-VF and TG, Homogeneous Subsets and Mean Plot table showed mean score for the SC-VF group (19.62) is bigger than EC-VF (18.53) and TG (19.56). Post Hoc Multiple Comparison tests also showed there is significant self-efficacy between the PR-VF group with EC-VF and the TG group with EC-VF. Homogeneous Subsets and

Mean Plot table showed mean score for the PR-VF group (19.51) is bigger than EC-VF (18.53) and TG (19.56) bigger than EC-VF (18.53).

Self-efficacy, defined by Bandura (1977), as the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations, is a crucial determinant of how well people motivate themselves and persist in the face of adversities. The differences observed among the feedback groups can be understood through several theoretical lenses: Bandura's Four Sources of Self-Efficacy (Mastery experiences, vicarious experiences, verbal persuasion, and physiological states) are identified as primary sources of self-efficacy. SC-VF and PR-VF likely provided stronger mastery experiences by allowing

students more control over their learning process and enhancing their engagement with the task. Vygotsky's Social Constructivist Theory suggests that learning occurs in a social context and is deeply influenced by interaction with peers and teachers. PR-VF and TG, which inherently involve more social interaction than EC-VF, might have bolstered self-efficacy through this mechanism.

Deci and Ryan's Self-Determination Theory emphasizes the importance of autonomy, competence, and relatedness for intrinsic motivation. SC-VF, which provides autonomy, likely enhances the sense of competence and intrinsic motivation, contributing to higher self-efficacy. Research in the field of motor learning and sports psychology provides empirical support for the effectiveness of different feedback strategies such as Wulf et al (2010), which found that self-controlled feedback enhances learning and self-efficacy by promoting autonomy and involvement in the learning process. This supports the higher efficacy scores seen in the SC-VF group. Hattie and Timperley (2007), highlight the importance of feedback in shaping self-efficacy. They argue that feedback should provide information about what the learner is doing right, the direction in which they need to go, and how they can get there. This formative approach might be more effectively implemented in SC-VF and PR-VF settings. Magill and Anderson (2014) discuss how peer-assisted learning can enhance the learning experience, supporting the effectiveness of PR-VF in improving self-efficacy through peer feedback and collaborative learning environments.

For educators and coaches, these findings underscore the importance of carefully selecting and tailoring feedback methods to enhance not only performance but also psychological outcomes such as self-efficacy. Implementing more self-controlled and peer-reviewed feedback mechanisms can empower learners, enhance their learning experiences, and improve their confidence in their abilities.

In summary, the significant differences in self-efficacy observed at the final post-test among different feedback groups highlight the critical role of feedback modality in enhancing psychological outcomes in educational settings. The success of SC-VF and PR-VF in boosting self-efficacy suggests that these modalities, by providing more autonomy and peer interaction, effectively contribute to a learner's confidence and motivation. These findings not only contribute to the theoretical understanding of feedback in learning but also offer practical guidance for designing effective training environments that foster both skill acquisition and self-belief.

H₃ There is a significant difference in the self-efficacy concerning long jump performance among students aged 13-15 receiving SC-VF, EC-VF, PR-VF, and TG in the retention test

The ANOVA results $F(df = 3, 176, p = 0.000) = 203.15$ indicate that the differences in the mean of self-efficacy between the four groups are statistically significant at the retention test and H₇ failed to be rejected. Post Hoc Multiple Comparison tests showed there is significant self-efficacy between the SC-VF group with EC-VF, PR-VF, and TG, Homogeneous Subsets and Mean Plot table showed that the mean score for the SC-VF group (25.62) is bigger than the EC-VF (20.53), PR-VF (22.51) and TG (22.56). Post Hoc Multiple Comparison tests also showed significant self-efficacy between the PR-VF group with EC-VF and the TG group with EC-VF. Homogeneous Subsets and Mean Plot table showed that the mean score for the PR-VF group (22.51) is bigger than EC-VF (20.53) and TG (22.56) bigger than EC-VF (20.53).

The data suggest profound distinctions in how each feedback type influences students' beliefs in their abilities to perform long jumps over time. The superior performance of the

SC-VF group in enhancing self-efficacy, followed by significant yet varying levels among PR-VF and TG groups, highlights intricate dynamics in feedback efficacy. Albert Bandura's seminal work on self-efficacy posits that beliefs in one's capabilities to execute specific actions significantly affect one's choices, effort, perseverance, and resilience (Bandura, 1997). Self-efficacy is primarily developed through mastery experiences, vicarious experiences, verbal persuasion, and physiological states. The high self-efficacy scores in the SC-VF group could be attributed to the enhanced mastery experiences this feedback modality facilitates, where students control their learning and receive feedback tailored to their specific actions and timings.

Vygotsky's theory emphasizes social interactions in learning, suggesting that knowledge is constructed through social interaction and cultural tools (Vygotsky, 1978). The PR-VF and TG modalities, which inherently involve more interpersonal interactions than EC-VF, may foster self-efficacy through more enriched social and cultural learning contexts, explaining their effectiveness over EC-VF. Deci and Ryan's Self-Determination Theory suggests that fulfilling needs for autonomy, competence, and relatedness fosters greater motivation and engagement (Deci & Ryan, 2000). SC-VF, by promoting autonomy, likely enhances self-efficacy by satisfying these psychological needs more effectively than other feedback types.

Wulf et al (2010), research indicates that self-controlled practices in sports settings enhance learning outcomes and self-efficacy by providing learners with control over their feedback and practice, which aligns with the superior results of the SC-VF group. Hattie & Timperley (2007), argue that effective feedback answers three major questions: Where am I going? How am I going? Where to next? Feedback modalities that effectively address these questions can significantly enhance self-efficacy by providing clear pathways to improvement and success. Magill and Anderson (2014), discussions on the role of feedback in motor learning suggest that feedback's timing, frequency, and specificity significantly influence learning and self-beliefs. SC-VF, by allowing individualized control over these aspects, likely results in better self-efficacy outcomes.

For practitioners in educational and sports settings, understanding the differential impacts of feedback modalities on self-efficacy can guide the design of more effective training and educational programs. Emphasizing self-controlled and peer-involved feedback mechanisms can significantly empower learners, enhancing their confidence and performance in sports skills. In summary, the significant differences in self-efficacy observed among different feedback groups at the retention test stage underscore the critical influence of feedback modality on learners' self-beliefs in their sports capabilities. The results from the SC-VF group particularly highlight the potential of self-controlled feedback to substantially enhance self-efficacy, supporting the integration of learner autonomy in training strategies. This study not only reinforces the theoretical frameworks of Bandura, Vygotsky, and Deci and Ryan but also offers practical insights for optimizing feedback to foster self-efficacy and performance in sports training.

Conclusion

In terms of self-efficacy, no differences were noted in the post-test 1, but the SC-VF group outperformed EC-VF and TG in the post-test 2, with PR-VF also showing higher scores. This trend was more pronounced in the retention test, where SC-VF scored the highest, followed by PR-VF, and TG exceeding EC-VF. This suggests that self-controlled feedback boosts initial self-efficacy, while peer-reviewed feedback significantly builds confidence over time. These findings advocate for the adoption of self-guided learning methods in physical education to enhance skill acquisition, retention, and confidence. Future research should include assessing self-efficacy using qualitative methods.

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