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The effectiveness of self-controlled video feedback in improving the teaching of track and field sports in physical education teachers from Chinese universities

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ABSTRACT

This study aimed to explore the effectiveness of self-controlled video feedback in improving the teaching of track and field sports among physical education teachers at Chinese universities. A cross-sectional survey was conducted with 144 Chinese track and field teachers. The data was collected using a researcher-made online survey questionnaire for this research. This questionnaire used a five-point Likert scale to assess the impact of self-controlled video feedback on teaching and student performance. Data were analyzed using factor analysis, ANOVA and regression to evaluate the relationship between self-controlled video feedback, teacher effectiveness, and student outcomes. The findings revealed that self-controlled video feedback significantly improved the teaching effectiveness of Chinese track and field teachers, which was closely associated with increased proactivity among both teachers and students in evaluating physical education performance. Additionally, the use of this method was linked to improvements in motor skills and performance among students. However, the role of teachers in using this method to enhance student performance was not found to be significant. These discrepancies could be attributed to factors such as low digital competence among teachers and inadequate student involvement. The study highlights the need for further policies and training to address these challenges, ensuring more effective use of self-controlled video feedback in Chinese track and field teaching.

Contribution/Originality: This study is original in its exploration of self-controlled video feedback as a tool to enhance teaching and student performance in track and field sports within Chinese universities. It uniquely applies this method in a context where previous research is limited and provides new insights into effective pedagogical strategies in physical education.

1. INTRODUCTION

Obtaining comprehensive feedback or assessment information is extremely important for athletes to optimize their performance (Koopmann, Faber, Baker, & Schorer, 2020; Otte, Davids, Millar, & Klatt, 2020). It is particularly important for athletes engaged in track and field events (Hartmann & Niessen, 2011). Sports including athletes who must run or jump on a track, throw an item or do a mix of these are known as track and field sports (Aoki, Kohmura, Sakuma, Koshikawa, & Naito, 2015). Common examples of track and field-based sports include long- and short-distance running races, javelin, shot put, steeplechase, discus, hammer throws and crossing hurdles (Meron & Saint-Phard, 2017). Sporting disciplines that are a part of track and field events need a broad range of demands linked to energy systems (Błażkiewicz, Łysoń, & Wit, 2019; Joaquim, Juzwiak, & Winckler, 2018), body types

(O'Connor, Olds, & Maughan, 2007) motor fitness and skill (Zhao, Siener, Zhao, & Hohmann, 2023) biomechanical performance (Valamatos, Abrantes, Carnide, Valamatos, & Monteiro, 2022) and required movements (Horst, Janssen, Beckmann, & Schöllhorn, 2020) for ideal performance. Therefore, track and field events are the ideal sport to examine the relationship between specific assessment or feedback methods and optimum sporting performance (Chapman, Laymon, & Arnold, 2014; Reid, Dolan, & DeBeliso, 2017). Furthermore, in physical education, the importance of assessment is taken a step further where teachers have a core responsibility towards providing feedback, demonstration and instructions for improved student learning (Marjan Kok, Komen, van Capelleveen, & van der Kamp, 2020; Lhuisset & Margnes, 2015; Potdevin et al., 2018). Recently, students who are given control over their learning environment have been found to improve their motor skills acquisition and performance. Such environments include situations where the students can decide which physical assistance devices they require, how they want their tasks to be scheduled, required time for practice and so on (Kitsantas & Zimmerman, 2002; Wulf & Lewthwaite, 2016). However, such self-regulated and self-reporting processes are also prone to being influenced by mood, fatigue, memory and pain leading to biased findings (Taylor, Wright, Smoliga, DePew, & Hegedus, 2016; Van Maarseveen, Oudejans, & Savelsbergh, 2018). Self-controlled video feedback serves as a promising tool for assessment since it provides teachers a model for further instruction and also provides students with real-time feedback on their performance which can be supplemented with verbal instructions from teachers to address this situation (Kok & Van der Kamp, 2018; Trabelsi et al., 2022). Further examining the role of self-controlled video feedback particularly in the context of complex disciplines such as track and field events can offer interesting insights into how digital video measures can optimize assessment and teaching in physical education for teachers and students, respectively.

Limited participation, physical activity, performance of Chinese athletes and physical education students, especially in the context of track and field events are observed problems in universities and schools (Liu et al., 2016; Liu et al., 2019; Wu, 2006). The country scored less in track and field events due to a lack of adequate training, an early age of retirement for elite athletes, a lack of advancement in sports training, and increased participation of young, inexperienced athletes during the London Olympic Games (Jin & Xu, 2014). Indeed, the education ministry of the country has recently mandated regional schools and universities to make physical education a compulsory part of the curriculum so that students are encouraged to participate in these activities (An, Yang, Niu, & Wang, 2022). Therefore, these discrepancies indicate the need to adopt more advanced or interesting forms of teaching and learning in track and field sports that can improve participation and performance in physical education students. Unfortunately, studies to examine how this can be improved, particularly in the track and field aspect of Chinese physical education have been scarce. According to a different study by Johnson, Erwin, Kipp, and Beighle (2017) who examined the physical activity of middle school students in China, track and field students had the lowest levels of participation and physical activity performance particularly when they concentrated on jumping rather than running. The author deduced that teachers are not creating a mastery climate for their physical education students (Wang, Liu, Sun, Lim, & Chatzisarantis, 2010). Higher student motivation results from the teacher's emphasis on personal development, valuation of the student's learning process, and use of self-referenced criteria for evaluating success (Cox & Williams, 2008; Hastie, Rudisill, & Wadsworth, 2013). Its absence leads to less feelings of enjoyment and engagement in the physical education lesson leading to poor participation (Johnson et al., 2017). Self-controlled video feedback appears to offer this scope of mastery by providing students the opportunity to be directly involved in their assessment (Kok & Van der Kamp, 2018). Again, there are no studies to validate the experiences of Chinese track and field teachers on how this novel feedback method improves teaching, learning and performance. The dearth of research and the ongoing problem of poor participation and performance in Chinese track and field events possibly due to a poor teaching and learning climate, therefore form the rationale for this study.

Therefore, the objective of the study is to investigate the effectiveness of self-controlled video feedback in improving the teaching of track and field sports in physical education teachers from a Chinese university. The study seeks to find answers to the following research questions that will guide the following research process:

RQ1. Is self-controlled video feedback effective in improving the ability of physical education teachers to teach track and field sports in Chinese universities?

RQ2. Is self-controlled video feedback effective in improving the ability of physical education teachers to enhance performance in physical education students for track and field sports in Chinese universities?

The importance of this research is that it tries to resolve the problems noted during participation and performance by Chinese college students in competitive sports such as track and field, caused frequently by poor teaching methods. Therefore, if found effective in Chinese universities, this study may have useful implications for designing more innovative PE curricula that comply with the directive from the Ministry of Education to promote PE (An et al., 2022). Moreover, this research can be applied practically by teachers on how to create a mastery climate that focuses on personal development which makes students take part in physical activities more meaningfully (Johnson et al., 2017). This investigation can act as a catalyst towards changing the status quo in China's university PE department thereby improving its track and field performance.

2. LITERATURE REVIEW

2.1 Self-Controlled Video Feedback in Physical Education Teaching

SCVF has been widely used in PE instruction and there are several studies analysing its efficacy in facilitating motor learning and enhancing teaching practices. In their systematic review Mödinger, Woll, and Wagner (2022) explored how visual feedback in video can assist motor learning among students. They have found that the correct behavior of teachers can be modelled more effectively such as forehand stroke by using verbal instructions along with SCVF. However, this study also indicated that effective use of video feedback was hindered by a lack of digital competence among teachers. These results are valuable but restricted to basic basketball skills rather than track and field sports. In addition, it is not about how Chinese teachers negotiate SCVF while using it in their teaching practice as well as in other cultural contexts. This limitation emphasises that more context-specific research is needed for investigating the efficacy of SCVF in instructing complex games like track and field events in different educational situations.

Yantha, McKay, and Ste-Marie (2022) also investigated the role played by teachers in delivering SCVF. The experimental study by them cautioned against overemphasising the importance of feedback from a teacher suggesting that active involvement of a learner is essential for retention of PE learning. This study is similar to that of Mödinger et al. (2022) but it is restricted to high school students and has nothing to do with track and field or the experiences of Chinese physical education teachers. These researchers have shown how SCVF is used in PE but they have not provided details about how it can be applied in track and field in China.

Additionally, Heemsoth and Kleickmann (2018) stress the need for educational video materials to match both theoretical perspectives and curriculum content applied during PE instruction. Their analysis suggests that pre-service teachers' personal assumptions and prior experiences can conflict with the basic principles of SCVF when they demand students to follow their movements exactly. As a result, this discrepancy nullifies the potential benefits of video feedback in motor learning. Furthermore, Van der Kamp, Duivenvoorden, Kok, and Van Hilvoorde (2015) continue by suggesting a teaching method that enables students to watch themselves on video while instructors can show them mistakes and demonstrate how things are done correctly. These results are invaluable in demonstrating the possibility of SCVF in enriching the teaching practice, but they focus narrowly on general PE and not track and field sports. The literature gap emphasises the need for studies that particularly focus on how SCVF can be used to effectively teach track and field events especially considering that such games are less developed in Chinese universities.

2.2. Self-Controlled Video Feedback in Improving Physical Education Performance

According to existing research, SCVF is effective for enhancing performances in PE classes with respect to motor skill development. However, a critical analysis reveals that this research did not concentrate on track and field sports in particular while some had little attention to what PE teachers think about this phenomenon. For instance, Han, Syed Ali, and Ji (2022) conducted a meta-analysis and systematic review that indicated that visual feedback including SCVF enhanced motor skills learning among PE students. However, according to the study, this was least significant when feedback was purely informational or verbal. This restriction was necessary since the study was not focused on track and field sports which differ greatly from other sports in terms of skill sets and performance standards. It is crucial that we conduct further research to know how SCVF can be applied in track and field events to determine its specific benefits and challenges.

Post, Aiken, Laughlin, Fairbrother (2016) and Van der Meer, van den Hoven, van der Kamp, and Savelsbergh (2024) also examined the influence of SCVF on various aspects of PE performance. Van der Meer et al. (2024) found a significant increase in tactical skills but none with self-efficacy in tennis players who received SCVF. On the other hand, Post et al. (2016) showed that learners who were given feedback had better perception about their own abilities and they could easily recognize the mistakes made during their performances. According to these results, SCVF contributes to improve accuracy and self-assessment abilities. Nonetheless, such an approach may not have practical implications for athletics-like games such as those found in tennis focused experiments since this type of games contains different types of motor skills as well as performance dynamics. It also shows the requirement for research that particularly investigates how SCVF can be utilised to improve performance in track and field sports particularly within educational settings where these sports are less emphasised.

Makki, Abdoshahi, and Ghorbani (2021) and Marjan Kok et al. (2020) provide further insights into different effects of SCVF based on target activity or sport. Makki et al. (2021) showed that university students who participated in SCVF showed enhancement in learning but not necessarily in performance when it came to fine motor skill-demanding tasks like dart throwing.

Conversely, Marjan Kok et al. (2020) noticed significant improvements both in technique as well as self-efficacy among shot put secondary school students, a track and field sport after receiving SCVF. This suggests that the effectiveness of SCVF may differ depending on the type of sport or activity with more complex or dynamic sports potentially benefiting more from this type of feedback. This variability emphasises the importance of further investigation to identify specific conditions under which SCVF is most effective especially during track and field events.

An additional argument on the potential benefits of SCVF to sport performance was given by Van Maarseveen et al. (2018). They conducted a study in which conversations between teachers and soccer players during video feedback sessions were analyzed. In this way, students could have more meaningful discussions about their performances and as a result they would take more responsibility for finding out any other possible weaknesses or strengths that may be related to it. This research is limited since it only focused on football and excluded track and field players, although it showed how SCVF may enhance communication and engagement regarding instructors' attempts to instruct and inspire students. This limitation highlights the need for more research that explores how self-controlled video feedback can be used to improve communication and performance in track and field events particularly in the context of physical education in Chinese universities.

2.3. Research Gap

The concentration on general physical education or sports other than track and field severely restricts the literature on self-controlled video feedback in physical education instruction and performance although it offers insightful information. Although several studies evaluated the effects of self-regulated video feedback on students, there were relatively few that particularly looked at teacher experiences using this method to instruct and raise

student performance. The few papers that indeed examined the perspectives of teachers were mainly narrative or based only on secondary data. Furthermore, the findings on the effectiveness of self-regulated video feedback were highly heterogeneous with limited focus on Chinese physical education teachers and students or track and field events specifically. This gap in the literature therefore formed the foundation of the objectives and methodology of this study which have been discussed in the succeeding sections. The outcomes of the literature review were further used to develop the data collection tools of this study.

2.4. Theoretical Framework

The self-regulation of learning theory can be a useful theoretical framework for this study. Firstly, self-regulated learning (SRL) is when a person generates certain feelings, actions and thoughts and plans them in a structured or cyclical manner to achieve specific personal goals. This is primarily done in the following three stages: self-reflection, performance, and foresight. In the first stage of forethought, students analyse the task at hand by carefully establishing goals related to it and determining how they can achieve them. This is also a stage where the student activates strategies of self-learning by using motivational methods such as setting outcome expectations, harnessing self-efficacy, orienting themselves towards the goals and evaluating the extrinsic or intrinsic value of the task at hand (Lawson, Vosniadou, Van Deur, Wyra, & Jeffries, 2019; Reparaz, Aznárez-Sanado, & Mendoza, 2020; Van Laer & Elen, 2017). Students engage themselves in various activities that mainly involve self-control strategies like imagery, self-instruction, and focused attention among others while performing this phase. In addition to these processes of self-observation there are also other methods used by students such as self-experimentation and self-recording to keep them connected with the task at hand. Lastly, during self-reflection, students evaluate their performance (Van Laer & Elen, 2017). Indeed, the SRL theory is appropriate since it provides insights into the possible stages that physical education teachers can encourage their students to overcome when they are using self-controlled video feedback for teaching and assessing track and field performance. Teachers can effectively direct and modify their use of self-controlled video feedback to ensure that students mould their performance after carefully thinking, performing and reflecting on their track and field behaviours and tactics by applying each of these stages.

3. METHODODOLOGY

3.1. Research Design

A cross-sectional research design was adopted to satisfy the research objective and address the research questions. According to Creswell and Creswell (2017) ascertaining the relationships between or among certain variables, this approach entails collecting data from a given population at a specified period. This research design employed a survey questionnaire to assess the impact of SCVF on teaching effectiveness with respect to track and field.

3.2. Sample and Recruitment

A convenience sampling method was used for recruiting the sample of this study. A social media post was shared across LinkedIn and Facebook where the researcher briefly advertised the main objectives, methodology, and significance of the study as well as the focus on Chinese physical education teachers who were engaged in track and field events. People who voluntarily responded and showed an interest in the advertisement were mailed a consent form as well as an online survey questionnaire for data collection. This was done across 200 respondents since this is the minimum sample size required for maintaining statistical power (Lei & Li, 2013). However, a total of 158 people provided their consent and responded to the survey, of which only 144 responses were complete and valid. Therefore, this was the final sample size of the study.

3.3. Instrument

Data was collected using a researcher-made online survey questionnaire. All the existing studies in the relevant field are experimental-based. Therefore, the researcher constructed a fresh survey questionnaire taking influence and insights from a few previous studies. Research by Jaquess et al. (2021) and Marjan Kok et al. (2020) on self-controlled video feedback effectiveness in physical education used three trials per session. Students frequently requested video feedback after practice sessions, indicating good learning. Items were included in the questionnaire to understand the frequency of self-controlled video feedback used by physical teachers. Few other studies such as Barros, Yantha, Carter, Hussien, and Ste-Marie (2019); Marjan Kok et al. (2020); Post et al. (2016) and Van Maarseveen et al. (2018) have shown to enhance performance parameters particularly in track and field events by allowing teachers to identify performance errors and improve motor control. Therefore, items related to how self-controlled video feedback was used by Chinese physical education teachers to improve the performance and error recognition of their students were also included in the survey. Thus, the final survey questionnaire consisted of a total of 15 items, which were divided into two parts (see Appendix 1). The first four questions (Q1-Q4) aimed at collecting the demographic data of participants such as their gender, age, years of physical education teaching and the time since which they have been using self-controlled video feedback. The second part of the survey (Q5-Q15) examined various aspects related to the use and outcomes of self-controlled video feedback in track and field teaching. These questions had multiple choices and followed a five-point Likert scale format.

3.4. Validity and Reliability Test

According to Table 1, the KMO coefficient is 0.850 which is higher than the threshold level of 0.6. It indicates that the sample size is adequate. Bartlett's test also shows that the variables and items chosen for this research are significantly valid ($p < 0.05$).

Table 1. Sampling adequacy and data validity test.

Kaiser-Meyer-Olkin measure of sampling adequacy.		**0.850**
Bartlett's test of sphericity	Approx. Chi-square	1244.821
	Df	55
	Sig.	0.000

The factor analysis has been done considering all the questions using the questionnaire related to self-controlled video feedback, teaching effectiveness and student effectiveness. For factor analysis, principle component analysis was used as the extraction method, and oblimin rotation was used with delta = 0.

Table 2. Factors, item loadings, validity and reliability analysis.

Scales	**Items**	**Components**			**AVE**	**CR**
		1	**2**	**3**		
SCVF	The student has taken a video	0.89			0.705	0.921
	The teacher has taken a video	0.905				
	Student engagement evaluation	0.573				
	Teacher engagement evaluation	0.804				
	Student teacher feedback	0.968				
Teaching effectiveness	Ability critical evaluation			0.784	0.728	0.889
	Ability to communicate effectively.			0.945		
	Convenience			0.822		
Student effectiveness	Student confidence		0.889		0.737	0.893
	Student performance score		0.847			
	Student motor functionalities		0.838			
Extraction method: Principal component analysis						
Rotation method: Oblimin with Kaiser normalization						
Rotation converged in 5 iterations.						

According to Table 2, 3 factors are identified from factor analysis. No overlapping or parallel loading in factor analysis has been found. A total of 5 items are loaded into the implementation of the Self-Controlled Video Feedback (SCVF) factor, 3 items are loaded into the teaching effectiveness factor and another 3 items are loaded into the student effectiveness factor. The validities of all 3 identified factors in terms of average variance extracted (AVE) are higher than 0.6 which signifies adequate validity of each factor and their underlying items. The reliability of these three identified factors and the underlying items is between 0.88 and 0.92 which is very high. The mean of underlying items has been calculated to develop the respective factors as variables, namely SCVF, teaching effectiveness and student effectiveness.

3.5. Data Analysis

Descriptive statistics were used to analyse the demographic data of the participants. Furthermore, regression models and analysis of variance (ANOVA) were used to identify whether self-controlled video feedback was statistically significantly linked to improved effectiveness of teachers in track and field and improved ability of the teachers to enhance student effectiveness and performance, respectively.

4. RESULTS

4.1. Demographic and Background

144 responses were included in the final analysis after removing invalid and incomplete responses (see Table 3). Of the participant, 62.5% are male and 25% are female indicating a higher proportion of male participants within the sample. 45.8% of participants are 30 to 39 years old and 33.3% are 40 to 49 years old which indicates that 79% of participants are 30 to 49 years old. Of the teachers who are participants, 45.8% have 5 to 10 years of teaching experience and 29.2% have 1 to 5 years of teaching experience. Around 46% of teachers have experience of 1 to 5 years in video-based feedback-driven assessment and learning methods in physical education and 25% of them have 6 months to 1 year of experience. Therefore, most of the teachers have high experience as teachers in the field of physical education and sports. However, they have started to use the self-controlled video feedback method recently.

Table 3. Demographic characteristics and background.

Variables	Characteristics	N	%
Gender	Male	90	62.5
	Female	36	25.0
	Other	6	4.2
	Prefer not to say	12	8.3
Age	18-29	18	12.5
	30-39	66	45.8
	40-49	48	33.3
	50+	12	8.3
Professional experience	Less than 1 year	12	8.3
	1 to 5 years	42	29.2
	5 to 10 years	66	45.8
	Above 10 years	24	16.7
Experience video feedback	Less than 6 months	18	12.5
	6 months to 1 year	36	25.0
	1 to 5 years	66	45.8
	Above 5 years	24	16.7

4.2. Factor

4.2.1. Descriptive Analysis and Regression Modelling

Table 4 shows that student engagement in taking video (3.25 ± 1.215) is at a moderate level whereas student engagement in critical evaluation (2.99 ± 1.188) of video is at a low to moderate level. The engagement of teachers

in the evaluation of videos (3.04 ± 1.211) is also at a moderate level. The convenience of the existing self-controlled video feedback methods (3.04 ± 1.211) is only at a moderate level. Student motor functionalities (3.46 ± 0.923) are high compared to student performance scores (3.17 ± 0.895). The implementation of SCVF, student effectiveness, and teaching effectiveness are all at moderate levels.

Table 4. Descriptive statistics of variables and items.

Variables	Mean	SD	1Q	Median	3Q
The student has taken video	3.25	1.215	2.25	3.00	4.00
The teacher has taken video	3.33	1.188	3.00	3.00	4.00
Student engagement evaluation	2.99	1.274	2.00	3.00	4.00
Teacher engagement evaluation	3.04	1.211	2.00	3.00	4.00
Student teacher feedback	3.58	1.113	3.00	4.00	4.00
Ability of critical evaluation	3.36	0.951	3.00	3.50	4.00
Ability to communicate effectively	3.38	1.051	3.00	3.00	4.00
Convenience	3.06	1.056	2.00	3.00	4.00
Student confidence	3.25	0.743	3.00	3.00	4.00
Student performance score	3.17	0.895	2.00	3.00	4.00
Student motor functionalities	3.46	0.923	3.00	3.00	4.00
SCVF	3.24	1.055	2.60	3.40	4.00
Teaching effectiveness	3.27	0.919	2.67	3.33	4.00
Student effectiveness	3.29	0.733	2.67	3.33	4.00

Table 5. Correlation analysis of variables and items set 1.

S. No.	Variables	1	2	3	4	5	6	7
1	SCVF	1	0.671**	0.339**	0.966**	0.876**	0.798**	0.892**
2	Teaching effectiveness	0.671**	1	0.290**	0.671**	0.533**	0.607**	0.633**
3	Student effectiveness	0.339**	0.290**	1	0.344**	0.267**	0.279**	0.333**
4	Student has taken video	0.966**	0.671**	0.344**	1	0.825**	0.730**	0.858**
5	The teacher has taken video	0.876**	0.533**	0.267**	0.825**	1	0.604**	0.734**
6	Student engagement evaluation	0.798**	0.607**	0.279**	0.730**	0.604**	1	0.590**
7	Teacher engagement evaluation	0.892**	0.633**	0.333**	0.858**	0.734**	0.590**	1
8	Student teacher feedback	0.864**	0.496**	0.265**	0.834**	0.693**	0.553**	0.745**
9	Ability of critical evaluation	0.719**	0.935**	0.342**	0.709**	0.558**	0.645**	0.691**
10	Ability to communicate effectively	0.510**	0.886**	0.232**	0.511**	0.426**	0.453**	0.504**
11	Convenience	0.597**	0.887**	0.220**	0.605**	0.465**	0.552**	0.528**
12	Student confidence	0.406**	0.380**	0.917**	0.411**	0.319**	0.343**	0.423**
13	Student performance score	0.223**	0.213*	0.831**	0.217**	0.183*	00.162	0.213*
14	Student motor functionalities	0.265**	0.179*	0.837**	0.278**	0.201*	0.232**	0.246**

Note: **. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

According to Tables 5 and 6, students' pro-activeness in taking videos (r = 0.671) and teacher's engagement in critical evaluation of the video (0.633) are the most correlated factors of SCVF with teaching effectiveness. The students' pro activeness in taking videos (r = 0.344) and teachers' engagement in critical evaluation of the video (0.333) are also the most correlated factors of SCVF with student effectiveness. All other correlations are within 0.2 to 0.7 apart from correlations between the 3 identified factors and their underlying items which shows less risk of multi-collinearity.

Table 6 represents the model to predict teaching effectiveness by SCVF. Table 7 represents two models using student effectiveness as a dependent variable whereas model 1 was developed considering teaching effectiveness as a predictor and model 2 was developed by adding SCVF to model 1.

Table 6. Correlation analysis of variables and items set 2.

S. No.	Variables	8	9	10	11	12	13	14
1	SCVF	0.864**	0.719**	0.510**	0.597**	0.406**	0.223**	0.265**
2	Teaching effectiveness	0.496**	0.935**	0.886**	0.887**	0.380**	0.213*	0.179*
3	Student effectiveness	0.265**	0.342**	0.232**	0.220**	0.917**	0.831**	0.837**
4	The student has taken a video	0.834**	0.709**	0.511**	0.605**	0.411**	0.217**	0.278**
5	The teacher has taken a video	0.693**	0.558**	0.426**	0.465**	0.319**	0.183*	0.201*
6	Student engagement evaluation	0.553**	0.645**	0.453**	0.552**	0.343**	00.162	0.232**
7	Teacher engagement evaluation	0.745**	0.691**	0.504**	0.528**	0.423**	0.213*	0.246**
8	Student teacher feedback	1	0.549**	0.337**	0.466**	0.281**	0.208*	0.204*
9	Ability of critical evaluation	0.549**	1	0.771**	0.774**	0.426**	0.238**	0.241**
10	Ability to communicate effectively	0.337**	0.771**	1	0.623**	0.316**	00.152	00.150
11	Convenience	0.466**	0.774**	0.623**	1	0.294**	0.189*	00.103
12	Student confidence	0.281**	0.426**	0.316**	0.294**	1	0.701**	0.698**
13	Student performance score	0.208*	0.238**	00.152	0.189*	0.701**	1	0.445**
14	Student motor functionalities	0.204*	0.241**	00.150	00.103	0.698**	0.445**	1

Note: **. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 7. Regression analysis to find the relationship between SCVF and teaching effectiveness.

Model summary					
R	**R square**	**Adjusted R square**	**Std. error of the estimate**		
0.671	0.450	0.447	0.684		
ANOVA					
	Sum of squares	df	Mean square	F	Sig.
Regression	54.410	1	54.410	116.386	0.000
Residual	66.385	142	0.468		
Total	120.796	143			
Coefficients					
	Unstandardized coefficients		Standardized coefficients		
	B	Std. error	Beta	T	Sig.
(Constant)	1.373	0.184		7.443	0.000
SCVF	0.585	0.054	0.671	10.788	0.000
Predictors: (Constant), SCVF					
Dependent variable: Teaching effectiveness					

Note: B - Unstandardized coefficient.

According to the model summary of Table 7, a 45% variance in teaching effectiveness can be predicted by the implementation of self-controlled video feedback (R-square = 0.45). The model is also found to be significant ($F = 116.38$, $p < 0.05$) predictability. The coefficient results showed that SCVF ($B = 0.585$, $p < 0.05$) has a significant positive effect size on teaching effectiveness. Therefore, higher implementation of SCVF is significantly related to higher teaching effectiveness in physical education.

According to model 1 in Table 8, only teaching effectiveness can predict a 29% variance in student effectiveness (R-square = 0.29) and the model predictability is also significant ($F = 13.036$, $p < 0.05$). However, the predictability increased after adding SCVF and with SCVF in model 2, a 35% variance in student effectiveness can be predicted. In model 2, teaching effectiveness is not a statistically significant predictor of student effectiveness with a uniquely independent effect. However, the implementation of self-controlled video feedback ($B = 0.182$, $p < 0.05$) is a statistically significant predictor of student effectiveness with a uniquely independent effect. Figure 1 also suggests that self-controlled video feedback has a direct and significant relationship with student effectiveness ($B = 0.182$, $p < 0.05$) where the mediator role of teacher effectiveness is not significant ($B = 0.091$, $p = 0.286$).

Table 8. Regression analysis to find the relationship between CSVF, teaching effectiveness, and student effectiveness.

Model summary						
Model	**R**	**R square**	**Adjusted R square**	**Std. error of the estimate**		
1	0.29	0.084	0.078	0.704		
2	0.35	0.122	0.110	0.691		
ANOVA						
Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	6.469	1	6.469	13.064	
	Residual	70.309	142	0.495		
	Total	76.777	143			0.000
2	Regression	9.379	2	4.689	9.810	
	Residual	67.398	141	0.478		
	Total	76.777	143			0.000
Coefficients						
Model		Unstandardized coefficients		Standardized coefficients		
		B	Std. error	Beta	t	Sig.
1	(Constant)	2.538	0.217		11.687	0.000
	Teaching effectiveness	0.231	0.064	0.290	3.614	0.000
2	(Constant)	2.407	0.220		10.941	0.000
	Teaching effectiveness	0.091	0.085	0.114	1.071	0.286
	SCVF	0.182	0.074	0.263	2.467	0.015

Note: Dependent variable: Student effectiveness.
Model 1 predictors: (Constant), teaching effectiveness.
Model 2 predictors: (Constant), teaching effectiveness, SCVF.

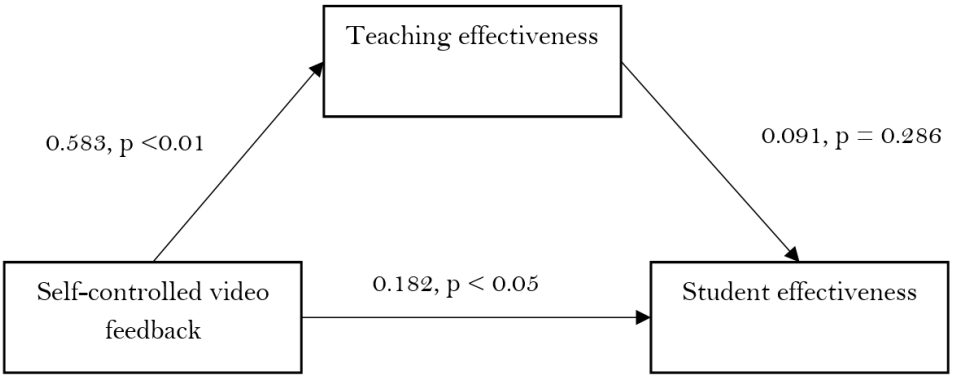
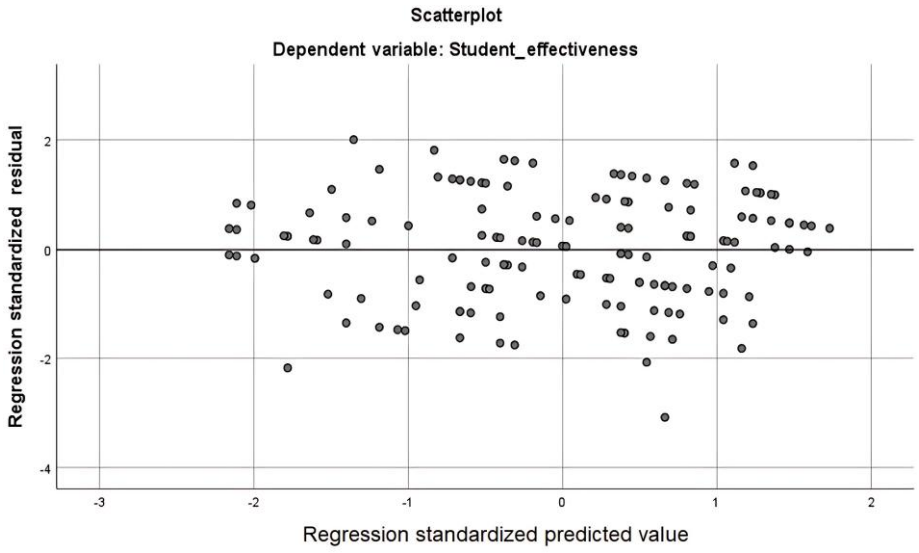


Figure 1. Conceptual map with mediator.



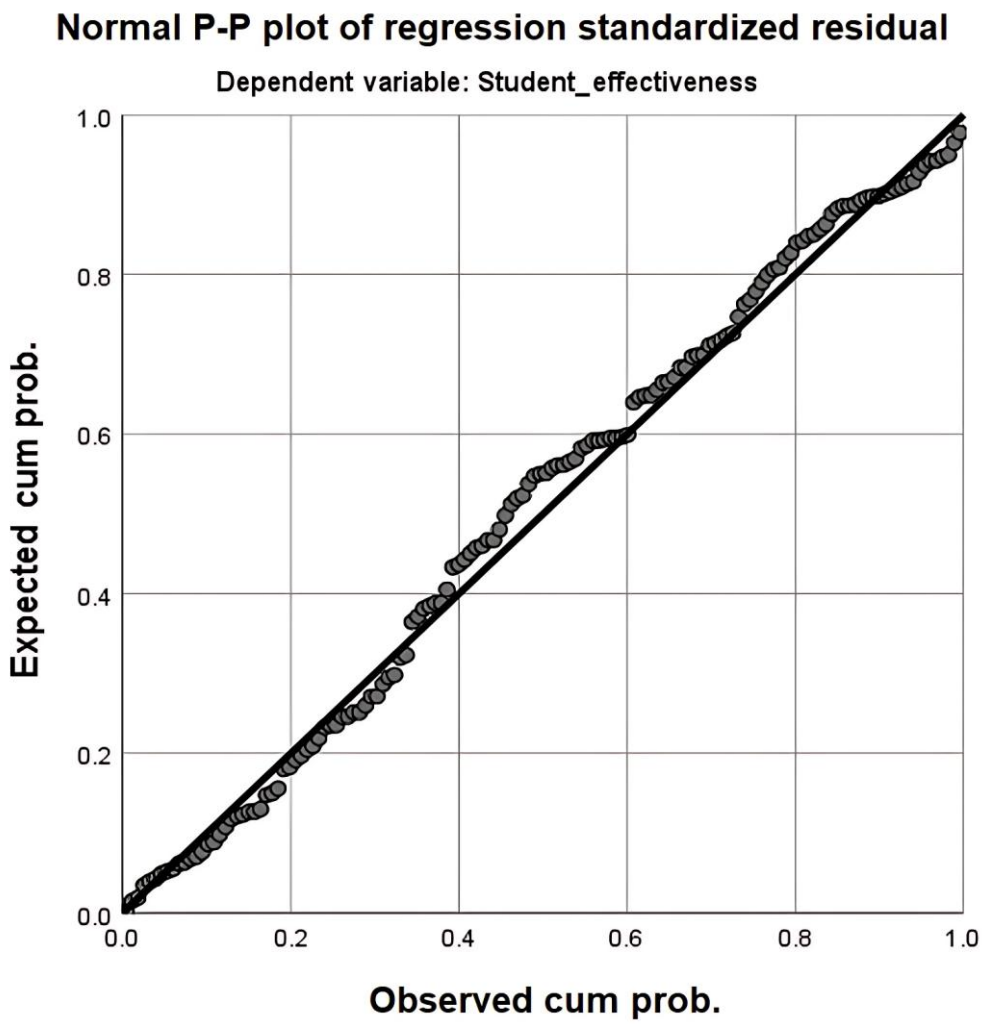


Figure 2. Homoscedasticity (Left) and normality of residuals (Right) test.

The residual versus predicted plot of Figure 2 showed no pattern in the distribution of the plots. Therefore, the risk of heteroscedasticity is low and the homoscedasticity assumption can be satisfied. The P-P plot also showed that the distribution of residuals also follows a normal distribution which also satisfies the normality assumption. Therefore, the regression models are robust.

5. DISCUSSION

5.1. The Impact of Self-Controlled Video Feedback on Teacher Effectiveness

This paper first aimed to find out whether SCVF is effective and can statistically significantly improve the ability of physical education teachers to teach track and field sports in Chinese universities. Indeed, it was found that SCVF was statistically significantly linked to teaching effectiveness in Chinese physical education (track and field ($p < 0.01$)). Similar findings were also noted with respect to basketball as well (Aiken, Fairbrother, & Post, 2012). The most closely associated components of SCVF with teaching effectiveness are students' initiative in taking videos and teachers' evaluation of the video. In a similar context, Marjan Kok et al. (2020) also postulated that SCVF improved shot-put performance in physical education students and this technique improved motor learning through improved motivation by enhancing perceived competence and autonomy. This mechanism further proves the self-regulated learning (SRL) theory by which individuals actively monitor and control their learning processes, including motivation, behavior, and cognition by showing how SCVF possibly strengthens motivational self-reflection leading to improved motivation and therefore, motor learning (Kok & Van der Kamp, 2018). It has also been researched that motivating students to take responsibility for their learning using self-controlled methods

satisfies their sense of autonomy (Matric, 2019). This further improves self-efficacy in the learner leading to higher motivation for them to do the physical activity at hand (Leyton-Román, Nunez, & Jiménez-Castuera, 2020). Therefore, this results in effective teaching. Furthermore, such self-controlled practice also improves competence in the learner leading to higher confidence and motivation which permanently changes motor skills (Marjan Kok et al., 2020; Łuba-Arnista & Biegajło, 2020; Romdhane & Khacharem, 2023; Souissi et al., 2021). Therefore, it implies that SCVF improved the effectiveness of Chinese track and field teachers by indicating increased engagement from students and also high engagement from the teachers in critical evaluation of performance. These factors improved teaching effectiveness by empowering students and making them feel more controlled and autonomous in their learning leading to better motor skill acquisition, and performance. However, this study also revealed that SCVF significantly improved the effectiveness of the students in terms of performance. Chinese track and field teachers experienced moderate levels of convenience during its implementation due to the fact that teachers may not be acquainted with the technical knowledge needed to handle such self-controlled videos. This can be overcome by using pre-recorded videos of older lessons (Mödinger et al., 2022). Nevertheless, this finding suggests that there may be a need for further professional development to enhance the digital literacy of Chinese track and field teachers ensuring they can fully leverage SCVF in their teaching practices.

5.2. The Impact of Self-Controlled Video Feedback on Student Effectiveness

Secondly, this study also wanted to explore whether SCVF is statistically significantly effective in helping teachers enhance performance in physical education students for track and field sports in Chinese universities. However, the data showed mixed results in this regard. It was found that similar to teacher effectiveness, SCVF directly and significantly influenced the performance effectiveness of Chinese track and field students. SCVF had a significant effect on students' effectiveness. On the other hand, teaching effectiveness was also significantly correlated with students' effectiveness in terms of performance, confidence, and motor functionalities. However, the direct impact of SCVF on students' effectiveness was stronger than the indirect impact through teaching effectiveness. Therefore, the role of student involvement in SCVF is more crucial than having an indirect effect through teaching effectiveness. Indeed, the importance of student involvement to reap the benefits of SCVF has been reviewed previously in relevant literature (Aiken et al., 2012; Marjan Kok et al., 2020; Van der Meer et al., 2024). For instance, teachers must be important in evaluating the video feedback and their role must not hinder the autonomy of the students (Skeates, 2012). Students must be actively included in the recording, checking, and evaluating of their performance. This will lead to better learning and motor skill acquisition in the students (Potdevin et al., 2018). This sense of student involvement can also be improved if the teacher carefully uses SCVF to promote curriculum content and also uses this feedback to model correct physical education performance instead of telling students to only imitate their teaching (Goffena & Horn, 2021; Jaquess et al., 2021; Wang et al., 2023; Yantha et al., 2022). However, this study also showed that the involvement of Chinese track and field students in critically evaluating their performance through SCVF was at a low to moderate level. This raises concerns that Chinese track and field teachers do not actively involve their students in autonomously recording, regulating, and evaluating their performance videos. Such discrepancies provide room for the scope of improvements in future research and practice.

6. CONCLUSION

Assessment and feedback are important for students in physical education and especially for track and field athletes where complex motor movements are involved. There has been a growing interest in using self-controlled video feedback as a form of assessment since it gives students some control over how they are performing in the field. Therefore, this study aimed to examine the role of self-controlled video feedback in improving the teaching of track and field sports in Chinese universities. The cross-sectional survey with Chinese physical education teachers

found that self-controlled video feedback improved the teaching effectiveness of Chinese track and field teachers. This was correlated significantly with the proactiveness with which both teachers and students used SCVF to critically evaluate their performance. Furthermore, the mediating role of teachers by using SCVF to improve the performance of students was not significant while SCVF improved the effectiveness of student performances because of low digital competence or low involvement of students by Chinese physical education teachers.

However, the study was not without its limitations. Notably, its focus on a specific sample of Chinese physical education teachers involved solely in track and field events limits generalizability to other sports and excluding students' perspectives on SCVF's effectiveness in enhancing performance and motor skills. However, this focus was also a strength as it addresses a gap in understanding the impact of SCVF on teaching effectiveness in a field where China has underperformed. A cross-sectional and descriptive design was a challenge highlighting correlations but not causality. Future research should use experimental and randomized designs to establish causal relationships between SCVF, teacher and student effectiveness.

6.1. Implications

The findings of this study have several important practical implications. The research demonstrates that self-controlled video feedback (SCVF) can significantly enhance the effectiveness of track and field teachers in Chinese universities by potentially increasing students' motivation, autonomy and self-confidence. This suggests that the current challenges in physical education particularly in track and field instruction in China could be addressed by integrating innovative assessment and teaching methods like SCVF. However, the research also raised an issue such as Chinese PE teachers may face the challenge of limited ability to implement SCVF due to their low digital competence. Therefore, it is important for universities and policymakers in China to have strategies and policies that support PE teachers so as to be able to acquire the necessary technological skills that can be used by them effectively when introducing new models like SCVF into their teaching practices. In addition, this study discovered that SCVF had more direct effects on students' achievement than teacher effectiveness. This implies that Chinese athletics coaches are not fully involving learners in the critical appraisal process when using SCVF. Further studies should be carried out to examine the specific barriers experienced by Chinese track-and-field teachers who want to use innovative methodologies such as SCVF. Additionally, investigating students' perspectives on how SCVF is used by their teachers to evaluate and enhance their performance would provide valuable insights for improving educational practices.

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Transparency: The author states that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Competing Interests: The author declares that there are no conflicts of interests regarding the publication of this paper.

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Appendix 1. Survey questionnaire.

Demographic Information:

1. What is your gender?

- Male
- Female
- Other
- Prefer not to say

2. What is your age group?

- 18-29
- 30-39
- 40-49
- 50+

3. How much experience do you have as an educator, coach, or trainer of physical education or sports?

- Less than 1 year
- 1 to 5 years
- 5 to 10 years
- Above 10 years

4. For how many years have you been practicing video-based feedback methods for teaching and training in physical education or sports?

- Less than 6 months
- 6 months to 1 year
- 1 to 5 years
- Above 5 years

Role of SCVF in Track and Field Teaching:

5. How frequently have you found the student's pro-activeness in taking videos of their sports and physical education activities?

- Very rarely
- Rarely
- Sometimes
- Frequently
- Very frequently

6. How frequently are you, as a teacher, educator, trainer, or coach, proactive in taking videos of the sports and physical education activities of students?

- Very rarely
- Rarely
- Sometimes
- Frequently
- Very frequently

7. How frequently do students become highly engaged in critically identifying issues by reviewing the videos?

- Very rarely

- Rarely
- Sometimes
- Frequently
- Very frequently

8. How frequently do you highly engage yourself in critically identifying issues from recorded videos?

- Very rarely
- Rarely
- Sometimes
- Frequently
- Very frequently

9. How frequently do you engage with students for feedback sharing and communication for reviewing, evaluation and scope of improvement?

- Very rarely
- Rarely
- Sometimes
- Frequently
- Very frequently

10. How effectively can you critically identify the gaps and problems to address from recorded videos?

- Very less
- Loss
- Moderate
- High
- Very high

11. How much can you communicate the problem effectively to the student using video-based feedback?

- Very low
- Low
- Moderate
- High
- Very high

12. How convenient is the process of the video feedback method for you?

- Very less
- Loss
- Moderate
- High
- Very high

13. How much improvement in confidence level regarding sports activities have you found in students?

- Very less
- Loss
- Moderate
- High
- Very high

14. How much improvement in measurable performance scores in sports can be found in students?

- Very less
- Loss
- Moderate

- High
- Very high

15. How much improvement in motor performance and physical abilities within students can you find?

- Very less
- Loss
- Moderate
- High
- Very high