

# The Effect of Using Video in Teaching to Acquire Content Knowledge in Physical Education—A Systematic Review

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## Abstract

While studies have indicated that using videos can promote students' acquisition of Content Knowledge, there is disagreement about whether this method can be implemented in traditional physical education classroom settings. Additionally, research on the use of videos in physical education to acquire knowledge across the two domains of Content Knowledge has not been thoroughly conducted. Therefore, a systematic review of literature on the use of videos in physical education was undertaken. The results showed that the use of videos had different effects on the two forms of Content Knowledge (Common Content Knowledge and Specialized Content Knowledge), with most studies indicating positive outcomes in knowledge acquisition. Furthermore, most studies also reported a high level of acceptance for this approach.

: Content Knowledge, Video, Physical Education

## Introduction

Teachers' Content Knowledge (CK) is considered as an important factor affecting students' learning for long. This cognition was more recognized after Shulman proposed Pedagogical Content Knowledge (PCK). As one of the knowledge bases in PCK, CK is considered as a core knowledge base, which is not controversial like other knowledge bases (Depaepe et al., 2013). In the past decade, many studies on the relationship between CK, PCK and student learning in physical education have also been confirmed (Herold & Waring, 2017; Kim et al., 2018; Ward & Ayvazo, 2016).

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However, the research on CK most of the previous studies on improving CK levels were conducted in workshops, and most research subjects were teachers. The measurement of students' CK levels was to verify whether improving teachers' CK had an impact on students' learning. There were few studies on whether adopting different teaching methods would affect the improvement of students' CK levels. In the context of rapid technological development, modern technology has begun to be integrated into teaching. At the same time, under the situation that China's teacher qualification certificate examination has changed, students majoring in Physical Education need to obtain more CK during their university years. Based on these reasons, this study will explore whether using video technology in teaching can affect students' acquisition of CK in the classroom, and explore whether this technology is suitable for use in daily teaching.

### **Theoretical Background and State of Research**

In 2009, Ward borrowed Ball's approach and divided CK into two forms of knowledge: the first is Common Content Knowledge (CCK), which includes a) rules and etiquette knowledge, and b) technical and tactical knowledge. For example, the rules of basketball shooting, and the student's own shooting skills and tactics. The second is Specialized Content Knowledge (SCK). It includes (c) student errors, and (d) teaching tasks. For example, in teaching, it can identify student movement errors, and how to teach students shooting skills. In short, motor skills can represent CCK, while teaching tasks used to teach CCK can represent SCK, both of which are purely content-based descriptions (Ward et al., 2015).

### **Research on CCK**

The CCK can be defined as a basic understanding of how to perform skills acquired from being taught how to perform, observing, and performing (Ward, 2009). CCK mainly refers to knowledge of rules and etiquette, as well as technical and tactical knowledge. Students majoring in Physical Education can acquire CCK in many situations, for instance, from courses of their curriculum specially designed to train physical education teachers, from their experiences after classes, such as participating in sports activities and online activities, etc.

In previous studies, most research has been conducted on the CCK of pre-service and in-service teachers. These studies evaluated the CCK of teachers (Castelli & Williams, 2007; Ince, 2013; Santiago, Disch, & Morales, 2012), and ultimately found that their CCK levels were low. However, in subsequent studies, PE teachers should not only master the theoretical knowledge of a certain sport but be able to correctly demonstrate the physical activities they teach, meaning that teachers or coaches should be proficient in their own technical and tactical abilities (Iserbyt et al., 2017; Siedentop, 2002). Therefore, in the study of CCK, it is also necessary to conduct skill tests on teachers' technical and tactical knowledge.

In terms of the measurement of CCK, first, it is usually conducted at the end of the course as teachers intend to assess their students' mastery of CCK at the end of a teaching unit. Second, the testing of CCK varies from country to country. In the past few years, China, South Korea, and Turkey have validated several instruments to test CCK in football (Dervent, 2018; He et al., 2018; Lee et al., 2018) and gymnastics (Devrilmez et al., 2019). Despite the differences regarding instruments to test CCK, the evaluation of CCK was mostly conducted through paper-and-pencil tests.

**Research on SCK**

Specialized Content Knowledge (SCK) refers to the content knowledge and skills required to teach CCK, primarily including students' errors and teaching tasks. Unlike CCK, which can be acquired by anyone through various means, SCK is considered specific to teachers. This is because SCK can only be obtained through formal and informal professional training (Loewenberg Ball et al., 2008; Ward, 2009). Currently, SCK is an important focus in research on CK (Kim et al., 2018). This is because in teaching, teachers need to select tasks and teaching events derived from these tasks (e.g., feedback, hints) to conduct instruction, which are the main factors determining teaching quality (Ward & Ayvazo, 2016). SCK is the primary factor affecting how teachers make these selections.

In physical education, Rink (1979) conceptualized instructional tasks in terms of their function, and this has been a significant methodological advancement because it allowed teachers use instructional tasks to observe and classify. He described the initial task of teaching as the task of informing. He categorized the task of informing can be extended, improved, or applied to the game in teaching depending on its function. Ward (2009) made a more subtle distinction between teaching tasks based on this foundation, creating three additional categories. Rink and Ward's research provided a basic tool for measuring the effect of SCK on PCK. Subsequently, Ward created a SCK index in 2017 to measure the depth of SCK.

**Research on Video Using in Sport**

The development of science has led to many modern technologies and equipment being applied in physical education. Video technology is one of them. The utility of video technology in elite sports is undeniable. For example, it allows athletes and coaches to better study their own and their opponents' performances. It can help referees make better judgments. It also allows viewers to have a better experience while watching the game (Palao et al., 2015). However, the application of video in physical education is not very common. In a review of research by Mödinger et al (2022), it was found that there are few studies on the effectiveness of video in physical education in school settings.

There has been extensive research on video-based approaches to motor learning. Video-based learning provides visual feedback to motor learning as a form of augmented feedback (Swinnen, 1996), overcomes problems associated with visual perception, sensory information (auditory, tactile, or proprioceptive), and temporal availability of task-intrinsic feedback. Despite the various forms of visual feedback, including text, pictures, video, etc. video or dynamic materials are more effective in teaching display-changing features (Ploetzner et al., 2020). For example, Hoogerheide et al (2016), found that video and other dynamic materials have advantages in motor skill learning because these dynamic materials can depict the trajectory of movement in a clear and continuous manner.

However, not all studies support the idea that dynamic visualization is more effective for learning than static materials (Rekik et al., 2019, 2021). According to cognitive load theory, many studies have found that not all dynamic materials have better learning effects than static materials (Rekik et al., 2021). When learners need to learn from dynamic materials, they not only need to process the current information, but also need to try to maintain active working memory in previously seen information, which increases memory load. This

phenomenon is known as the transient information effect (Leahy & Sweller, 2011; Wong et al., 2012).

Much of the previous research has focused on the role of video approaches in CCK. In recent study, In terms of SCK, this approach has also been proved to be an effective way. Ward (2020) included Online, Video Scenarios and Technology, Video Software among several teaching methods that effectively improve SCK. Videos can provide learners with precise movements and related details. This allows learners to better observe incorrect movements and clarify task sequences.

This study will evaluate the following issues to explore the impact of video on CK acquisition:

1. Can the use of video in teaching affect the acquisition of CCK?
2. Can the use of video in teaching affect the acquisition of SCK?
3. What is the attitude of participants towards this approach?

## Methods

The author conducted a systematic search using EBSCOhost, PUBMED, SCOPUS, Web of Science, and CNKI databases from June 23 to June 29, 2023. According to Table 1, the four categories of task, modality, environment, and group were used to determine the search keywords. The search results were systematically excluded based on year, research direction, and document type (Figure 1).

Table 1

*Categories and keywords for the literature search*

Category	Keyword
Task—what?	modeling or motor learning or CK or contend knowledge or rules or etiquette or techniques or tactics or student errors or instructional tasks
Modality—how?	Video* or tablet* or videotape* or mobile device* or video analysis or handheld or device* or observation or Multimedia
Setting—where?	Physical education or PETE or sport*
Population—who?	Sport* teacher, gym teacher, PE teacher, physical education teacher, student*, pupil*, children*

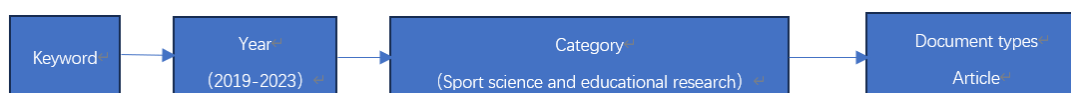


Fig. 1 screening strategy

The same procedure is applied to all databases. First, the title and abstract are reviewed, and if the content is appropriate, the full text is read further. If the research characteristics are met, the article will be selected. Finally, 17 articles were selected. The specific process is shown in Figure 2.

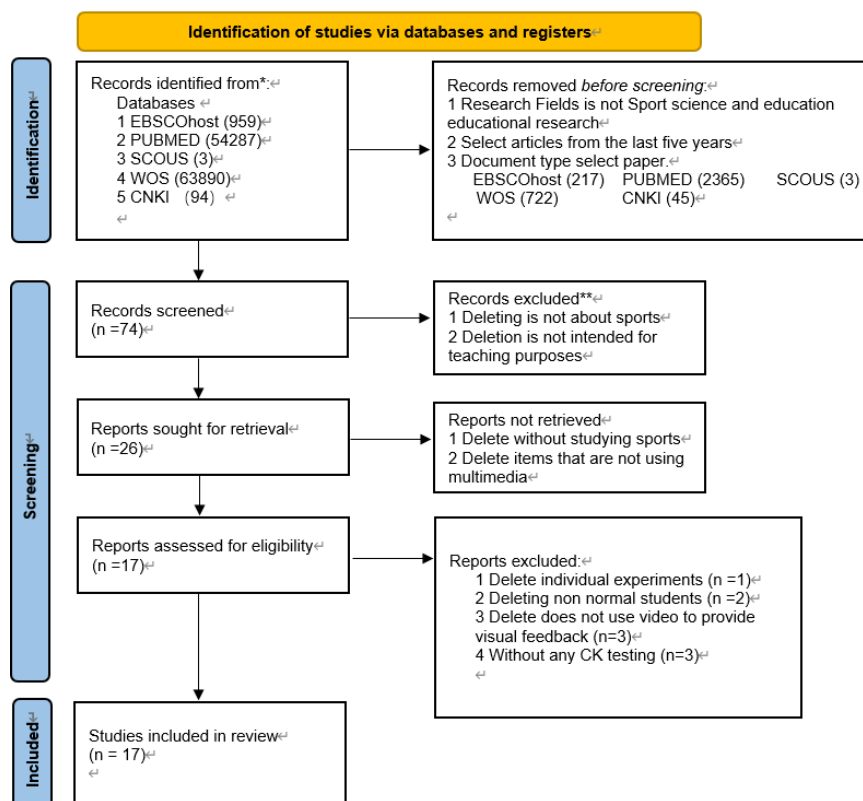


Fig. 2 Identification of included studies

## Result

The following section summarizes the research findings using keywords and related screening procedures. It contains research results from 11 countries from 2015 to 2021, involving Learners of different educational backgrounds (primary, junior high, high school, and university), and different learning experiences (beginners and experienced). Table 2 provides a more detailed overview of the extracted features. Systematic literature retrieval identified 18 studies that met the inclusion criteria.

The research results in Table 2 were sorted and given a study number. The numbers were assigned randomly. In the following text, for clarity, the articles will be referred to by their assigned numbers rather than the authors' names.

Table 2  
Overview of included articles

No	Author	Content	Focus	Result	Gap	Geography
1	Kao et al. (2020)	Ninety-five participants underwent a four-week experiment to test the effects of multimedia instructional environments on the basketball	basketball game recording methods	Both groups improved, but the experimental group was better than the control group	one area of CK.	Taiwan

		game recording methods.				
2	Nicolas Robin et al. (2019)	The free throw shooting of forty-six college basketball players was assessed over a period of five weeks to examine the impact of a video model.	Basketball free throw	The results of Model + imagery groups are superior to those of the other two groups	one area of CK.	France
3	Souissi et al. (2021)	The study involved a group of twenty-four students, aged between 10 and 12 years old, who participated in six self-control video feedback sessions to examine the impact on the learning effectiveness of weightlifting in Tunisia.	Weightlifting	The experimental group was better in technical improvement, technical knowledge and cognitive processing	two areas of CK primary school students	Tunisia,
4	Lin et al. (2020)	199 students participated in badminton teaching using tablets and Facebook to observe the impact of this approach on skill learning.	badminton skills	significantly higher in the EG than those in the CG.	one area of CK.	Taiwan,
5	Marjan Kok et al. (2020)	56 middle school students underwent 7 class shot put exercises to observe the impact of self-control video feedback on skill learning and self-efficacy.	Shot put	There was no significant difference between groups in all tests	one area of CK. secondary school	Netherlands,
6	Ghazi Rekik et al. (2018)	68 middle school students from 6 classes participated in a 90 minutes test to study the impact of different learning materials	basketball tactical	The experimental group was superior to the control group in learning	two areas of CK primary school students	Tunis

		on learning basketball tactics		outcome, Cognitive load and attitude		
7	Shuaiyu Lian (2021)	82 badminton major students were tested to assess the impact of multimedia teaching on badminton learning	badminton skills	In terms of physical fitness, badminton scores (skills and written tests), and attitude, the experimental group is superior to the control group	two areas of CK	Malaysia,
8	Cyrine H'mida et al. (2020)	107 students learned judo through three forms of feedback	a Judo technique	The experimental group was superior to the other two groups in Acquisition, Retention, Cognitive load measurement and Cognitive load measurement	one area of CK	Tunis,
9	Ove Sollie et al. (2021)	54 young skiers participated in the role of different forms of feedback in sports skill learning	cross- country skier	The coach's feedback group outperformed the other two groups	one area of CK Athletes	Norway,
10	Brett Wilkie et al. (2020)	16 students majoring in physical education participated in four interviews to study the impact of providing video materials with coach feedback	Students majoring in physical education	The subjects confirmed this approach	qualitative research	UK
11	Cédric Roure et al. (2019)	A situational interest test was conducted on 361 middle school students' ways of providing video feedback	middle school student	There are significant differences between the video and teacher groups and	qualitative research middle school students	Switzerland,



				the other two groups		
12	Omar Trabelsi et al. (2021)	56 middle schools participated in the impact of video modeling on gymnastics learning	gymnastics	Significant difference in results between the video group and the control group	Two areas of CK. Primary school	Tunisia,
13	Palao et al. (2015)	The impact of 60 students participating in three different feedback methods on learning track and field	track and field	There are significant differences in skills and knowledge between the experimental group and other groups	two areas of CK. High school	Argentina
14	Oleg A. Sinelnikov et al. (2015)	Two physical education teachers participated in a CK workshop to improve their CK level, and then conducted teaching to study the impact of improving CK on students' learning	badminton	Effectively improving teachers' CK level through video in the workshop and having a positive impact on students' learning	Badminton Physical Education Teachers Workshop	USA,
15	Phillip C. Ward et al. (2016)	191 students participated in experiments to improve CCK and SCK in different sports to investigate whether SCK can be taught in teaching	Five projects	All groups showed improvement in CCK and SCK, with significant differences in the SCK group	Traditional teaching	USA,
16	Cyrine H'mida et al. (2020)	181 students participated in three different forms of feedback to observe the impact on the learning effectiveness of judo skills	Judo	181 students participated in three different forms of feedback to observe the impact on the learning effectiveness of judo skills	One area of CK	Tunisia,
17	Souissi et al.	Thirty-five children were involved in	Weightlifting	The results of the	One area of CK	Tunisia



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(2021)	the effects of two types of feedback on snatch learning	experimental group were better than those of the control group
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### Using Video to Acquire the Impact of CCK

In the selected articles, except for the 5,7 articles, all the other articles have researched the impact of using video in teaching on obtaining CCK.

Among these 17 articles, there are also differences in the two areas of CCK research. Articles 1,9,14, and 18 focus on the first area of CCK knowledge. These articles measure the knowledge of rules and etiquette before and after the experiment to identify the impact of the intervention on them. The second area of knowledge, Skills and Tactics, has received the most attention, including articles 1, 2, 3, 4, 6, 8, 10, 11, 12, 13, 14, 15, 16, 17, and 18. None of the studies mentioned above focus on the theoretical testing of technology or tactics solely. Most studies combine both aspects (1,2,3,4,6,14,17,18) or focus solely on skills testing (8,10,11,12,13,15,16).

In the conclusions of the selected articles, there are also differences. Among the articles involving CCK, the experimental groups that used video materials as intervention methods mostly had higher scores than other groups in the results (1,2,3,4,6,8,10,11,12,13,14,15,16,17,18). Among them, the results of articles 1,4,6,8,10,12,13,16,17 showed significant differences, while there were no significant differences in articles 2,3,11,14,15 and 18. In study 15, it was shown that the coach feedback group had higher scores than the video feedback group and the Dyad practice group.

### Using Video to Acquire the SCK

Regarding the impact of using video on acquiring SCK, articles 2,3,4,9,14,17 respectively studied the acquisition of knowledge in two areas of SCK.

However, these articles do not provide a complete study of the two areas of SCK. Articles 9 and 17 measured the third area of knowledge before and after the experiment, while articles 4 and 14 measured the fourth area of knowledge before and after the experiment. In articles 2 and 3, research on SCK is conducted. Article 2 focuses on improving teachers' CCK level and observing its impact on students' learning, using video-based methods to enhance teachers' SCK level. Article 3 investigates the use of different teaching models to improve students' CCK in the CCK group and SCK group, with video-based methods used in the SCK group.

In the conclusions of the selected articles, the groups that used video-based methods showed positive results, although not all studies had significant differences.

### Participants' Attitudes towards the Use of Video in Teaching

Regarding participants' attitudes towards the use of video in teaching, selected articles 1,4,5,7,8,9,11,15,16,18 have conducted research on participants' attitudes. Among them, articles 5 and 7 are qualitative studies, while the others are quantitative studies.

In the conclusion of the selected articles, it was found that participants in the video-based experimental groups generally exhibited more positive attitudes in terms of cognitive load, self-efficacy, and interest, except for articles 1 and 15. In article 1, the researchers not only investigated learners' attitudes but also examined the attitudes of organizers. The results showed that organizers had a more negative attitude towards this approach due to increased time and their limited technological capabilities. However, for students, this approach enhanced their interest in learning. In article 15, different results were presented. The coach feedback group scored higher than the video feedback group in three items (Enjoyment, Self-perception of improved technique, Number of self-practice).

## **Discussion**

The purpose of this systematic review is to investigate the application of various video types in physical education, with the following objectives: Firstly, to determine whether video materials can effectively enhance learners' acquisition of CK in physical education, including both CCK and SCK. Secondly, to investigate learners' attitude of using this approach in the classroom.

### **The Effectiveness of Video in Acquiring CK in Physical Education**

CCK refers to common content knowledge, which is the basic knowledge required for performing a particular sport. SCK refers to specific content knowledge, which is the knowledge required for teaching the CCK of a particular sport. According to the research by Ward SCK is knowledge that needs to be taught separately. Therefore, in the process of screening, it was found that most of the studies using video focused on the impact on CCK or SCK, and no research was conducted on the impact of four areas of knowledge of CK together. In the process of conducting research, most of the literature shows that video has improved the independent variable. These studies support the view that video may be suitable for enhancing students' acquisition of CK in physical education.

Research has shown that the use of certain forms of Information and Communications Technology (ICT) (such as internet, video, etc.) can stimulate students and facilitate knowledge acquisition (Hastie et al., 2010; Kibble, 2005; O'hara et al., 2011). This perspective is also supported by the screening results of the current study. The use of video as a teaching tool in enhancing students' acquisition of CK is influenced by various factors. For example, different video models can impact the effectiveness of physical education instruction. Studies have shown that videos using expert modeling are more effective than those using self-modeling. However, this conclusion is not absolute, as different video models may have different learning effects for different learners. For novice learners, expert modeling is more effective, whereas for experienced learners, self-modeling appears to be more effective. This is because expert modeling focuses on skill execution, while self-modeling emphasizes error identification. Carroll and Bandura (1990) also discussed this issue in their research, suggesting that young students have more difficulty developing cognitive representations to benefit from visual feedback. Verbal feedback seems to be the preferred method for novice and younger learners in the early stages of learning (Kernodle et al., 2001).

However, this does not necessarily indicate that video is effective in enhancing students' acquisition of CK in physical education. There is limited research on the impact of video technology on CK in physical education. Moreover, not all studies in the past support this

view. In the articles screened in this research, only about half of the articles showed significant improvements in the experimental group. A review study by Moritz Mödinger (2022) and Rhoads (2014) found that the positive impact of visual feedback on motor learning is minimal.

### **Learners' Attitudes towards Using Video in Physical Education**

In general, attitude can be defined as a person's overall emotional feeling or assessment towards objects, people, or systems, which may affect one's behavior or determine whether he or she will perform some target behaviors (Fishbein, 1977; Mantle-Bromley, 1995; Rhoads et al., 2014; Venkatesh, 2003).

The learner's attitude will greatly affect the learner's behavior and engagement, and ultimately affect one's learning efficiency and outcomes. Specifically, it is reported that attitude is important in the learning process, whether positive or negative (Csizér & Dörnyei, 2005; Dörnyei, 2014).

Regardless of the impact of videos on achieving CK results, it seems that learners have shown positive interest in this approach. In the selected articles, only one article did not show a positive impact in attitude research (Sollie et al., 2021). It is believed that this is because the coach satisfies important basic psychological needs, such as enhanced expectations and positive effects. Therefore, the application of video technology in physical education has great potential and possibilities (Silverman, 1997), which has been supported in subsequent studies (Crook et al., 2012; Fukkink et al., 2011). As an advanced teaching method, videos can enhance students' positive attitudes, thereby exerting a positive impact on their learning behaviors and intentions (Silverman, 1999). Additionally, this approach enhances students' sense of self-efficacy during learning, which has a positive impact on learning motivation and subsequently improves their learning performance.

### **Limitations**

This study systematically investigates the impact of using videos in physical education on students' acquisition of CK, and therefore extends existing knowledge with new findings. However, in the existing research, only a few studies have targeted video's effect on learners' acquisition of complete CK, so this review is subject to certain limitations.

Moreover, few studies have conducted retention tests, so it is not possible to determine the extent to which this method can maintain improvements. High-quality studies (Maher et al., 2003) with appropriate test procedures such as early retention tests, retention tests, and possibly also transfer tests for the development and maintenance of learning progress, as used in other studies (Krause, 2009; Stöckel et al., 2007), are required in the future to confirm the suitability of the methods discussed over time.

At the same time, because the data come from different countries and education systems, the differences in educational concepts, purposes, and design principles of physical education will affect the results of the experiments.

### **Significance of the Study**

In the field of education, multimedia has been widely recognized for the positive role of learning, also in the field of sports. But the application of different sports is not balanced. This

paper explores the influence of using video formats in multimedia on improving the content knowledge of normal school students in physical education. The outcome of this research is likely to be of interest to instructors, students majoring in Physical Education, educational applications, and sports-lovers.

For teacher. Teachers can use as an auxiliary tool which can solve the imbalance between the number of teachers and students, resulting in a lack of attention to each student conflict. This tool can also greatly improve the enthusiasm of students to learn. For students majoring in Physical Education. The findings of this study may provide them a learning tool for motor skills can enhance their understanding of the four area of CK.

For educational applications, developers of educational applications may find inspiration to refine and enhance their offerings to meet user needs, thereby maintaining and expanding their market share. For sports-lovers. This method will give them immediate feedback during physical exercise and effectively improve their own sports level. In addition, they may post interesting videos of themselves on social media while participating in physical activity, which can have a positive impact on their lives

### **Conclusion**

Using videos as a teaching tool in physical education seems to have the potential to facilitate learners' acquisition of CK. During this study, it was demonstrated that using videos as a teaching tool in physical education is more effective than traditional teaching models and other materials (text, pictures) as teaching tools.

To sum up, the main defects of current research on using video to improve CK are as follows.

First is the intervention gap. Most of the current researches on how to improve CK are carried out through concentrated workshops. For example, Oleg A. Sinelnikov (2016) studied the influence of A 4-hour CK-workshop on two teachers' PCK, which had a positive impact on students' learning. In this study, more diverse visual and verbal representations were used in workshop, with more correct task representations and more mature tasks.

Second, in the research on CK improvement through the workshop, most of the research objects are concentrated in physical education teachers and pre-service physical education teachers. For example, Phillip Ward (2015) selected four PE teachers from middle schools to participate in the workshop for one to two days, to study the influence of PE teachers' CK on PE teaching and students' learning.

Third, in terms of the influence of video on students' learning in physical education, most researches focus on skills, which is only the second field of knowledge in Ward's CK theory, and there is few research on the influence of video on knowledge in other fields. For example, Jose Manuel Palao (2015) studied the learning effect of students in different ways, and the dependent variables included skill test and track and field content.

In this context, it can be explored whether using videos as a teaching tool can improve students' acquisition of CK in the classroom. At the same time, because factors such as different class sizes, the technology used to provide video materials, and teachers' digital literacy can affect research results, exploring the best balance point in future research is

necessary. Additionally, it is also necessary to explore the acceptability of different sports to this approach.

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