The Impact of Different Types of Teaching Videos on Learning Satisfaction and Cognitive Load

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Abstract : The development of information technology provides a variety of ways for humans to acquire knowledge. Among the more common information technology used in teaching and learning is the video. This research explores the concept of teaching videos of declarative knowledge and the influence of different types of teaching videos on learners' learning satisfaction and cognitive load. It first sorts out the related research of instructional videos through literature research, and attempts to comprehensively consider the manpower, material resources, and technical difficulties invested in the production process of several common types of instructional videos summarized through literature research. They are classified into three categories, namely low cost, medium cost and high cost. Then, the impacts of three common but different types of teaching videos with different production processes on the learning effect of learners are studied. The study is in an experimental environment, with college students as the research object, strictly controlling the number and time of video viewing by learners, first pre-testing the subjects, and then letting the subjects learn the video followed by a post-test. The data analysis results show that in an experimental environment, the impact of three different types of instructional videos – i.e. PPT screen recording, picture-in-picture fusion and studio recording - on the retention test, transfer test and cognitive load of learners had no significant difference. However, in terms of learning satisfaction, the studio camera group has the highest learning satisfaction, while the PPT screen recording group has the lowest, with the studio camera group having a significantly higher score than the PPT recording group. F(2,68)=3.267, P=0.044. Based on these findings, this article provides a reference for the

design and development of future declarative knowledge instructional videos from the level of instructional video resource construction, so that instructional video designers and developers will discuss how to ensure the learning effect while better reducing the teaching in the process of making the video. At the same time, due to the limitation of research time, this research still has some shortcomings, which requires more rigorous and comprehensive argumentation in the future.
Keywords: teaching video, cognitive load, learning satisfaction

INTRODUCTION

Since the end of the 1990s, society has undergone significant changes due to the amazing development of information technology. Education has to keep up with the trend of the times, applying computer technology, digital multimedia technology and network technology to the field of education. New teaching learning methods are also gradually being introduced, especially in recent years, with the development of MOOC, micro-classes, and flipped classrooms. A large number of open educational resources have appeared in people's vision, and the construction of open educational resources has also attracted the attention of educators.

The mass media that presents teaching content with audio-visual technology are called teaching videos (Nicolaou, 2019). As a kind of educational resource, it is welcomed by everyone because it is more vivid than images and words, and more intuitive than sounds. Especially driven by modern information technology, instructional videos have become the first choice for many people to learn online and offline. Universities, organizations and educational institutions invest a lot of funds, equipment and resources in the design and development of instructional videos every year. Consequently, a large number of teaching videos of different forms have sprung up. With the increase in the number of teaching videos, a variety of video types and presentation forms naturally appear. (Pisarenko, 2017)

Different types of instructional videos use different production methods, and the corresponding investment costs are also different. According to calculations, the time input and output ratio of studio recording video is about 8:1 to 100:1, which means that it takes about 8 to 100 hours to make a

one-hour video in the early stage. The production process of recording-type instructional video is relatively simple. It takes about 4 to 8 hours to make a 1-hour instructional video. With such a high cost in producing such videos, it is important to learn what the learning effect is. Reasonable allocation of education funds, while ensuring the effect of learning and minimizing the cost of education information construction is also an issue that we need to continue to pay attention to. Based on this, this article will study the impact of three different types of instructional videos on the learning effect of learners from the perspective of production costs.

It should also be mentioned that in recent years, there has been a lot of research on the presentation and organization of instructional video content (Swarts, 2012,;Chorianopoulos, 2018). For example,Wang Jian and other scholars from China discussed the impact of four different presentation forms of instructional videos, namely, videos with explanatory subtitles, videos without subtitles, pictures with explanatory subtitles and pictures without subtitles, and their impact on learners' online autonomous learning (Zhang, 2009). Some scholars have taken cognitive psychology as the starting point for their research, and explored the influence of teaching videos that present teachers' image in different ways on students' information processing, cognitive load and learning effect. In order to study the role of teacher image in teaching video learning, Zheng Jun and others used eye movement technology to explore the learning gaze of the teacher image area and text PPT area Zheng 2012. In recent years, foreign scholars have conducted research on instructional videos mainly in conjunction with related knowledge of psychology. For example, Bhat et al. (2015) used the learners' access data and learning data as the basis to analyze the learning situation of the learners when they watched two different forms of teaching videos: the teacher and the picture fusion and the teacher and the picture overlap. Chen et al. discussed the impact of three forms of instructional videos of classroom recording, picture-in-picture fusion, and three-split screen on the mental performance, cognitive load, emotional experience, and academic performance of learners with different cognitive styles (Chen et al., 2015) Wang et al. studied the influence of teacher image on learners' learning performance, attention distribution, cognitive load and learning satisfaction (Wang et al., 2017) In addition, there are scholars who classify them from the perspectives of the difficulty of production, production cost, and the relationship between teachers and teaching content. For example, Li

Qing and others comprehensively considered the technical support required in the video production process, the input of the production staff and the use of equipment, etc., and divided the current videos in the MOOC into three categories: simple, medium, and complex, and summarized each type of instructional videos included in each grade (Li, 2016). Yu Qingqing and others took the production of "Crowd and Network" course video as an example, aiming to reduce the production cost of instructional videos and improve efficiency, and explored a new method of recording videos, which helps alleviate teachers' psychological pressure of the lens and improves the efficiency of video production, thereby achieving the purpose of reducing the time cost of video production and improving work efficiency.

In summary, the research on instructional video has made good progress, but there are few studies that take the production cost of instructional video as a starting point. In fact, in the actual development, design, and production, whether the cost of instructional video has been reciprocated is also a question we should be concerned about. Therefore, this article will take the cost of video production as the starting point, and through experimental research, explore the video learning effects and video effects of three teaching videos (PPT screen recording, picture-in-picture fusion and studio recording) of different production forms on learners to see the impact of learning satisfaction and cognitive load.

LITERATURE REVIEW

With the development of MOOC, micro-classes, flipped classrooms, etc., instructional video, as the main form of teaching content, has also become a hot spot for scholars in the field of educational technology. In the past few years, scholars have paid more attention to the application and production of instructional videos. For example, Jensen analyzed several common instructional video production methods based on their own practical experience, and put forward a series of improvements based on actual problems. (Jensen, 2015). Koumi in response to the problems of simple composition and monotonous composition of the teaching video, put forward suggestions for different scenes or shooting angles of the video pictures Koumi 2006. In addition, Susantini (2016) also put forward suggestions for improvement in response to the problems existing in the current teaching video. The above research is all about the design and

production of instructional videos. With the increase in the frequency of instructional video applications, the research on instructional videos has become more and more abundant.

2.1 Research on the Image of Teachers in Teaching Videos

Nowadays, there is endless empirical research on the problem of teacher image, but controversy continues. Secules studied the impact of four forms of teaching videos with no teacher image, a large teacher presentation ratio, a middle teacher presentation ratio, and a small teacher presentation ratio on the learning situation. The results show that the teaching video has a teacher image than a society without a teacher image Secules, 1992). The sense of existence is low, the teacher presentation ratio is lower than that of the large and small ratios, and the learning effect of the image of a teacher is better than that of no teacher. Wong studied the impact of four videos, including operating recording with teacher image, graphic explanation with teacher image, operating recording without teacher image, and graphic explanation without teacher image, on learners' cognitive load, social presence, and learning immersion (Wong, 2012). Finally, it was concluded that the learning effect of operation recording with a teacher is better than operation recording without the image of a teacher, the learning effect of the graphic explanation with a teacher is better than the graphic explanation without the image of the teacher, and the learning immersion of the graphic explanation teaching video is the worst. Knowledge load and social presence have no significant impact. Pi & Yang used eye movement experiments in his master's thesis to study the impact of teachers' presentations in micro-course teaching videos on micro-course learning. His research results show that: 1) When learning declarative knowledge, there is a good teacher's image. When learning procedural knowledge, whether or not there is a teacher image has no significant impact on the learning effect; 2) Presenting the teacher image at the upper right of the video has a better effect on the learning effect of the micro-course (Pi& Yang ,2020). The study by Kizilcec et al. (2014) also found that the appearance of teacher images in instructional videos can play a role in attracting learners' attention. In addition, some other researchers conducted comparative experiments on the text in the online course and the three common

forms presented by teachers, and the results showed that there was no significant difference between the three groups. In addition to the above studies, some scholars have obtained relatively negative results. For example, Mayer (2014) believes that the effect of not showing the image of the teacher on the screen is better than that of showing the image of the teacher, because the facial expression and body language of the teacher will affect the learner and interfere with the learning state. Research by Lyons et al. also shows that the appearance of a teacher image will reduce the learning effect.

We mainly study the production cost of instructional videos. The instructional videos used in the above research are analyzed from the perspective of production cost. We can find that, compared with instructional videos without teacher image, instructional videos with teacher image cost more production, the production process of intermittently presenting the image of the teacher is slightly more complicated than the teaching video that continuously presents the image of the teacher; and the different presentation ratio of the teacher's image does not cause a difference in production cost. Therefore, according to the above research, we can find that different forms of instructional videos produced by investing different production costs in the process of making videos may affect the learning effect.

2.2 Research on Subtitle Design in Teaching Video

Subtitles originally refer to the text form of dialogue voices in movies or TV programs, generally appearing at the bottom of the video, and are designed to help the hearing impaired obtain the dialogue information of the film and television works. It is an important part of the film and television works. In recent years, scholars have begun to study the problem of subtitles in instructional videos. For example, Metruk used the survey method as the main research method to investigate the necessity of explaining the existence of subtitles in online instructional videos. The results show that college students believe that it is necessary for the explanation subtitles to appear, and when watching the video, college students will choose to use the explanation subtitles (Metruk, 2018). In addition, in the follow-up research, 131 college students from normal universities were also used

as the research object to conduct empirical research on the three forms of full subtitles, keyword screens, and no subtitles in online teaching videos. The research results show that there are explanatory subtitles. It is more helpful to improve learners' retention test and transfer test scores; compared to the full appearance of the explanation captions, the effect of presentation in the form of keyword screens is better, and the redundancy effect in the cognitive theory of multimedia learning is also corrected. (Bouki, 2001). Hinderliter' s research has also reached a similar conclusion. They studied three common caption designs in online instructional videos: no captions, full captions, and summary captions, and used an eye tracker to record the visual cognitive process of learners. The results show that the type of knowledge presented in the video is different, and the impact is slightly different. When the knowledge content is declarative knowledge, full captioning can help learners capture more knowledge content, but the learning quality of summary captions is the highest; When the knowledge content is procedural knowledge, summary captions are not only conducive to the acquisition of the number of learning, but also conducive to the improvement of learning quality, and full captions will interfere with the learning effect of learners (Hinderliter, 2021). In summary, regarding the design of subtitles in instructional videos, we can see that learners have a positive attitude towards adding explanatory subtitles to instructional videos. And with the emergence of barrage, trying to include barrage in the production of instructional videos is also a new development trend in the future. However, from the perspective of production costs, adding explanatory subtitles or applying bullet screens to instructional videos will cost more production costs. This also indirectly shows that the production cost of the instructional video may have an impact on the learning effect.

2.3 Research on the Presentation Form of Instructional Video

With the increase in the number of instructional videos, the presentation methods of instructional videos have become more and more diversified. Schneider (2020) explored and the existence of clues as well as studied the impact of different types of cues in instructional videos on learning, particularly learners' cognitive load, learning effect, learning satisfaction and attention. She added three

different cues: visual cues, verbal cues, and visual-verbal combination clues in the instructional videos. The research results show that, in terms of learning effect, whether in a laboratory environment or in a real teaching environment, instructional videos containing clues can improve the learning effect, but the promotion effect of maintaining knowledge only appears in the laboratory environment, and the promotion effect of knowledge transfer is reflected in both environments, especially the promotion effect of the teaching video of visual and verbal combination clues is the most significant. Calhoun et al. (2007) also reported on the three presentation forms of teaching videos in classroom recording, picture-in-picture synthesis, and three-split screen recording. Empirical research has been conducted on the impact of performance. The experimental results show that in terms of academic performance, the video format of classroom recording and picture-in-picture can promote learning more than the video format of three-split screen recording. In terms of concentration, three-split screen recording, the video is more able to attract the continuous attention of the learner, but it also makes the learner have the highest cognitive load. In the thread experience, there is no difference between the three different video types. Lai et al. (2013) conducted research on how to highlight the important and difficult content in the teaching video screen, and used eye movement test as the main research method. When there are important and difficult points in the instructional video, not adding mouse guidance helps learners to internalize the understanding of the knowledge; when there are no important and difficult points, it is better to add mouse guidance; at the same time, it is better to put important and difficult points on the right side of the video screen. With the advent of the "Internet +" era, instructional videos have also begun to develop towards sharing and openness. The interactive functions in the videos have brought new learning experiences to learners.

During the learning process, the learner can realize the interaction between the learner and the video by operating the mouse, and the results show that the performance of the students who study through the interactive teaching video is better than the students who do not use the interactive video for learning (Schaffer, 1986). Alkhatib (2018) used screen recording software to design three interactive mini-video

resources with different interaction times and text prompts. In order to facilitate the study and use of the participants, the examiner also shared these video resources to the 360 cloud platform for learners to learn, and analyzed the learning results. Through data analysis, it was found that no matter how many interactions there are, there is no text prompt in the instructional video. The learning effect is better than that with text prompts; regardless of whether text prompts are added to the video, instructional videos with more interactions will enable learners to obtain better learning results. In summary, we find that teaching videos in different presentation forms have different effects on learners' learning effects. From the perspective of production cost, it is found that different presentation forms of instructional videos will cause different costs.

METHODOLOGY

3.1 Purpose and Hypothesis

Can high-cost instructional videos bring better learning effects to learners? We measure the effect of a teaching video, mainly from whether it produces a good learning effect, whether it brings learners a higher learning satisfaction, and whether it can take up less cognitive resources of the learner during the learning process. Although we continue to pursue high-quality graphics in the process of making instructional videos, we have not conducted empirical research on this. This study adopts the learning videos of the "feeling" of psychology knowledge, and the researchers spent different costs to produce three different types of teaching videos to study the impact of different video types on learning satisfaction and cognitive load. Among them, learning the effects include retention tests and migration tests. This experiment focuses on exploring the following two questions: (1) In an experimental environment, and through an empirical study, what are the impacts of three different types of teaching videos on learners' learning satisfaction, and cognitive load? (2) Do teaching videos produced at higher costs give learners higher learning satisfaction and lower cognitive load?

H1a: Different types of instructional videos will have different effects on learners' learning satisfaction.

H1b: Different types of instructional videos will have different effects on the cognitive load of learners.

3.2 Participants

The subjects in this study are undergraduates majoring in Educational Technology and English from Anhui University. These students have taken the public course "Modern Educational Technology", and all the subjects voluntarily participated and had been informed of the experiment process in advance. The independent variable of the experiment is the video type. Participants in the experiment are randomly divided into three groups by drawing random numbers. Among them, the participant who drew the number 1 is the first group. During the experiment, they should watch video 1, which is a PPT. For Screen-recording instructional video; the participants who drew the number 2 were selected as the second group. During the experiment, they watched Video 2, which is a picture-in-picture fusion instructional video. Participants who got the number 3 were in the third group and watched video 3, which is a studio-recorded instructional video. The total number of subjects was 75, of which 4 were eliminated due to incomplete questionnaires or abnormalities. In the end, there were 71 valid data. The number of subjects in each group was 25, 24, and 22, respectively.

3.3 Instrumentation

The experimental materials are three instructional videos with different presentation forms. Their knowledge content is the same, but the cost invested in the production process is different, so the production process is also different. First, the video-recorded instructional video is selected from the "Feeling" of the National Open University "Five-minute Course Network (www.5minutes.com.cn)". The original video is 6 minutes and 12 seconds long. The remaining length of the final video is 5 minutes and 48 seconds. The teacher explained the knowledge content in a rigorous and humorous way, and also interspersed with the lively performances of the actors to help understanding. Later, dynamic text effects, sound effects, and video effects were added to

the screen. This video is a typical studio-camera teaching video. The production process of this type of instructional video is: (1) Write text manuscripts based on knowledge content; (2) Choose a shooting location and arrange personnel to shoot; (3) Post-production staff edits the video as needed, and add text effects and video animation effects to the video. The entire process from design to development of the video requires at least one teacher, two camera staff, and one editing staff, and the production process requires effective communication between the teacher and the personnel in each link, and also requires a special venue, which is usually fully equipped in the studio. Therefore, it is a high-cost instructional video.

The PPT screen-recording teaching video in the experiment is made based on the video-recording. The first step is to make a PPT. The PPT is designed and made according to the teaching content. The PPT has both pictures and texts. The presentation of knowledge is logical, and the slides also have a simple switching effect. Subsequently, the sound in the video-recording video is decomposed, combined with PPT to show and record the screen, and the screen-recording teaching video effect is obtained. The production of this type of instructional video has been called: (1) Making PPT; (2) Recording PPT with sound. The entire production process can be completed by a teacher. On the whole, screen-recording teaching videos require very little time, manpower, material resources and money. Therefore, it is a low-cost instructional video.

In order to eliminate the interference of the teacher's image in the three types of teaching videos on the teaching effect, the picture-in-picture fusion teaching video in this study is based on technical means where the teacher's picture in the studio-recorded teaching video and the screen-recorded teaching of the PPT in the video is synthesized. The production process of this type of instructional video is: (1) make ppt; (2) record PPT; (3) record teacher image; (4) synthesize the teacher image with the recorded PPT. The entire production process requires at least one teacher, one camera crew and one post-editing crew. However, unlike the video-recorded instructional video, it requires less technical difficulty. Therefore, it is a medium-cost instructional video.

3.4 Procedure

The experiment was carried out in the computer room of Anhui University. After entering the computer room, the subjects randomly selected the computers that could be used. Then, by drawing random numbers, the subjects were randomly divided into three groups, and the first group was drawn with the number 1, Watch video 1; the second group is drawn to number 2 and video 2 is drawn; the third group is drawn to number 3, and video 3 is drawn. After the groups were determined, the examiner will read out the instructions and handed out a prior knowledge questionnaire to the subjects. The pre-test was conducted to understand the subject's prior knowledge level for 10 minutes; after the pre-test was completed, the examiner conducted the pre-test knowledge questionnaire. The allocation of the type of video that the participant should watch was determined by the random number drawn. Each video was watched twice in a row. The first time is equivalent to learning, and the second time is equivalent to review. The video duration is 5 minutes and 48 seconds. After the viewing, the two groups of subjects immediately completed the retention test and the transfer test. After completing the post-test questionnaire, the test subjects were then given the learning satisfaction scale and the cognitive load self-rating scale in turn. The entire experiment lasted about 50 minutes.

ANALYSIS AND DISCUSSION

In order to unify the unit scale of test scores, the scores of the subjects' prior knowledge test, retention test and transfer test were divided by the full scores of each test to convert them into correct percentages. The author first compared the average scores of the three groups on the pre-test, the retention test, and transfer test. The results are shown in Figure 1. From the data in the figure, we find that in the pre-test, the score of the PPT screen recording group is slightly higher than the other two groups; in the maintenance test scores, the picture-in-picture fusion group has the highest score, followed by the PPT screen recording group, and the studio video recording group had the lowest score; in the transfer test scores, the picture-in-picture fusion group scores were slightly different from the studio video recording group

scores, and the PPT screen recording group scores were lower than the other two groups. In order to understand the specific differences of the dependent variables, SPSS was used to analyze the results of the pre- test, the retention test and the transfer test respectively.

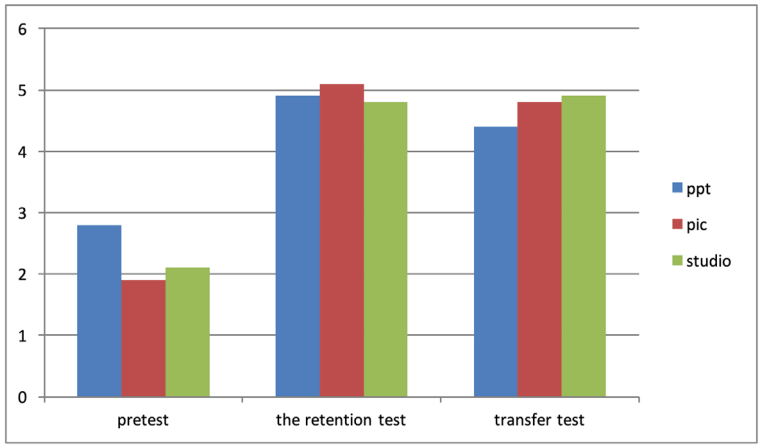

Figure 1 Comparison Charts of Test Scores in Three Test

Descriptive statistics on the pre-test results and the results are shown in Table 1.

Table 1: Prior Knowledge Test Scores (mean/standard deviation)

Groups	N	Pretest	
		Average	Standard deviation
PPT	25	26.10	14.360
Picture	24	19.05	8.769
Studio video	22	21.21	15.672

According to the average scores of the subjects shown in the table, there is little difference in the average scores of the pre-test scores in each group. Next, we use the prior knowledge test as the dependent variable and the video type as the independent variable to perform one-way analysis of variance. The results of the analysis of variance are shown in Table2. The data results show that the prior knowledge and experience of the three groups of subjects

are not significant. Difference (F(2,68) =1.830, P=0.168>0.05). It can be seen that the previous knowledge levels of the three groups of subjects are the same, and there is no significant difference between the groups, so the subsequent research results will not be affected by the difference in the previous knowledge level.

Table2: The Results of the Analysis of Variance in the Pre-test Transcript

	Square	DF	Mean square	F	Sig
Between groups	639.292	2	319.646	1.830	.168
Within groups	11875.160	68	174.635		
total	12514.452	70			

The test was independently reviewed by two reviewers. The Pearson correlation coefficient of the score is 0.930 (P=0.000). The result of the correlation coefficient shows that the consistency of the two reviewers' scores is very high. Therefore, the average score of the two scores is taken as the average score of the two reviewers. The descriptive statistical analysis on the retention test scores, and the analysis results are shown in Table 3

Table 3: Retention Test Scores (average/standard deviation)

Groups	N	Average	Standard deviation
PPT	25	49.47	8.810
Pictures	24	51.62	11.299
Studio Video	22	45.32	7.856

Next, the previous test scores are used as covariates, the test scores are kept as the dependent variable, and the video type is a fixed factor. One-way covariance analysis is performed. This result shows that the difference in the retention test scores of the three groups of subjects is not significant (F(2,68)=2.845, P=0.065>0.05), indicating that the learners' retention test scores will not be significantly affected by the different types of instructional videos.

4.1 Learning satisfaction

The Cronbach consistency coefficient of the Learning Satisfaction Scale is 0.833, indicating that the scale has good reliability. Therefore, the author used the type of instructional video as the independent variable and the total score of learning satisfaction as the dependent variable and carried out descriptive statistical analysis and one-way analysis of variance on the investigation of the three groups of subjects' learning satisfaction. The descriptive statistical results are as follows, as shown in Table4:

Table 4: Learning Satisfaction Score (mean/standard deviation)

Groups	N	Overall satisfaction	
		Average	Standard deviation
PPT	25	79.08	9.282
Picture	24	82.63	9.609
Studio video	22	85.86	8.265

A one-way analysis of variance was performed on it, and the results are shown in Table 5: $F(2,68)=3.267$, $P=0.044$, indicating that the three groups have significant differences in learning satisfaction.

Then the LSD post-test was performed on the three groups. The results are shown in Table 6. According to the data in the table, it was discovered that the learning satisfaction of the participants in the studio recording group was significantly higher than that of the PPT recording group ($P=0.013<0.05$). Compared with the learning satisfaction of the picture-in-picture fusion group, although the average of the studio camera group ($M=85.86$) is slightly higher than that of the picture-in-picture fusion group ($M=82.63$), there is no significant difference ($P=0.232>0.05$), there is no significant difference between the PPT recording group and the picture-in-picture fusion group.

Table5: One-way ANOVA Results of Learning Satisfaction

	Square	DF	Mean square	F	Sig
Between groups	540.676	2	270.338	3.267	.044
Within groups	5626.056	68	82.736		
total	6616.732	70			

Table 6: LSD Post-test Results of Learning Satisfaction

I	J	Mean difference	Standard error	Sig	95% confidence interval	
					Lower limit	Upper limit
PPT	Picture-picture	-3.545	2.599	.177	-8.73	1.64
	Studio video	-6.784*	2.659	.013	-12.09	-1.48
Picture-picture	PPT recording	3.545	2.599	.177	-1.64	8.73
	Studio video	-3.239	2.685	.232	-8.60	2.12
Studio Video	PPT recording	6.784*	2.659	.013	1.48	12.09
	Picture-picture	3.239	2.685	.232	-2.12	8.60

The measurement of learning satisfaction mainly includes four dimensions of teacher teaching, teaching content, learning environment and video format. The score comparison of each group on the four dimensions is shown in Figure 2.

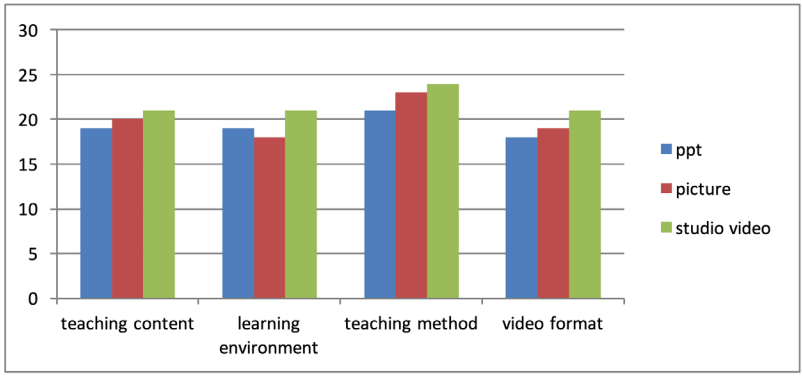

Figure 2: Comparison of Scores in Various Dimensions of Learning Satisfaction

Through the comparison in the figure 4.2, we can clearly find that in terms of satisfaction with teaching content, teacher teaching satisfaction, and video format satisfaction, the studio recording group has the highest average score, followed by the picture-in-picture fusion group, which has the lowest satisfaction. For the PPT screen recording group, in terms of satisfaction with the learning environment, the studio recording group's satisfaction is slightly higher than the PPT screen recording group and slightly higher than the picture-in-picture fusion group. Descriptive statistical analysis is performed on each dimension, and the results are shown in Table 7.

Table 7: Average Score and Standard Deviation of each Dimension of Learning Satisfaction

Groups	N	Content	Method	Environment	Video format
ppt	25	19.16 (2.625)	21.40 (3.819)	19.76 (2.385)	18.76 (2.437)
Picture	24	20.04 (2.726)	23.13 (2.983)	19.63 (3.160)	19.83 (2.839)
Studio video	22	20.77 (2.287)	24.36 (2.888)	20.55 (2.632)	20.18 (2.442)

Next, this research conducted a one-way analysis of variance on the four dimensions. The results showed that the three groups had no

significant differences in teaching content, learning environment, and video format, but there were significant differences in teacher teaching method (Teaching content: $F(2,68)=2.339$, $P=0.104>0.05$; Learning environment: $F(2,68)=0.747$, $P=0.478>0.05$; Video format: $F(2,68)=1.973$, $P=0.147>0.05$; Teaching method: $F(2,68)=4.873$, $P=0.011<0.05$).

For the teacher's teaching dimension, the LSD post-test found that the teacher's teaching satisfaction of the studio recording group was significantly higher than that of the PPT recording group ($P=0.003$). Through the above-mentioned data analysis, we conclude that learners learning through studio-recorded teaching videos have higher learning satisfaction. Learning through PPT recording-type learning videos has the lowest learning satisfaction. Among them, the performance is the most obvious in the teaching method of teachers; the studio video recording is significantly higher than the PPT recording screen.

4.2 Cognitive Load

This study conducted descriptive statistics and one-way analysis of variance on the impact of different types of instructional videos on learners' cognitive load. The results of descriptive statistics are shown in Table 8.

From the data in the table, it can be found that the cognitive load of the three groups has little difference. Therefore, a one-way analysis of variance on the cognitive load scores was carried out. The results are shown in Table 9. This result shows that there is no significant difference in the impact of different types of instructional videos on the cognitive load of learners ($F(2, 68) =0.170$, $P=0.844$).

Table 8: Cognitive load score (mean/standard deviation)

Groups	N	Cognitive Load	
		Average	Standard deviation
PPT	25	10.32	3.065
Picture	24	10.00	2.377
Studio video	22	9.91	2.091

Table 9: Cognitive Load One-way Analysis of Variance Results

	Square	DF	Mean square	F	Sig
Between groups	2.235	2	1.117	.170	.844
Within groups	447.258	68	6.577		
total	449.493	70			

CONCLUSION

This research was conducted in an experimental environment with three types of teaching videos (PPT recording, picture-in-picture fusion, and studio recording) as independent variables, learners' retention transfer test, learning satisfaction and recognition. An experimental study on knowledge load as a dependent variable found that the three types of instructional videos have no significant differences in learning effects and cognitive load. In terms of learning satisfaction, studio-recorded instructional videos have the highest learning satisfaction and is significantly higher than the PPT recording type, but there is no significant difference from the picture-in-picture type. According to the above research results, in the experimental environment, the learner's learning satisfaction is determined by the video itself. Therefore, the studio-recorded teaching video will bring learners better learning satisfaction by virtue of its rich split-screen effect.

Therefore, when designing and producing instructional videos, it is particularly important to allocate various resources reasonably. Here are some suggestions for the construction of future instructional video resources based on the research results:

(1) In the process of making instructional videos, we should follow the principle of "content-based, design supplemented". We should not spend so much on production cost purely in pursuit of good viewing effects but ignore the meticulous design of teaching content. Although the rich split-screen effect may bring a better learning experience for learners, from the perspective of learning effect, it may not necessarily improve the learning effect. The authors believe that the fundamental factor that determines the learning effect is not whether the picture is rich or the technology is complicated, but whether the teacher's explanation is clear, whether the design of the teaching plan is reasonable, and whether the design is

appropriate.

The cost for the design of teaching videos should be as low as possible and with high returns. That is to say, we should make the best teaching videos with the lowest production cost according to the teaching content, instead of spending more on production technology. Be mindful, and try to simplify the video production technology so that more people can participate. The results of this study show that although the cost of PPT recording-based instructional videos is relatively less than the other two types, and the production process is simpler than the other two types, it still does not affect a teacher's teaching quality.

In the process of making videos, it is necessary to fully consider the type of knowledge of the teaching content itself, and different forms of teaching videos are suitable for different types of knowledge. At the same time, the prompt information in the video, the presentation design of knowledge points, whether there is a summary, the teacher's speaking speed, etc. may affect the final learning effect.

LIMITATIONS AND FUTURE STUDIES

It should be noted that this study has a small number of tests, and the sample size is not big enough so the sample may be underrepresented. In the future, we need to expand the research and verification. In addition, the duration of this study is relatively short, and the number of studies is small. In order to obtain more reliable conclusions, the experimental results need to be repeatedly verified in the future, especially the conclusions of only one experimental study.

In this study, the cognitive load test of learners is tested through the cognitive load self-rating scale. The results may be subjective. For the learner's cognitive load to be overloaded, a more objective test method is needed. Whether the learner's learning effect is affected by cognitive load still needs to be further explored. In the future, we can design secondary tasks of different difficulties to interfere with video learning, so as to precisely control the cognitive load.

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