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Interactive Videos in Web-Based Education: Technology Proficiency and Digital Literacy Levels

Web Tabanlı Eğitimde İnteraktif Videolar: Teknoloji Yeterlilikleri ve Dijital Okuryazarlık Düzeyleri

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ABSTRACT: The objective of this study is to ascertain the impact of interactive videos on web-based courses on students' technology proficiency and digital literacy levels, as well as their perceptions of this approach. To achieve this objective, the study was conducted using quasi-experimental designs, which are a type of quantitative research approach. The research group was selected using the convenience sampling method. The quantitative data gathered with the aid of data collection instruments were analyzed using dependent and independent samples t-tests. Qualitative data were analyzed using content analysis. The study's findings revealed a significant difference between the technology proficiency and digital literacy pre-test and post-test scores of the students in the experimental group. Furthermore, the findings indicated a significant difference between the technology proficiency and digital literacy scores of the groups, with the experimental group exhibiting superior performance. The results demonstrated that the use of interactive videos in web-based lessons can enhance students' technology proficiency and digital literacy levels. Therefore, the findings and results of the study will make a significant contribution to the field.

Keywords: Interactive video, web-based teaching, technology competencies, digital literacy, interactive.

ÖZ: Bu çalışmanın amacı, web tabanlı derslerde etkileşimli videoların kullanımının öğrencilerin teknoloji yeterlilikleri, dijital okuryazarlık düzeyleri ve bu yaklaşıma ilişkin algıları üzerindeki etkisini tespit etmektir. Bu amaca ulaşmak için çalışma, nicel araştırma yaklaşımının bir türü olan yarı deneysel desen kullanılarak gerçekleştirilmiştir. Araştırma grubu kolayda örnekleme yöntemi kullanılarak seçilmiştir. Veri toplama araçları yardımıyla toplanan nicel veriler bağımlı ve bağımsız örneklem t-testleri kullanılarak analiz edilmiştir. Nitel veriler ise içerik analizi kullanılarak analiz edilmiştir. Çalışmanın bulguları, deney grubundaki öğrencilerin teknoloji yeterliliği ve dijital okuryazarlık ön test ve son test puanları arasında anlamlı bir fark olduğunu ortaya koymuştur. Ayrıca, bulgular grupların teknoloji yeterliliği ve dijital okuryazarlık puanları arasında anlamlı bir fark olduğunu ve deney grubunun daha üstün performans sergilediğini göstermiştir. Sonuçlar, web tabanlı derslerde etkileşimli video kullanımının öğrencilerin teknoloji yeterliliklerini ve dijital okuryazarlık düzeylerini artırabileceğini göstermiştir. Dolayısıyla çalışmanın bulgu ve sonuçları alana önemli bir katkı sağlayacaktır.

Anahtar kelimeler: Etkileşimli video, web-tabanlı öğretim, teknoloji yeterlilikleri, dijital okuryazarlık, etkileşim.

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The impact of diverse digital resources used to reinforce pedagogical approaches and augment the efficacy and durability of learning in various educational contexts remains a subject of ongoing investigation. A considerable number of educational settings employ digital materials, with animation, simulation, digital text, and video being among the most commonly used (Taşlıbeyaz & Karaman, 2015). These materials are used in different segments of education, and positive outcomes have been documented (January 2004; Albanese, 2005; Katz et al., 2009). To enhance the effectiveness of this approach, digital materials have recently been augmented with novel features, increasing their impact on the educational environment. In this context, efforts have been made to facilitate learning by incorporating diverse forms of interaction into digital materials tailored to specific course topics (Domagk, Schwartz & Plass, 2010; Cardoso & Santos, 2014; Petan et al., 2014). This approach aims to enhance cognitive processes (Petan et al., 2014). One category of digital material that can be augmented with diverse forms of interaction is interactive video.

Interactive Videos

In contrast to traditional video formats, interactive videos permit a range of interactions to be incorporated into the content, offering a more dynamic and engaging experience for the viewer. The integration of diverse interaction types into video content has resulted in a notable surge in their utilization and a discernible enhancement in their overall quality. Several studies have identified the potential advantages of utilizing interactive videos instead of conventional video formats (Vural, 2013; Kolås, 2015). These studies have demonstrated that incorporating interactions into videos enables students to become more active in their use (Kolås, 2015). The active use of interactive videos by students facilitates the formation of a flexible learning environment that they control (Domagk et al., 2010; Petan et al., 2014). This results in a more permanent and powerful learning environment (Hrastinski & Monstad, 2014; Vural, 2013), which motivates students to achieve effective learning (Zhang et al., 2006). In this context, the various interaction types present in interactive videos are regarded as significantly important. The specific interaction types employed in interactive videos depend on the goals and objectives of the course or subject. To achieve these objectives, a variety of question types can be used, including open-ended questions, multiple-choice questions, comment and discussion-based activities, fill-in-the-blank questions, and quizzes (Dong & Goh, 2015; Wachtler et al., 2016). Additionally, features such as adjusting the video speed, fast-forwarding, rewinding, highlighting, receiving feedback, and searching for alternative resources (Delen et al., 2014; Dong & Goh, 2015; Schwan & Riempp, 2004) can be employed. The deployment of interactive video functionality can help discern students' comprehension, identify areas requiring improvement, and determine subjects on which they may be experiencing difficulties. Moreover, the integration of these features can significantly enhance students' capacity for higher-order thinking (Wilson, 2016).

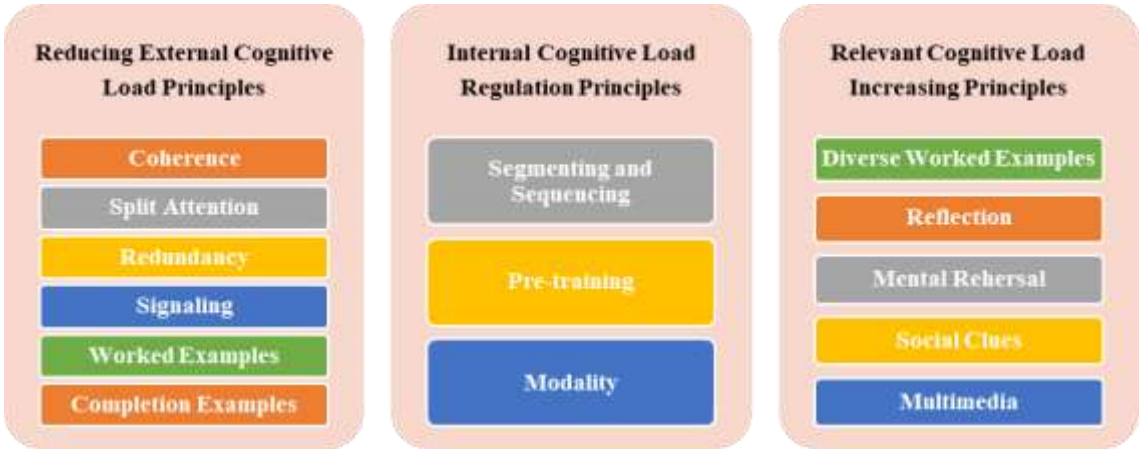
Interactive Videos and Message Design

The use of interactive videos plays a pivotal role in fostering and enhancing the interaction between students and content, which is of paramount importance for the learning resources available in a particular program (Aydin, 2011). For this reason, videos are widely employed in traditional and blended learning and teaching processes,

as well as in tertiary education and massive open online courses (MOOCs) (Emirtekin, 2019). Moreover, studies demonstrating the effectiveness of videos as multimedia tools also emphasize their importance (Means et al., 2010). Videos, as multimedia tools, comprise a variety of elements, including images, sounds, pictures, and texts. Materials with multiple elements may prove challenging for students, particularly in terms of their cognitive capacities. Consequently, it is paramount to consider cognitive load (Brame, 2016) during the video preparation process. Cognitive load theory and the cognitive theory of multimedia learning have led researchers to propose several principles that should be considered when designing messages for use in learning and teaching environments. The aforementioned principles are designed to reduce external cognitive load, regulate internal cognitive load, and enhance germane cognitive load (Yildirim, 2016). Videos prepared with these cognitive load principles in mind can be effective tools in various learning and teaching processes and environments. Moreno and Mayer (2010) posit that providing students with explanatory feedback on their understanding of multimedia content facilitates the selection and organization of new information, thereby contributing to germane cognitive load. Furthermore, the findings of a study by Kilic and Yildirim (2010, 2013) indicate that students are significantly more successful and motivated when they utilize their working memory more effectively in a multimedia environment designed with principles to manage external cognitive load. In light of the aforementioned points and the findings of previous studies, the interactive videos created for this study were designed in accordance with the following message design principles (Figure 1).

Figure 1

Message Design Principles



Note. (Yıldırım, 2016).

Interactive video material prepared with these principles in mind will help students achieve a fast and effective learning experience without straining their cognitive systems and will greatly improve their performance in various areas of competence and skills. Based on this intuition, the study used interactive videos to demonstrate changes in students' technology proficiency and digital literacy levels.

Technology Proficiency

The advent of new technologies is rapidly transforming the manner in which teaching is conducted, the nature of learning environments, and the role of teachers within the classroom. It is therefore essential that teachers possess the requisite technological competencies to enable them to effectively keep pace with the aforementioned change process. Consequently, it is paramount that teachers not only have access to digital devices but also can utilize various technologies effectively within the classroom (U.S. Department of Education, 2017). Nevertheless, many educators currently encounter difficulties in integrating contemporary technologies into their pedagogical practices, aligning technological applications with the course objectives, and developing an understanding of these technologies (Çuhadar, 2018; Heitink, Voogt, Verplanken, Braak, & Fisser, 2016; Instefjord & Munthe, 2015). In light of this, recent studies of teacher education programs have focused on creating a technologically rich environment, particularly on how teachers interact with various technologies in the classroom (Foulger, Graziano, Schmidt-Crawford, & Slykhuis, 2017; Instefjord & Munthe, 2015). In this context, teachers' desire to effectively and efficiently leverage technology in educational settings has underscored the importance of their technological proficiency levels. Teachers' technology competencies differ from those of ordinary technology users due to their connections to teaching and learning, necessitating examination (Wang & Lu, 2021). However, few studies in the literature have addressed the measurement of technological literacy (Wang & Lu, 2021), indicating a gap in the existing literature regarding the assessment of teachers' technological competence. The objective of this study was to address this gap in the literature.

Digital Literacy

The term "literacy" encompasses not only the ability to read and write but also the capacity to create, comprehend, apply, analyze, synthesize, organize, and evaluate information using technology (Çetin, 2021). The use of technology in learning and teaching contexts can facilitate the development of literacy skills (Çetin, 2021). Incorporating video, images, graphics, filmmaking, and other similar audiovisual materials contributes to the enhancement of literacy skills (Collier, 2013). The five categories of literacy skills include digital, visual, technological, global, and information literacy (Robin, 2008). Upon reviewing the definitions of digital literacy in the literature, it became evident that this concept arises from the intersection of students' cognitive, technical, and socio-emotional competencies (Ng, 2012). Digital literacy is defined as the practical skills required to use digital technologies, as well as social and creative abilities (van Deursen, Helsper & Eynon, 2016). The prevailing perspective is that digital literacy is essential for students who must navigate the technological, cognitive, and socio-emotional demands of the digital age (List, Brante & Klee, 2020). The concept of digital literacy encompasses a range of competencies, including information literacy, computer literacy, information and communication technologies (ICT) literacy, and media literacy, among others. Employing these digital literacy competencies ensures the integration of various technologies, particularly in educational environments, thereby facilitating learning and teaching processes. Teachers and prospective teachers play a crucial role in this process, necessitating examination of the factors influencing changes in digital literacy levels. Consequently, the study aimed to

determine the impact of interactive video in web-based courses on prospective teachers' digital literacy levels.

Aim and Importance of the Study

Researchers have proposed that teaching in various learning environments should be more interactive, purposeful, and stimulating, supported by technology (Caamaño-Navarrete et al., 2021). Interactive videos represent a technology that incorporates a range of interaction types for diverse purposes, thereby motivating students to engage effectively in learning (Zhang et al., 2006). These videos comprise elements such as images, sound, and illustrations (Kasturi et al., 2022), offering a versatile learning environment with active engagement (Domagk et al., 2010; Petan et al., 2014). They provide students with materials and questions that allow specialization in different situations, based on images and sound (Lakapu et al., 2023). Given these attributes of interactive videos, it is postulated that such videos can effectively develop diverse skills and abilities in students. It is also important to consider digital literacy and technology competencies. As Collier (2013) suggests, using audiovisual materials with diverse characteristics and evaluations in a technological context significantly contributes to the development of digital literacy skills. The prevalence of such materials in interactive videos indicates that digital literacy can be enhanced through their use. Furthermore, interactive videos can be employed in contexts where students lack opportunities for practice and learning through usage, aiding them in learning technology use (Çetin, 2021) and enhancing the retention and efficacy of students' learning (Hrastinski & Monstad, 2014; Vural, 2013). This suggests that digital literacy skills and technology competencies can be developed through interactive video use. The ability of interactive videos to be used synchronously and asynchronously, without temporal or spatial constraints, coupled with their incorporation of interactions with diverse features, enables repeated student engagement. Such videos can effectively support courses requiring the application of knowledge (edtech, 2022), facilitating students' learning of technological concepts and applications. Interactive videos accommodate individual differences in learning by providing a personalized learning environment, enabling students to direct content and personalize experiences (Çetinoğlu, 2024). As technological tools, equipment, concepts, and applications are often learned through actions and decisions, interactive videos can provide similar experiences (Çetinoğlu, 2024). In light of these scenarios, it can be posited that interactive videos are more effective than other technologies and tools with different features when used in lesson contexts. This study examines whether interactive videos affect students' technology proficiency and digital literacy levels.

The findings of various experimental studies on the use of videos in learning and teaching processes have shown that videos are beneficial for learning (Chan, 2010). However, there is a scarcity of literature specifically investigating the effects of interactions in interactive videos. This is evidenced by the limited number of studies in this area, including those by Mar et al. (2017), Rice et al. (2019), Vural (2013), and Wachtler et al. (2016). These studies indicated that interactive videos are effective learning materials for students (Cherrett et al., 2009). Among the few studies on interactive videos, investigations into their effects when used in web-based systems on various variables have also been conducted. Findings from Zhang et al. (2006)

suggested that integrating interactive videos into e-learning systems enhances students' learning and satisfaction. Building on these findings, Petan et al. (2014) suggested that interactive videos should be considered the primary resource in massive open online courses (MOOCs). Overall, there remains a scarcity of studies examining the effects of interactive videos on different variables and integrating them into any web-based system. Despite discussions in the literature on various variables and scientific issues related to interactive videos, no study has thoroughly examined students' technology proficiency and digital literacy levels. This study aims to address this gap in the literature. Its principal objective is to determine the impact of using interactive videos in web-based courses on students' technology proficiency and digital literacy levels, as well as their perceptions there of.

Accordingly, the answers to the research questions listed below will be sought in accordance with the study's purpose.

1. Is there a difference between students' technology proficiency and digital literacy pretest-posttest scores?
2. Is there an effect of using interactive video in web-based courses on students' technology proficiency and digital literacy levels?
3. What are students' perspectives on the effects of using interactive video in web-based courses on technology proficiency and digital literacy levels?

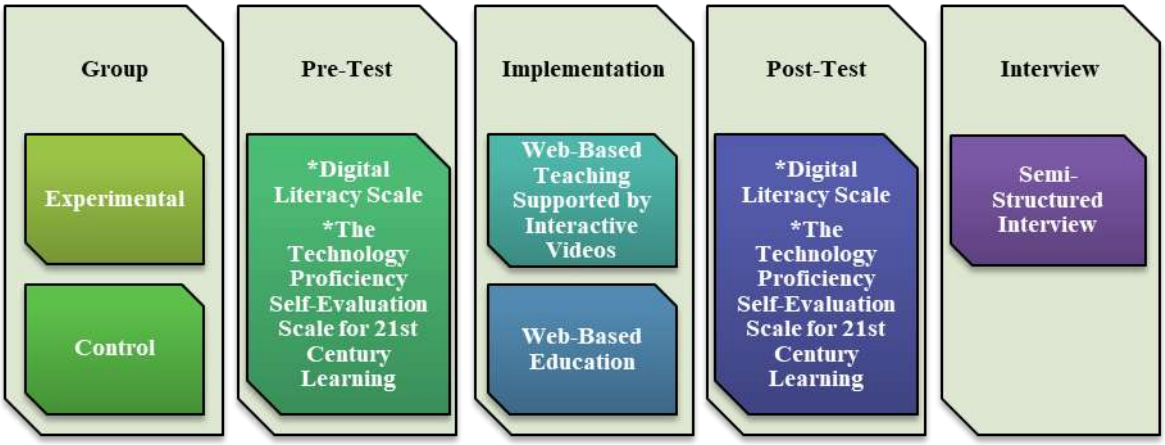
Method

Research Model

In the study, the effect of using interactive videos in web-based courses on students' technology proficiency and digital literacy levels was investigated using a quasi-experimental design, which is one of the quantitative research methods. In cases when experimental and control groups cannot be formed randomly and instead existing classes are used, the quasi-experimental design can be preferred (Fraenkel & Wallen, 2000; McMillan & Schumacher, 2010). In this design, the experimental and control groups are compared using pre-tests over the scores of the independent variable or variables. In this comparison, if the pre-test scores of the groups show similarity, one of the groups can be designated as the experimental group and the other as the control group (Şahin & Yilmaz, 2020). In the study, pre-tests were given to all students in two groups. The pre-test scores for the technology proficiency and digital literacy levels of the students in the groups were compared with the independent samples t-test. The results of this test revealed that there was no significant difference ($t(88)_{\text{Technology Prof.}} = .309$, $p = .758$), ($t(88)_{\text{Digital Lit.}} = .520$, $p = .605$) in technology proficiency and digital literacy levels between the experimental ($M_{\text{Technology Prof.}} = 64.66$, $SD_{\text{Technology Prof.}} = 8.87$), ($M_{\text{Digital Lit.}} = 35.97$, $SD_{\text{Digital Lit.}} = 5.36$) and control ($M_{\text{Technology Prof.}} = 65.75$, $SD_{\text{Technology Prof.}} = 10.9$), ($M_{\text{Digital Lit.}} = 36.35$, $SD_{\text{Digital Lit.}} = 6.21$) groups. Because the two groups have similar levels of technology proficiency and digital literacy, one was randomly assigned as an experiment and the other as a control group. The study's design process is given in Figure 2.

Figure 2

The Study's Design Process



The study's implementation lasted for a total of seven weeks (21 hours). During this period, the curriculum covered the following subjects: "Problem-solving concepts and approaches", "Algorithms and flowcharts", "Internet use in education", "Communication and collaboration technologies", "Safe use of the Internet", and "Information ethics and copyrights". In the experimental group, active course processes and extracurricular activities were conducted with the assistance of interactive videos. These videos were used in the introductory part of lessons to review previous topics, administer short quizzes based on video content, and introduce new topics. Additionally, at the end of each lesson, a brief review of the subject matter was conducted using interactive videos to identify any points not fully understood, followed by a short quiz based on video questions. Students were encouraged to use interactive videos independently for repetitions, self-testing, learning at their own pace, and self-assessment, particularly during extracurricular activities, with careful monitoring of their progress. Conversely, lessons in the control group were conducted using traditional methods such as direct instruction, Q&A sessions, and discussions. The researcher planned and conducted lessons for both the experimental and control groups in line with the course curriculum. All lessons were conducted via the Microsoft Teams program, with separate one-hour sessions scheduled for each group at different times for web-based courses.

The "Digital Literacy Scale" and the "Technology Proficiency Self-Evaluation Scale for 21st Century Learning" were used as pre-test and post-test to determine the experimental and control groups' levels of technology proficiency and digital literacy. Furthermore, a "Semi-Structured Interview Form" was used to elicit the students' perspectives on this. The differences in pre-test and post-test scores of students in the experimental and control groups were investigated in the study to determine the effects of using interactive video in web-based lessons. Following that, the two groups were compared to determine the effects of using interactive video in web-based lessons on students' technology proficiency and digital literacy levels. Finally, the students' perspectives in this sense were revealed.

Research Group

The study's research group is composed of 90 undergraduate students in the first year of the faculty of education. The students in the research group took the information

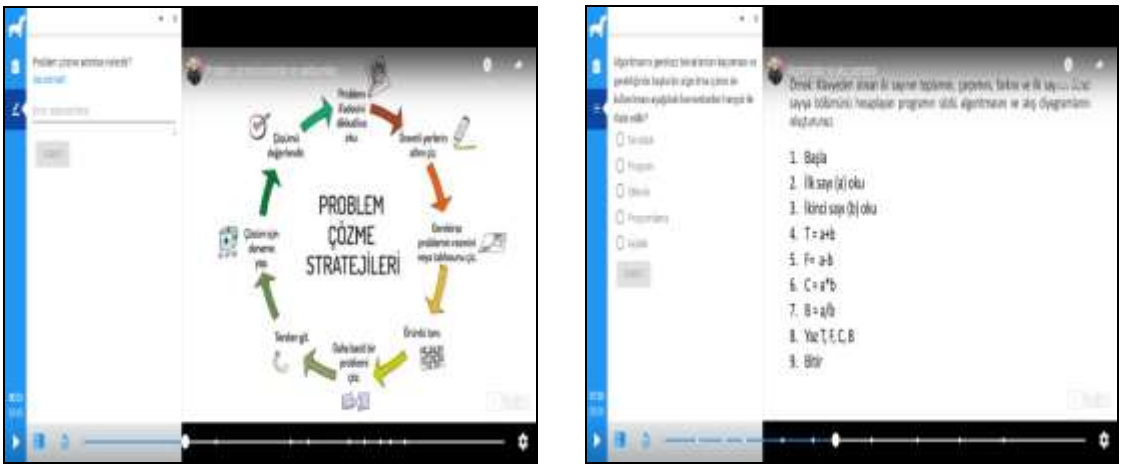
technology course in a web-based class. These students have never used interactive video in any of their classes. The study included two groups, experimental and control, with each group containing 45 students. There were 29 girls and 16 boys in the experimental group, and 36 girls and 9 boys in the control group. The convenience sampling method was used to determine the research group. With this method, the research gains momentum by selecting a sample that is easily accessible (Yildirim & Simsek, 2016). In this sense, the reason why this method was chosen is that the information technology course of the students in the research group was being done by the researcher.

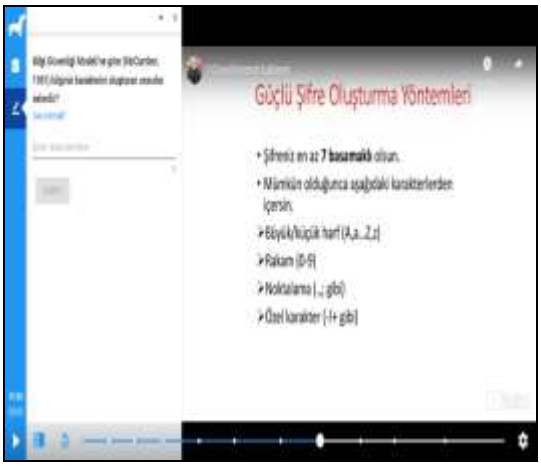
Interactive Videos

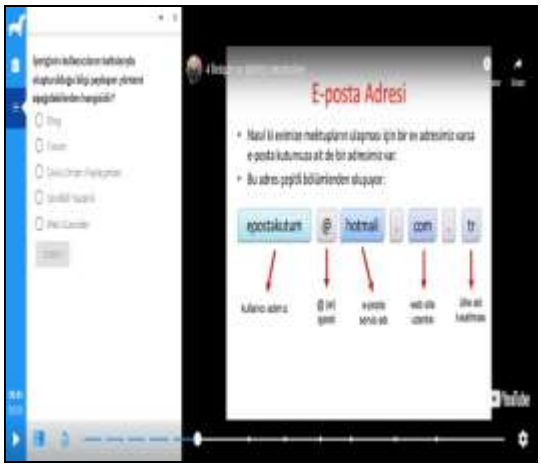
The interactive videos used in the study were prepared in the PlayPosit program. In this program, a virtual classroom was created for the study's activity phase. This class included students from the study's experimental group. The researcher created the videos for the study in accordance with the course curriculum and weekly lectures. The videos were uploaded to the researcher's YouTube channel and turned into an interactive structure using the PlayPosit program. The YouTube channel is set to be seen only by students participating in the study. Only the students who participated in the study were included in the virtual classroom in the PlayPosit program. The interactive videos created for the study ranged in length from six to nine minutes. In this way, it is aimed to increase the participation time. To ensure interaction in certain parts of the videos, various types of questions and activities were added. In addition to open-ended, multiple-choice, and fill-in-the-blank questions, the videos include checklists, surveys, and discussions to support interaction. After the videos began to play, these question types and activities appeared on the left side of the screen at various points, allowing students to respond. Depending on whether the students' answers to the questions were correct or incorrect, different feedback was provided. In the virtual classroom environment, the information about which videos the students watched and how many times they watched them, the answers they gave to the questions, and the activities were carefully monitored. Some images of interactive videos are given in Figure 3.

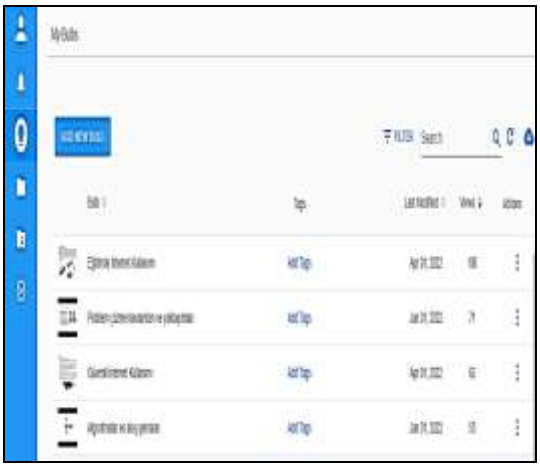
Figure 3

Some Images of Interactive Videos Used in the Study





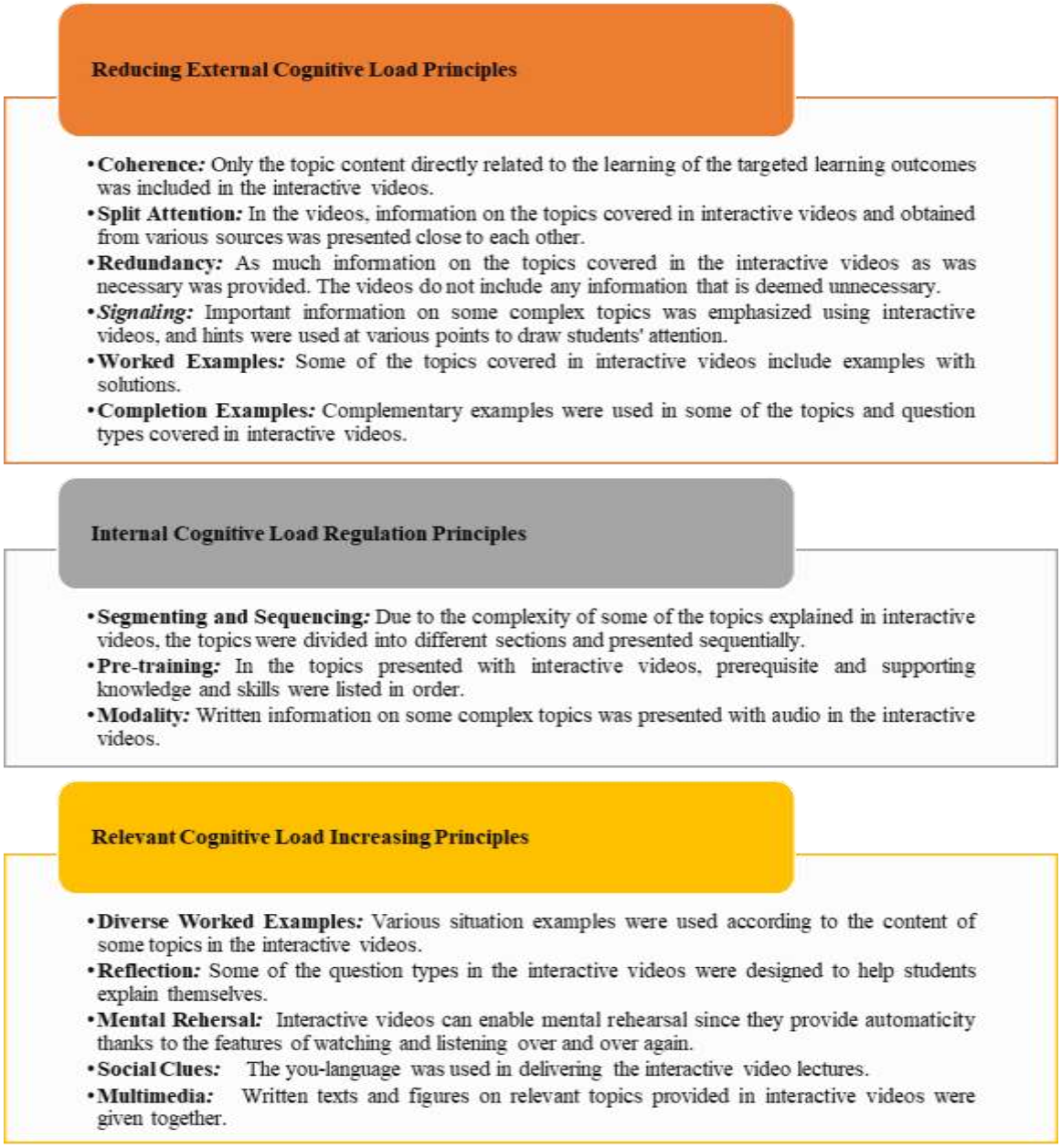




The interactive videos created for the study adhered to the principles of cognitive load theory and cognitive multimedia learning theory (Mayer & Moreno, 2010), which is a theory adapted from cognitive load theory, as well as the principles proposed by the researchers (Yildirim, 2016) of these theories. These principles and the considerations regarding the principles while preparing interactive videos are given in Figure 4.

Figure 4

Considerations Regarding the Principles while Preparing Interactive Videos



Data Collection Tools

Different data collection tools were used to collect data in the study. The first two are the digital literacy scale and technology proficiency self-assessment questionnaire for 21st century learning. The digital literacy scale was developed by Ng (2012). The scale was adapted to Turkish by Ustundag, Gunes, and Bahcivan (2017), and this version was used in the study. The scale consists of ten items in total. The scale has four factors: cognitive, technical, social, and attitude, and in the structure of a five-point Likert scale (1, "I strongly disagree," 5, "I strongly agree"). The original scale's Cronbach alpha value was .89, the Turkish version's Cronbach alpha value was .91, and the Cronbach alpha value in this study was .84. Christensen and Knezek (2017) developed the other data collection tool for the study, technology proficiency self-assessment questionnaire for 21st century learning, which Fidan, Debbag, and Cukurbasi (2020) adapted to Turkish conditions. In the study, the adapted version of the

scale to Turkish conditions was used. There are twenty-four items in total in the scale. The scale is divided into four sub-dimensions: e-mail, www, integrated activitys, and technology-enhanced education. The scale is in the structure of a five-point Likert scale (1, "I strongly disagree," 5, "I strongly agree"). The original scale's Cronbach alpha value was .96, the Cronbach alpha value adapted to Turkish conditions was .81, and the Cronbach alpha value in this study was .91. On the other hand, the third data collection tool in the study is the researcher's semi-structured interview form, which was designed to reveal the students' perspectives on the use of interactive video in web-based teaching. There are two open-ended questions in the form. The form's open-ended questions were developed in consultation with experts from various fields. Two of these experts specialize in education sciences, two in computer education and instructional technology, and one in assessment and evaluation.

Validity Threats

In order to address potential threats to the study's internal validity, certain precautions were taken. The internal validity of a study is contingent upon a number of factors, including the temporal aspect, the subject selection process, the data collection tools employed, the subjects' backgrounds, and the potential for interaction effects (Büyüköztürk et al., 2013). In order to prevent the influence of extraneous variables on the dependent variables in the study, the application process was limited to seven weeks. The participants were randomly allocated to the groups. The students in the experimental groups were selected from those who had no previous experience with interactive videos. The same measurement tools were employed in the experimental and control groups. The entire process was conducted by the researcher. The study also sought to evaluate the technological proficiency and digital literacy levels of the students. The internal validity of the study was ensured under the specified conditions. Conversely, factors such as sampling, reactivity, and the interaction effect of the experimental variable impact the external validity of the study. To address these concerns, a pre-test was administered to both groups, thereby preventing any variability differences that might occur during the experiment. Furthermore, the participants were not informed of their involvement in an experimental study. These precautions served to enhance the external validity of the study. Furthermore, construct validity was ensured by clearly defining the reasons, effects, environment, and participants in the study.

A number of potential threats may compromise the reliability of the results obtained in experimental studies. These include inappropriate sample size, uniform data collection, inappropriate statistical tests and procedures, violations of assumptions in the tests, and low statistical power. The study ensured that the sample size was appropriate for the experimental application, in accordance with the relevant statistical principles. Both quantitative and qualitative data were collected in the study. The most appropriate statistical tests were employed for the analysis of the data. No assumptions were violated during the statistical analysis. Furthermore, effect size values were examined to determine the strength of the relationships between the variables, thereby increasing statistical power. The data were subjected to rigorous analysis, ensuring the reliability and validity of the study's results.

Data Analysis

The data collected with the technology proficiency self-evaluation scale for 21st century learning for digital literacy showed a normal distribution. A dependent sample t test was used to reveal the differences between the students' pre-test and post-test scores. On the other hand, an independent sample t-test was used to determine if the usage of interactive video in web-based courses influences students' technology proficiency and digital literacy levels. Eta squared (η2) value was used to determine whether the differences reached by the dependent and independent sample t-test results have practical significance. Furthermore, the content analysis method was used to examine students' perspectives on the effects of interactive video use in web-based courses on technology proficiency and digital literacy levels. The themes and codes linked to the subject were determined for this study, and the relationships between them were revealed. In this way, an in-depth analysis was conducted (Creswell, 2014).

Ethical Procedures

Ethical permission (31/01/2022-E-66323135-900.99-4512) was obtained from Kafkas University Social and Humanities Ethics Committee institution for this research.

Findings

Differences between Pretest and Posttest Scores of Students in Groups

The dependent sample t-test was used to compare the students' technology proficiency and digital literacy pre-test and post-test results in the experimental and control groups. According to the findings, there was a significant difference between the experimental (t= -13.279, p< .05) and control (t= -10.295, p< .05) groups' technology proficiency pre-test and post-test scores. The average technology proficiency score of the experimental group increased from 64.86 to 94.55, whereas the average score of the control group increased from 65.75 to 89.73 (See Table 1).

Table 1

The Results of Dependent Sample T-Test on the Groups' Technology Competencies

		N	M	SD	t	df	p	η2
Experimental	Pretest	45	64.86	8.44	-13.279	44	.000	.800
	Posttest		94.55	11.60				
Control	Pretest	45	65.75	10.90	-10.295	44	.000	.706
	Posttest		89.73	9.70				

Table 2 shows that, in terms of digital literacy, there is a significant difference between the pre-test and post-test scores of the experimental group (t= -2.226, p<.05), but not in the control group (t= -.574, p>.05). The average digital literacy score of the experimental group increased from 36.20 to 38.28, whereas the average score of the control group increased from 35.95 to 36.71 (See Table 2).

Table 2

Dependent Sample T-Test Results Regarding the Digital Literacy of the Groups

		N	M	SD	t	df	p	η2
Experimental	Pretest	45	36.20	5.01	-2.226	44	.031	.101
	Posttest		38.28	4.16				
Control	Pretest	45	35.95	6.12	-.574	44	.569	-
	Posttest		36.71	5.65				

The Effects of Interactive Video Use on Students' Technology Proficiency and Digital Literacy Levels

The effect of employing interactive video in web-based classes on students' technology proficiency was studied using an independent sample t-test. The test results revealed a significant difference in technology proficiency ratings ($p < .05$) favoring the experimental group (See Table 3).

Table 3

Independent Sample T-Test Results Regarding the Technology Proficiency Levels of the Groups

	N	M	SD	t	df	p	η2
Experimental	45	94.55	11.60	2.139	88	.035	.049
Control	45	92.40	12.17				

An independent sample t-test was conducted in order to evaluate the effect of interactive video usage on web-based courses in terms of digital literacy. It was observed that there was a considerable difference between the scores of digital literacy levels ($p < .05$) in favor of the experimental group according to the test results (See Table 4).

Table 4

Independent Sample T-Test Results Regarding the Digital Literacy Levels of the Groups

	N	M	SD	t	df	p	η2
Experimental	45	38.28	4.16	2.113	77.5	.038	.048
Control	45	35.95	6.12				

Student Opinions on The Effects of Interactive Video Use on Technology Proficiency And Digital Literacy Levels

Students' perspectives on the effects of interactive video use in web-based courses on students' technology proficiency and digital literacy levels were determined using the content analysis method. First, the answers to the question "How do you think the use of interactive video in your lessons affects your proficiency in different technologies?" were analyzed. Secondly, the answers to the question "How do you think the use of interactive video in your lessons affects your digital literacy skills?" were

analyzed. Within the parameters of the available data, themes and codes were developed (See Table 5).

Table 5

The Effects of Interactive Video Use on Students' Technology Proficiency and Digital Literacy Levels

Theme	Codes	**f**
Technology Proficiency	The ability to perform e-mail operations (creating an e-mail address, sending and receiving e-mail, sending bulk e-mail, etc.)	40
	The ability to browse web pages as well as download and save files from them	38
	The ability to watch and download videos from the internet using multiple devices	37
	The ability to use office programs (Microsoft Word, Excel, etc.)	37
	The ability to use various technologies for communication and collaboration	36
	The ability to use mobile devices effectively	35
	The ability to use both synchronous and asynchronous tools in distance education	34
Theme	Codes	**f**
Digital Literacy	Interest in various technologies	39
	The ability to develop different skills for various technologies	39
	Increasing self-confidence to use different technologies	38
	The ability to safely use internet technologies	36
	The ability to communicate and collaborate using various technologies	35

According to Table 5, students who use interactive videos in their classes stated that they can use them to perform various actions related to their e-mails (f= 40), effectively research different web pages, download and save different types of files on the internet (f= 38), and play videos on the internet on various devices and watch and download them (f= 37). Furthermore, students stated that they could use different office programmes for their purposes (f = 37) and that they could effectively use various communication and collaboration technologies (f = 36) thanks to the information they learned from the interactive videos. Additionally, students stated that they could use this information to effectively use mobile devices (f = 35) and synchronous and asynchronous tools related to the distance education process (f = 34). The following are some student perspectives on these issues:

> "By using interactive video, I was able to use technological devices like computers and phones more comfortably and clearly." (S:12)
>
> "Thanks to the interactive videos, I was able to learn the operating logic of applications such as Microsoft Teams and Zoom." (S:13)
>
> "The interactive videos that we watched in the lessons helped me to learn more about different technologies that we didn't know about or knew very little about, and I gained the ability to use them." (S:29)

"The interactive videos that we watched in the class had a significant impact on my technology competencies. My computer skills have greatly improved. I learned how to use software such as PowerPoint, Word, and Excel." (S:36)

When Table 5 is examined, the students stated that the use of interactive videos increased their interest in various technologies (f= 39), improved their various skills towards these technologies (f= 39), and increased their self-confidence in using them (f= 38). Furthermore, the students stated that the use of interactive videos aided them in terms of safely using various internet technologies (f= 36) and communicating and collaborating using various technologies (f= 35). The following are some participant perspectives that revealed these instances:

"The knowledge I gained from interactive videos enabled me to conduct more detailed and informed internet research." (S:14)

"The use of interactive video in our lessons assisted me in becoming acquainted with various technologies and keeping up with the digital environment." (S:19)

"Interactive videos taught me a lot about creating strong passwords, understanding and using privacy settings, and what can and cannot be shared on social media and internet safety." (S: 21)

"Interactive videos have advanced my digital literacy to a higher level. Thanks to these videos, I can now better understand and use technologies that I had no idea how to use, their operating logic, or that I had only a vague understanding of." (S:44)

Discussion and Conclusion

The objective of this study is to ascertain the impact of interactive videos in web-based courses on students' technology proficiency and digital literacy levels, as well as their perspectives on the subject. The study findings indicate that students in the experimental group exhibited notable improvements in their technology proficiency and digital literacy levels. Furthermore, the experimental group demonstrated superior performance to the control group in both technology proficiency and digital literacy, with a statistically significant advantage in favour of the former. The students' feedback indicated that the use of interactive videos in web-based courses had a positive effect on their technology proficiency and digital literacy levels. These results indicate that the use of interactive videos in lessons is an effective method for improving these skills. Given the importance of these concepts for teacher candidates, interactive videos related to technology proficiency and digital literacy, which are integral to many topics in the information technology course, were developed and applied in the experimental group. These skills are essential for individuals to actively participate in the information society and adapt to social and economic changes (Reisoglu & Cebi, 2020). Given the complexity and multifaceted nature of technology proficiency and digital literacy, the process of learning and developing these skills can be challenging and time-consuming for students. Nevertheless, the interactive videos enabled students in the experimental group to gain a more comprehensive and expedient understanding of these concepts, resulting in a higher level of technology proficiency and digital literacy compared to the control group.

Differences between Pretest and Posttest Scores of Students in Groups

The study examined the differences in pre-test and post-test scores between the experimental and control groups. The results demonstrated a notable disparity in the experimental group's scores between the pre-test and post-test periods, particularly in

terms of technology proficiency and digital literacy levels. In contrast, a significant difference was observed only in the technology proficiency levels for the control group. The mean score for technology proficiency in the experimental group increased from 64.86 to 94.55, while the mean score for digital literacy increased from 36.20 to 38.28. The change in mean scores for digital literacy was less pronounced. The effect size calculated from these mean scores also indicated that the effect of the method was weak. This may be attributed to students encountering difficulties in organising interactive videos in a manner that aligns with the course aims and objectives, as well as in forming a comprehensive understanding of them (Çuhadar, 2018; Heitink et al., 2016; Instefjord & Munthe, 2015). Furthermore, the weak effect observed may be attributed to the limited impact of interactive videos on students' knowledge of accessing information, using information, and employing digital tools necessary for sharing information (Makers, 2024).

The experimental group demonstrated superior post-test scores for technology proficiency and digital literacy levels in comparison to the control group. While the mean scores of the two groups were comparable, the effect size values, as defined by Cohen (2013), indicated that the interactive video method had a moderate effect in practice. This suggests that the utilisation of interactive videos in web-based courses has the potential to enhance students' technology proficiency and digital literacy levels. A comparison of the pre-test and post-test results indicates that the incorporation of interactive videos into lessons has a beneficial effect on the learning process, as evidenced by an enhancement in students' scores in technology proficiency and digital literacy. It is possible that the improvement in scores observed in both groups may be attributed to the teacher's explanations during active lessons. However, the use of interactive videos in certain parts of the course, particularly in extracurricular activities that do not involve the teacher, may be more beneficial. Consequently, interactive videos can be regarded as a valuable multimedia learning tool. Similar outcomes have been documented in the literature (Chen & Wu, 2015; Dieck-Assad et al., 2020; Barut Tuğtekin & Dursun, 2022). Nelles et al. (2011) posited that converting simulations into digital video format has the potential to develop complex skills. Furthermore, Hrastinski and Monstad (2014) demonstrated that employees who actively utilise videos exhibited enhanced cognitive and behavioural skills compared to those who did not. It is of the utmost importance to prepare learning materials that appeal to more than one sensory organ, whether visual, auditory, or audio-visual. This is because it allows for a more effective addressing of students' diverse learning and motivation needs (Jethro, Grace, & Thomas, 2012; Mayer, 2014). Videos are particularly useful in this context for conveying information to students at the higher education level (Smyth, 2011). They are frequently employed as educational and instructional materials in online and blended learning environments and courses (Ljubojevic, Vaskovic, Stankovic, & Vaskovic, 2014; Rice, Beeson, & Blackmore-Wright, 2019). The use of interactive videos, created to support a theoretical framework while considering students' cognitive loads, can assist in making sense of the information presented, actively participating in the learning process, and reducing cognitive load (Sorden, 2012; Cummins, Beresford, & Rice, 2016). The absence of any incorporation of theory or principles regarding cognitive load during the preparation of the videos is exemplified by Wilson’s (2016) study, which concluded that videos with embedded questions do not result in increased

student achievement. With regard to cognitive load, the incorporation of various interactions in interactive videos with a theoretical framework has been demonstrated to facilitate learning by appealing to different senses, both visually and audibly. This allows information to be transmitted to memory with greater efficiency (Schwan & Riempp, 2004). This approach facilitates learning while also enhancing retention. A number of studies in the literature provide evidence to support this (Schreiber et al., 2010; Chen & Wu, 2015). Our conclusions may also contribute to the existing body of literature in a similar manner.

The Effects of Interactive Video Use on Students' Technology Proficiency and Digital Literacy Levels

In terms of technology proficiency and digital literacy levels, there was a significant difference between the experimental and control groups. Students who used interactive videos demonstrated superior performance in both technology proficiency and digital literacy compared to those who took their courses in a traditional manner. It can be concluded that the use of interactive videos in the experimental group contributed to the observed differences between the groups. These findings are consistent with previous studies on interactive videos in the literature (Afify, 2020; Chen & Wu, 2015; Geri et al., 2017; Mahmudovna et al., 2024). Delen et al. (2014) found that the interactive video learning environment is a superior teaching tool compared to traditional video learning environments in terms of students' learning performance. A number of potential explanations can be put forward for the beneficial effects of using interactive videos on students' technology proficiency and digital literacy levels. For instance, students experienced a new and engaging learning format when they first used interactive videos in their lessons (Yilmaz, Kucuk, & Goktas, 2017). The increased interest in interactive videos among students in the experimental group contributed to their higher technology proficiency and digital literacy levels. Furthermore, the literature indicates that the integration of new technologies in education effectively captures students' interest and enhances their motivation (Şahin & Yilmaz, 2020). The utilisation of interactive videos in educational settings has been demonstrated to facilitate active participation in the learning process and to enhance students' understanding of the course content (Kreijns, Acker, Vermeulen, & Buuren, 2013; Küçük, 2015; Shen, Liu, & Wang, 2013). Furthermore, the incorporation of interactive videos, which combine visual and auditory content, has the potential to enhance the learning environment (Sever, Oguz-Unver, & Ruyamezoglu, 2013). It can be reasonably concluded that the experimental group's superior performance in terms of technology proficiency and digital literacy levels can be attributed to the various types of interaction present in the videos. The incorporation of interactive elements into videos can facilitate interaction between the learner and the content, transforming students from passive viewers to active participants (Ugur & Okur, 2016; Wachtler, Khalil, Taraghi, & Ebner, 2016; Zhang et al., 2006). This approach assists students in focusing their attention on course subjects (Wachtler et al., 2016) and enhances their learning effectiveness by motivating them (Zhang et al., 2006). Furthermore, the incorporation of interactive elements enables the assessment of students' comprehension of course subjects and the identification of areas where they may require additional support, while simultaneously fostering the development of higher-order thinking skills

(Wilson, 2016). Consequently, it is evident that the utilisation of interactive videos in the classroom is an efficacious instrument for the advancement of students' diverse abilities, aptitudes, and competencies.

Student Opinions on the Effects of Interactive Video Use on Technology Proficiency and Digital Literacy Levels

The students who participated in the study indicated that the use of interactive videos in lessons enhanced their technology proficiency and digital literacy levels. The students whose opinions were gathered reported that the use of interactive videos had a positive effect on their performance in these areas and expressed satisfaction with the results. Similarly, Zhang et al. (2006) found that students who used interactive videos in an e-learning environment performed better than those who did not. This improvement may be attributed to the engaging nature of interactive videos and their integration as new technology in their courses. The capacity to review subjects at any time and place, rewind videos, watch specific sections, engage in various types of interaction, and receive feedback can be considered effective features. The study concluded that students demonstrated enhanced knowledge and skills in technology proficiency, including email and web page operations, using office programs, employing different technologies for communication and collaboration, and effectively utilising mobile devices and both synchronous and asynchronous tools for distance education. The effect size values indicate that interactive videos have a significant impact on the development of these knowledge and skills. This may indicate that interactive videos are effective in web-based teaching environments where there are difficulties in implementing practice-based teaching and where the expectation is that knowledge will be applied (edtech, 2022). Furthermore, since such skills can be learned through actions and decisions, interactive videos, which provide students with similar experiences (Çetinoğlu, 2024), may also influence this outcome. The opinions of students in the experimental group corroborate this finding. Nevertheless, it cannot be asserted that all of the knowledge and skills developed by the students in the experimental group were acquired exclusively through interactive videos. In this context, it is important to consider individual factors that positively relate to technological competencies (Lucas et al., 2021). Furthermore, the experiences that students gain from using different technologies in their daily lives are worthy of note. In conclusion, the evidence suggests that interactive videos are an effective tool for developing students' technology competencies. A paucity of studies in the literature examines the impact of various technologies employed in educational settings on students' technology competencies. The number of studies in this area could be increased to provide valuable contributions to the field.

Conversely, the study's findings indicated that students exhibited enhanced digital literacy and interest in technology, developed proficiency in various technologies, demonstrated increased confidence in their use, utilized internet technologies in a secure manner, and engaged in communication and collaboration through various technologies. Similar results have been reported in previous studies (e.g., Taşlıbeyaz, 2015; Gijsen et al., 2024; Mahmudovna et al., 2024). It is plausible that the utilisation of interactive videos may result in alterations to students' understanding and abilities pertaining to technology competencies and digital literacy.

Furthermore, the opinions of students in the experimental group also support this hypothesis. Indeed, a substantial proportion of students in the experimental group expressed positive opinions in this context. Nevertheless, in terms of effect size, the evidence suggests that the use of interactive videos has a relatively weak impact on students' knowledge and skills related to digital literacy. This indicates that interactive videos are not an effective method for developing digital literacy in students in the experimental group. Furthermore, the impact of other variables on the acquisition of digital literacy competencies should not be underestimated. For example, the students' prior practical, social, and creative skills, which are related to digital literacy (van Deursen, Helsper & Eynon, 2016), may have positively influenced these outcomes. Furthermore, the students' existing competencies in areas such as computer, information and communication technologies, and media literacy (Liang, de la Torre & Law, 2021) prior to the study may have also influenced the results. The utilisation of interactive videos in the context of problem-based learning has been demonstrated to enhance students' decision-making abilities (Taşlıbeyaz, 2015). The recommendations for the use of interactive videos in teaching, which can facilitate the achievement of complex procedural gains (Schwan & Riempp, 2004), are in accordance with this view. The interactive elements of the videos facilitate a more active role for students in the teaching process, enabling them to engage in content creation and enhance their interaction with the material (Ugur & Okur, 2016). It can be concluded that students can gain knowledge and skills in various technologies by utilising different features and types of interaction in interactive videos.

The findings of this study indicate a notable disparity in the test scores of students who utilise interactive videos in web-based courses, with regard to their levels of technology proficiency and digital literacy. The study also demonstrated a significant disparity in technology proficiency and digital literacy levels between students who utilized interactive videos and those who did not. Students who utilise interactive videos demonstrate superior performance in both technology proficiency and digital literacy. The study found that students who use interactive videos tend to hold positive attitudes towards technology. Furthermore, the findings indicated that students perceived the use of interactive videos to be an effective means of acquiring substantial knowledge and skills related to these concepts, with improvements observed in their technology proficiency and digital literacy levels. Consequently, the study is expected to provide guidance to professionals in this field on the use of interactive videos, environments where interaction is prioritised, and the preparation of activities or materials.

Limitations, Suggestions and Future Studies

The study group consisted of 90 first-year students enrolled in the Faculty of Education. The researcher's direct involvement in conducting the courses may have influenced the study outcomes. The researcher oversaw the entire application process, which could be considered a potential limitation of the study. To ensure efficient execution and manage the application process, the study was conducted over a seven-week period. Another limitation was the students' lack of prior experience with interactive videos in their courses. Additionally, conducting the lessons online could be seen as a limitation in the study's implementation. Considering these constraints, future research in this context should address the following implications:

- The study group consisted of pre-service teachers. Future studies could involve students from different undergraduate or associate degree programs.
- The study examined the effects of interactive video use on students' technology proficiency and digital literacy levels. Future research could explore the impact of interactive videos on various variables.
- Future studies could investigate the effects of different technologies used in lessons on students' technology proficiency and digital literacy levels.
- The study's application phase lasted seven weeks. Future studies could extend this period to explore longer-term effects.
- Participants in the study had no prior experience with interactive videos. To enhance future study effectiveness, students with interactive video experience could be included.
- Based on the study's results and findings, several recommendations were made for researchers and teachers.
- The study focused on the effects of using interactive video in a web-based information technology course on teacher candidates' technology proficiency and digital literacy levels. Future studies could encompass a wider range of courses, research groups, and variables.
- The study did not investigate the research group's readiness for interactive video use. Future studies might consider assessing students' readiness levels to enhance study effectiveness.
- Students generally viewed the use of interactive videos positively. Thus, expanding the use of interactive videos in educational settings and activities could be beneficial.
- A limitation of the study was that devices used to watch videos had to be connected to the internet. Future studies could increase applicability by ensuring videos can be viewed offline.
- While some interactive videos in the study included discussion-based interactions, they primarily emphasized individual work. Therefore, future studies could diversify interactions to emphasize collaborative and group work.

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Conflicts of Interest

There is no conflict of interest in the study

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The researcher completed his doctorate Department of Computer and Instructional Technologies Education. He is currently working as a assistant professor doctor in the Computer Aided Design and Animation program, Department of Computer Technologies. The researcher's areas of interest are education and instructional technologies, computer-aided instruction, interactive videos in education,

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