

The Effects of Captioning Videos on Academic Achievement and Motivation: Reconsideration of Redundancy Principle in Instructional Videos

Muzaffer Ozdemir*, Serkan Izmirli and Ozden Sahin-Izmirli

Department of Computer Education and Instructional Technologies, Canakkale Onsekiz Mart University, Turkey

// mozdemir@comu.edu.tr // sizmirli@gmail.com // osahinizmirli@gmail.com

*Corresponding author

(Submitted March 12, 2015; Revised December 11, 2015; Accepted January 19, 2016)

ABSTRACT

The purpose of the present study was to investigate the effect of captioned vs. non-captioned instructional videos on the motivation and achievement. To this end, a pre-test and post-test experimental design was used on 109 sophomores from a Turkish state university. Videos with and without captions of the unit in question were prepared by the lecturer of the course “Graphics and Animation in Education.” The first group (captioned video group; $n = 57$) studied the applied dimension of the course with captioned videos but the second group (non-captioned video group; $n = 52$) studied without captions. Qualitative and quantitative data were collected for study. Quantitative data were collected via academic achievement test and instructional materials motivation survey while qualitative data were collected by means of focus group interviews to substantiate the quantitative data. The findings indicated that, in contrast to the suggestion of the redundancy principle, motivation and achievement scores of students do not vary according to the instructional video type under investigation (captioned vs. non-captioned). Thereby, it was concluded that a moderating effect of the streaming feature of instructional material should be considered to interpret the redundancy effect. However, further research is needed to better reveal this moderating effect.

Keywords

Redundancy principle, Multimedia, Captioned videos, Motivation

Introduction

As advances in educational technology can be of considerable benefit, they may inhibit rather than facilitate learning unless they are adapted to the human cognitive system (Leslie, Low, Jin, & Sweller, 2012). To achieve such an adaptation, it is required in educational settings to convey instructional messages to students effectively. The instructional messages can be communicated audibly and/or visually to the students (Kalyuga, 2012) by means of interactive multimedia that presents instructional materials in various combinations of on-screen texts, images, video, audio, and animation (Adesope & Nesbit, 2012). Many instructional designers frequently suggest that both audible and visual presentation of the same verbal information is likely to enhance learning. However, theoretically speaking, it is claimed that if students are provided with spoken and written texts simultaneously, the working memory will be overloaded (Kalyuga, Chandler, & Sweller, 2004; Sweller, Merriënboer, & Paas, 1998). This is called the “redundancy effect” in the related literature. The majority of studies on the redundancy effect used spoken-written presentations (i.e., audiobooks, lectures added spoken-written narrations by instructors, as well as subtitled television programs/videos) (Adesope & Nesbit, 2012).

Multimedia spoken-written presentations can be classified according to whether they have streaming or not. This streaming feature provides more interactivity to presented content compared to other educational presentations (Hartsell & Yuen, 2006). Thus, they help in understanding complex concepts and procedures that cannot be explained in a simple way with text and graphics (Klass, 2003). Instructional videos and TV programs can be given as examples of full streaming formats in which educational content is entirely presented to students as full streams. Other presentation formats (i.e., animation and audiobooks but not videos and TV programs) can be given as examples of non-streaming or partial streaming formats. The partial streaming format contains at least one video clip.

In the literature on the redundancy effect, few studies have investigated full streaming presentations such as instructional videos (e.g., Adegoke, 2010; Jadin, Gruber, & Batinic, 2009; Linebarger, 2001; Perez, Van Den Noortgate, & Desmet, 2013; Yüksel & Tanrıverdi, 2009; Winke, Gass, & Sydorenko, 2010). However, there are many studies that reported on educational non-streaming or partial streaming presentations such as animation and concurrent narration, spoken narration with the printed text and documents consisting of diagrams and spoken information (e.g., Mousavi, Low, & Sweller, 1995; Mayer, Heiser, & Lonn, 2001; Moreno & Mayer, 2002; Craig, Gholson, & Driscoll, 2002; Craig, Driscoll, & Gholson, 2004; Kalyuga et al., 2004; Chu, 2006;

Jamet & Le Bohec, 2007; Diao & Sweller, 2007; Diao, Chandler, & Sweller, 2007; Gerjets, Scheiter, Opfermann, Hesse, & Eysink, 2009; Rias & Zaman, 2010; Montali & Lewandowski, 1996; McNeill, 2004; Debuse, Hede, & Lawley, 2009; Chang, Lei, & Tseng, 2011; Samur, 2012; Schüler, Scheiter, & Gerjets, 2013; Mayer & Johnson, 2008, Ari et al., 2014). Hence, more studies are needed with instructional videos examined in reference to the redundancy effect. In addition, Mayer, Lee, and Peebles (2014) suggested that more comprehensive studies should be carried out to determine whether captioned instructional videos contribute to student learning. Therefore, this study compared “teaching with a captioned instructional video” with “teaching with a non-captioned instructional video” by taking the redundancy effect into consideration.

Instructional videos

Instructional videos can be described as powerful media that can provide narrative visualization and engage multiple senses of the students simultaneously (Palmer, 2007). The “watch again” feature of instructional videos with a variety of control elements such as “play,” “pause” and “stop” is an important step in learning, which can help learners enrich their notes on the subject (Whatley & Ahmad, 2007). Instructional videos also not only provide an environment for the learners to learn at the speed, time and setting they can decide, but also allow them to learn independently of others (Chan, 2010). Instructional videos, the preparation and dissemination of which has become quite easy thanks to advancements in modern information and communication technologies, play an important role in auditory and visual transfer of the instructional message to the learner. Videos are now widely used for the dissemination of the instructional content of applied sciences and language teaching (e.g., <http://englishcentral.com>; Aldera & Mohsen, 2013; Dufour, Cuggia, Soula, Spector, & Kohler, 2007). For example, the efficacy of instructional videos in physics, chemistry, biology, engineering, medicine and anatomy has been the focus of many researchers (e.g., Constantinou & Papadouris, 2004; Palmer, 2007; Aronson, Plass, & Bania, 2012; Hakkarainen, 2009; El-Sayed & El- Raouf, 2013; Holland, Smith, McCrossan, Adamson, Watt, & Penny, 2013). Similarly, instructional videos have enriched the curricula of such applied fields as teacher training (e.g., Moreno & Ortegano-Layne, 2008; Borko, Jacobs, Eiteljorg, & Pittman, 2008; So, Pow, & Hung, 2009), software programming, and graphic and web design.

Using captions in instructional videos

Captions are word-for-word translations of dialogues in videos, and can generally be inserted in videos in consideration of the figure-ground relation (Udo & Fels, 2010). Audiences mostly claim that captions are quite motivating in understanding the narrated and displayed content (Danan, 2004; Koolstra & Beentjes, 1999; Koskinen, Wilson, Gambrell, & Neuman, 1993). Nowadays, captions can be added easily to instructional videos by instructors or instructional designers by means of programs like Adobe Premier and Camtasia. Captions in instructional videos provide multisensory information allowing students to view the narration and written words in a synchronized way (Aldera & Mohsen, 2013). Due to all these aforementioned benefits, the use of annotations and captions in instructional videos to facilitate comprehension has been adopted by many teachers and researchers (Yüksel & Tanrıverdi, 2009).

Redundancy effect in captioning instructional videos

According to the cognitive theory of multimedia learning, there are different processing systems for visual and verbal information, and learning occurs by establishing connections between visual and verbal channels each of which has a limited processing capacity (Jamet & Le Bohec, 2007). The main claim of the redundancy principle, which is based on the cognitive theory of multimedia learning, is that students learn better when animation/illustration and narration are presented without written texts rather than when animation/illustration and narration are presented together with written words (Mayer, 2001; Mayer, 2005; Mayer, 2009; Mayer & Moreno, 2002; Mayer & Moreno, 2003). In other words, the redundancy effect suggests that the animated/illustrated and narrated presentation of an instructional video content affects the learning process more positively in contrast to an animated/illustrated and narrated presentation accompanied by captions or other written texts.

Most studies performed on captioning instructional videos did not support the redundancy principle. For example, in a study conducted by Linebarger (2001), it was found that audio and captions used in videos helped students to focus on the central elements by triggering their reading efforts. A study that utilized instructional material prepared by means of Microsoft PowerPoint, and then converted to instructional video format, revealed that students in the animation + narration + caption group got higher scores in physics achievement tests. They

also displayed an increase in the level of their interest according to the physics inventory compared to those of other treatment conditions (animation + captions only, animation + narration only, conventional lecture method) (Adegoke, 2010). In addition to these studies, Perez et al. (2013) investigated the effects of watching captioned instructional videos on listening comprehension and vocabulary in foreign language teaching, and they found considerable influence of captions in both cases. In another study, Winke et al. (2010) concluded that captioned videos were more effective than non-captioned videos in foreign language listening activities. In a study conducted on the use of video-based e-lecture presentations, Jadin et al. (2009) discovered that the presentation mode of the learning content (presentation of content with vs. without synchronized written transcript of the oral presentation) did not affect students' learning outcomes. Similarly, Yüksel and Tanrıverdi (2009) did not find a significant difference between the achievement levels of student groups after watching a movie with vs. without captioning.

As shown in the literature, when the achievement levels of the captioned and non-captioned video groups were compared, either the first group was more successful than the other, or there was no meaningful difference between them. Therefore, it would not be wrong to say that more studies are needed in reference to the redundancy effect on instructional videos. From this viewpoint, the current study aims to investigate, in consideration of the redundancy principle, the effect of using captioned instructional videos as supplementary course material on the academic achievement and motivation of university students. To this end, this study sought answers to the following research question: "Do the motivation and achievement scores of students vary according to the captioned or non-captioned instructional videos?"

Method

Design and participants

The experimental design was used in the study. In this respect, the dependent variables were academic achievement and motivation, while the independent variable was video-assisted instruction (captioned vs. non-captioned). The participants were 109 sophomores of the Computer Education and Instructional Technology Department at Çanakkale Onsekiz Mart University in Turkey. Fifty-seven students (34 male, 23 female, average age = 21) comprised the caption group, while the non-caption group consisted of 52 students (34 male, 18 female, average age = 21). Participants did not know whether they were assigned to a "caption" and "non-caption" group. All of the participants had computers and internet access at their place of residence (flats, dormitories, etc.). At the end of the intervention, an achievement test and a motivation survey were administered to both groups. Additionally, qualitative data were collected to substantiate the quantitative findings. More specifically, a focus group interview was conducted with the participants. Eight voluntary students (4 students from each group) participated in the focus group interview, which was voice-recorded.

Data collection tools and materials

Achievement test (applied test)

A seven-item applied test was developed for evaluation of the unit "The Use of Adobe Flash CS5 Tools and Basic Animation Methods." Cronbach's Alpha internal consistency coefficient was found to be $\alpha = .76$ for the pretest and $\alpha = .71$ for the post test. Two lecturers carried out the marking independent of each other.

Soru 4 (15 Puan)

Yandaki resme tıklayınız ve animasyonu izleyiniz.

Bu animasyonu Flash Programı'ndaki **Shape Tween** Animasyon olayını kullanarak hazırlayınız.

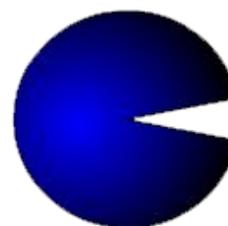


Figure 1. A sample question from the applied test [Question 4 (15 points)/Click on the following image and create this animation by using Shape Tweening on Flash Program]

As a result of this process, inter-rater reliability of the raters was found to be .95. According to Nunnally and Bernstein (1994), a value over .70 indicates that the internal consistency of the scale has been achieved. The

applied test was administered at a computer laboratory under the supervision of a proctor. The questions were presented via the Moodle Learning Management System. Students were given output files in the “.swf file format” (Figure 1) and asked to create their source files in the “.fla” file format. They created the source files and uploaded them to the Moodle platform.

Motivation survey

Motivation, which is defined as the direction and magnitude of a particular behavior, is an indicator of the effort expended on a subject (Keller, 1983). Motivation and learning are two concepts that complete each other, regardless of the environment (Schunk, 1996). Besides, the design of a given instructional environment may affect both motivation and learning (Dennen & Myers, 2010). From this perspective, each component of the ARCS model, which offers a systematic model for motivating instructional design (Orey, McClendon, & Branch, 2006), provides principles and strategies to increase learning motivation (Dennen & Myers, 2010). The ARCS model has four basic components consisting of the following (Keller, 1983). The [A]ttention component includes strategies to maintain and improve students’ curiosity and interest. The [R]elevance component involves strategies associated with students’ needs, interests and motivations. The [C]onfidence component comprises strategies that will ensure the continuous attendance and achievement of students. Finally, the [S]atisfaction component contains strategies that offer students internal and external reinforcements.

The Turkish version (Kutu & Sözbilir, 2011) of the ARCS Instructional Materials Motivation Survey originally developed by Keller (1987) was used to evaluate the effect of the use of supplementary captioned videos for the course on students’ motivation. While the original survey contained four dimensions, namely attention, relevance, confidence and satisfaction, the Turkish adaptation covered only two dimensions (attention-relevance and confidence-satisfaction) with a Cronbach’s Alpha value of $\alpha = .83$. An assessment tool might be reliable in a particular setting, yet unreliable in another setting or when used for another purpose (Vockell & Asher, 1995). Therefore, *a priori* application was carried out to explore whether the Turkish version would yield reliable results in the target group. In this *a priori* application, the ARCS motivation survey was administered on 111 juniors who were studying in the same department as the target group at the time of data collection. The *a priori* application yielded a Cronbach’s Alpha internal consistency coefficient of $\alpha = .90$ (.86 for attention-relevance and .87 for confidence-satisfaction), which signified that the survey was reliable (Nunnally & Bernstein, 1994), and could be administered on the target group. In the current study, Cronbach’s Alpha internal consistency coefficient was calculated to be $\alpha = .92$ (.85 for attention-relevance and .88 for confidence-satisfaction). Two sample items of the Instructional Materials Motivation Survey were “I could not really understand quite a bit of the material in this lesson.” and “The way the information is arranged on the pages helped keep my attention.”

Focus group interview form

The focus group interview form consisted of four open-ended questions. The form contained items about “the effect of the presence or absence of captions in the instructional video on the participants’ motivation and learning” and “which one they would prefer, and why.”

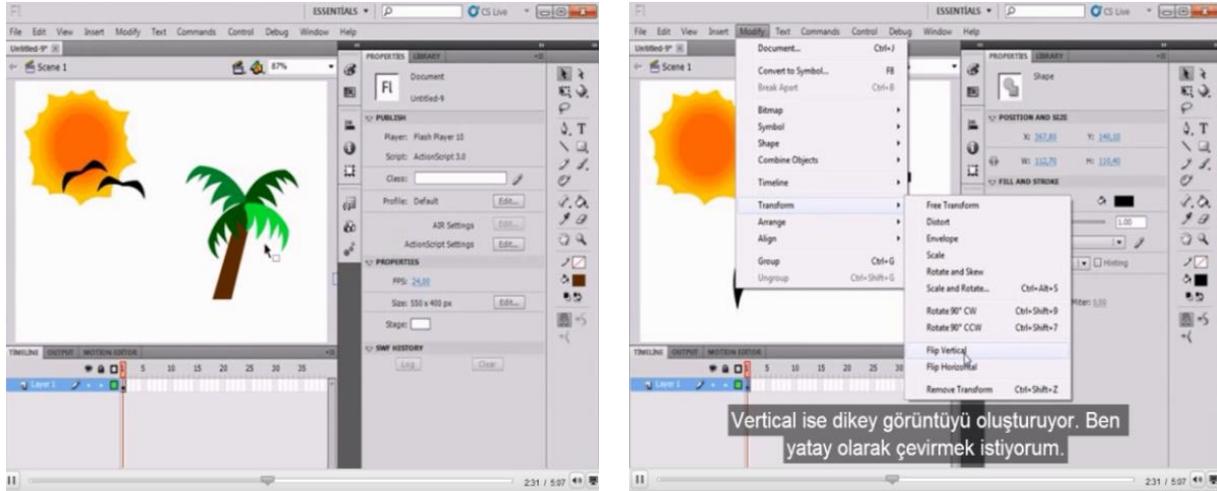
Captioned and non-captioned videos

Applications in the unit of “Using Adobe Flash CS5 Tools and Basic Animation Methods” course were video-recorded by the lecturer to be used in the course “Graphics and Animation in Education.” The videos were captioned by the same lecturer. The videos were captioned for the captioned video group but not for the non-captioned one (Figure 2). Separate video segments for each application of the unit were packaged to create learning objects in SCORM standards, and uploaded to the Moodle Learning Management System to collect their tracking data.

Implementation process

The implementation process took a total of six weeks. In the first week, an applied test (pretest) was administered both to the captioned video group and the non-captioned one to assess their initial achievements in the unit. No significant difference was found between the achievement scores of the groups ($t(107) = -1.43$, $p < .05$), which meant that they did not have prior knowledge. From the second week on, the instructor lectured

about the theoretical dimension of the unit for four weeks. The lecturer worked face-to-face with both groups in the first two hours of the weekly four-hour course. During the remaining two hours, the students studied only with instructional videos on the Moodle Learning Management System. In the sixth week following the completion of the unit, firstly a motivation survey and then an achievement test were administered to the students in the computer laboratory. A focus group interview was also conducted on the participants at the venue and mutually agreed upon by them and the researcher. The interview lasted 1 hour and 20 minutes.



a) Non-captioned Video

b) Captioned Video (*Caption: "Vertical" also creates a vertical image. But I want to flip it horizontally*)

Figure 2. Sample screenshots of captioned and non-captioned videos

Data analysis

SPSS was used for the analyses of the quantitative data, and NVIVO for the analyses of qualitative data. One way MANOVA was used to find out whether the motivation and achievement scores of students varied with the captioning or non-captioning conditions of the instructional videos. Qualitative data were analyzed via a descriptive analysis method because the conceptual structure and themes (effects of captioned and non-captioned videos on academic achievement and motivating factors) of the study were determined in advance. The simultaneous use of quantitative and qualitative data increases the validity and reliability of a study (Creswell, 2013). The qualitative data were analyzed by two independent researchers. It was concluded that reliability (Miles & Huberman, 1994) was 84% for the first question, 93% for the second, 91% for the third and 86% for the fourth question. Quotes were given in the following format (Captioned/Non-captioned group, Participant [1-8], temporal data).

Findings

The mean score of academic achievement was 62.18 ($SD = 21.12$) for the captioned group whereas it was 61.66 ($SD = 24.24$) for the non-captioned group. On the one hand, the mean score of motivation was 4.13 ($SD = .55$) for the captioned group while it was 3.92 ($SD = .49$) for the non-captioned group. Given the motivation dimensions, attention-relevance dimension's mean score was 4.25 ($SD = .53$) for the captioned group and 4.11 ($SD = .56$) for the non-captioned group. In addition, confidence-satisfaction dimension's mean score was 4.02 ($SD = .63$) for the captioned group and 3.77 ($SD = .53$) for the non-captioned group.

The one-way MANOVA revealed that the motivation level and achievement scores of the participants did not vary with or without the use of captions in instructional videos. ($F(2, 106) = 2.07, p = .132$; Wilks' Lambda = .962; partial eta squared = .038; observed power = .417). In other words, the motivation and achievement scores of the caption and non-caption groups showed no significant difference.

According to qualitative findings about achievement, the participants summarized the probable effects of the captioned and non-captioned instructional videos on their learning process as follows; "We may not have understood some parts because the videos didn't have captions. Then, we had to rewind the video and watch the unintelligible parts over and over. We listened to [the narration] again. In the end, we could understand but

wasted some time doing it.” (Non-captioned group, Participant 6, 14:12). Another student had this to say, “Because the material was prepared by the lecturer himself rather than because of the caption, I could follow the streaming and therefore managed to complete the application.” (Captioned group, Participant 4, 18:50).

According to the qualitative findings of the study, the effect of the captioned and non-captioned instructional videos on the participants’ motivation level was as indicated in Figure 3.

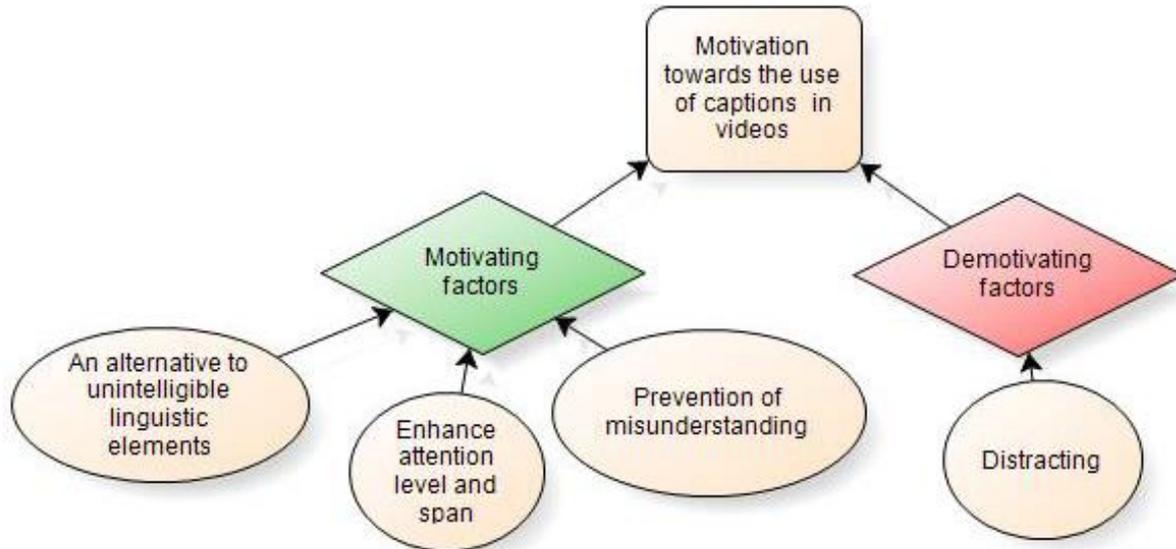


Figure 3. Effects of use of captions in instructional videos on learners’ motivation

Some students remarked that captions facilitated the understanding of a hard-to-understand segment. One of them said, “I was in the non-caption group, but it would be better if the video were captioned... The teacher streamed one part of the video so fast that I probably watched that part over and over for about 5 minutes. If it was captioned, then I would have rewind just once, and I would have done it by following the captions and successfully completed the application.” (Non-captioned group, Participant 8, 17:30).

Some students ($n = 2$) warned that captions might cause distractions in some cases, while some others ($n = 5$) stated that captions might play a positive role on sustaining attention in lectures. One such student said about the effect of captions on enhancing attention level and span that “Because it is an applied subject if you got distracted, you would not be able to come back. Just relying on the sound might make it difficult to follow the course, even if the teacher showed us on the screen. Captions would facilitate keeping up with the flow of the course, and increasing attention level.” (Non-captioned group, Participant 5, 37:00). Another student disagreed with this view suggesting, “...it is true that sometimes going back to unknown words adversely affected us, but I think a wholly captioned video would distract me.” (Non-captioned group, Participant 7, 29:58).

On the motivating effect of captions regarding prevention of misunderstanding, one participant offered the following opinion: “Sometimes it might be hard to understand whether the teacher said “Ctrl + D” or “Ctrl+ B”. We could clearly understand what he said when we checked out the captions. This is pretty comforting and motivating...” (Non-captioned group, Participant 8, 31:30), says he.

Even though the number of those who stated that captions motivated them was quite high, there were also some complaints about the adverse effects of captioning. Some suggested that students should be able to make the captions visible or invisible as they desired. One said, “...it is rather difficult to follow the instructions while doing what is said. It would be better if the captions could be hidable.” (Captioned Group, Participant 2, 58:04).

Discussion and conclusions

This study investigated whether the captions used in instructional videos had a significant impact on students’ achievement and motivation. In contrast to the suggestion of the redundancy principle, it was shown that the motivation and achievement scores of the participants were not significantly influenced by the captioning or non-captioning of instructional videos used in a course. Jadin et al. (2009) (video-based e-lecture) and Yüksel and Tanrıverdi (2009) (captioning movie), who used instructional materials with a streaming feature in their studies

did not find any significant difference in terms of achievement level. In this respect, the findings of the present study supported the findings of these prior studies. In addition, a reverse redundancy effect (Moreno & Mayer, 2002) was revealed in some other studies (e.g., Adegoke, 2010; Linebarger, 2001; Perez et al., 2013; Winke et al., 2010) in which instructional videos with the streaming feature were used. Consequently, the majority of the studies that were conducted on captioning instructional videos did not support the redundancy principle claims.

The research findings of this study could have been affected by the streaming feature of the instructional material used. In their meta-analysis study on verbal redundancy, Adesope and Nespit (2012) found that moderating variables such as the pacing of presentation, degree of correspondence between audio and text, segment size and inclusion of images or animation should be taken into consideration while interpreting the redundancy effect. However, one moderating variable they missed was the streaming feature of instructional material: animation and audiobooks can be examples of non/partial streaming formats while video and TV programs can be examples of full streaming formats. The moderating effect of the streaming feature of instructional material on redundancy should be further studied. From this viewpoint, the present study is considered to be beneficial in bringing about a new perspective on the redundancy principle as well as encouraging further research into the issue under discussion.

The research findings of this study could be affected by the subject type (theoretical or applied). In this study, the redundancy principle was investigated in the context of the instruction of an applied subject (practice regarding use of the Adobe Flash Program). According to Schwartzman and Henry (2009), the two elements that underlie applied learning are “concrete experience” and “learning by doing.” However, a review of the literature showed that almost all previous studies focused on the teaching of theoretical subjects (e.g., Chu, 2006; Craig et al., 2002, Experiment 2; Diao et al., 2007; Diao & Sweller, 2007; Gerjets et al., 2009; Jamet & Le Bohec, 2007; Kalyuga et al., 2004, Experiment 3; Mayer et al., 2001, Experiment 1; Rias & Zaman, 2010; Adegoke, 2010; Chang et al., 2011; Debusse et al., 2009; Jadin et al., 2009; Linebarger, 2001; McNeill, 2004; Montali & Lewandowski, 1996; Perez et al., 2013; Samur, 2012; Winke et al., 2010; Yüksel & Tanrıverdi, 2009). Therefore, research investigating the redundancy principle in the context of subject type (theoretical or applied) is a necessity.

According to the qualitative data, it was found that captions help motivate students by enhancing the comprehensibility of the narration and keeping the students alert. Therefore, it can be suggested that the unintelligibility of verbal statements in non-captioned videos cause students to feel somewhat insecure. On the contrary, students feel more motivated if captioned instructional videos are used in a course because they can more easily catch up with the flow of the narration. Findings that reveal that captions are both distracting and comforting at the same time can be perceived as contradictory, as one student’s suggestion that “the captions should be visible if need be” revealed. The qualitative findings regarding motivation do not support the quantitative findings (No significant difference was found.). Although motivation score in the captioned group ($M = 4.13$; $SD = .55$) was higher than that in the non-captioned group ($M = 3.92$; $SD = .49$), the difference was not significant. In addition, the value pertaining to the statistical power of the finding is very low (power < .80). From this perspective, further research is needed to investigate the motivation and achievement variables in similar studies.

Mayer and Johnson (2008) stated that the studies on the redundancy principle were carried out as short-term laboratory experiments and that this issue should be investigated in more realistic educational settings. Accordingly, this study was conducted in a realistic educational setting and, in a longer term, which differentiates it from other similar studies in the literature. Furthermore, the instructional video used in this study was intrinsically learner-paced. To put it more clearly, the theoretical parts of the subjects were presented face-to-face and the application sections were taught through instructional videos.

The participants’ repeated watching of the videos might have contributed to their learning process. Also, face-to-face lecturing of the theoretical dimension of the subject and/or students’ re-watching the videos might have eliminated the probable adverse effects of the captioned videos. Therefore, the data collected in this study on the effects of captioned and non-captioned videos on learner achievement and motivation needs to be substantiated by further research, which can additionally investigate video narration of theoretical dimensions.

References

Adegoke, B. A. (2010). Integrating animations, narratives and textual information for improving Physics learning and listening skills. *Electronic Journal of Research in Educational Psychology*, 8(2), 725-748.

- Adesope, O. O., & Nesbit, J. C. (2012). Verbal redundancy in multimedia learning environments: A Meta-analysis. *Journal of Educational Psychology, 104*(1), 250-263.
- Aldera, A. S., & Mohsen, M. A. (2013). Annotations in captioned animation: Effects on vocabulary learning and listening skills. *Computers & Education, 68*, 60-75.
- Ari, F., Flores, R., Inan, F. A., Cheon, J., Crooks, S. M., Paniukov, D., & Kurucay, M. (2014). The Effects of verbally redundant information on student learning: An Instance of reverse redundancy. *Computers & Education, 76*, 199-204.
- Aronson, I. D., Plass, J. L., & Bania, T. C. (2012). Optimizing educational video through comparative trials in clinical environments. *Educational Technology Research and Development, 60*(3), 469-482.
- Borko, H., Jacobs, J., Eiteljorg, E., & Pittman, M. E. (2008). Video as a tool for fostering productive discussions in mathematics professional development. *Teaching and Teacher Education, 24*(2), 417-436.
- Chan, Y. M. (2010). Video instructions as support for beyond classroom learning. *Procedia-Social and Behavioral Sciences, 9*, 1313-1318.
- Chang, C. C., Lei, H., & Tseng, J. S. (2011). Media presentation mode, English listening comprehension and cognitive load in ubiquitous learning environments: Modality effect or redundancy effect? *Australasian Journal of Educational Technology, 27*(4), 633-654.
- Chu, S. L. (2006). *Investigating the effectiveness of redundant text and animation in multimedia learning environments* (Unpublished doctoral dissertation). University of Central Florida Orlando, Florida.
- Constantinou, C. P., & Papadouris, N. (2004). Potential contribution of digital video to the analysis of the learning process in Physics: A Case study in the context of electric circuits. *Educational Research and Evaluation, 10*(1), 21-39.
- Craig, S. D., Driscoll, D. M., & Gholson, B. (2004). Constructing knowledge from dialog in an intelligent tutoring system: Interactive learning, vicarious learning, and pedagogical agents. *Journal of Educational Multimedia and Hypermedia, 13*(2), 163-183.
- Craig, S. D., Gholson, B., & Driscoll, D. M. (2002). Animated pedagogical agents in multimedia educational environments: Effects of agent properties, picture features, and redundancy. *Journal of Educational Psychology, 94*(2), 428-434.
- Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, CA: Sage publications.
- Danan, M. (2004). Captioning and subtitling: Undervalued language learning strategies. *Meta: Journal des traducteurs/Translators' Journal, 49*(1), 67-77.
- Debusse, J. C., Hede, A., & Lawley, M. (2009). Learning efficacy of simultaneous audio and on-screen text in online lectures. *Australasian Journal of Educational Technology, 25*(5), 748-762.
- Dennen, V., & Myers, J. (2010). Podcast pedagogy: Message design, motivation, and learning. In J. Sanchez & K. Zhang (Eds.), *Proceedings of E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2010* (pp. 43-49). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).
- Diao, Y., Chandler, P., & Sweller, J. (2007). The Effect of written text on learning to comprehend spoken English as a foreign language. *American Journal of Psychology, 120*, 237-261.
- Diao, Y., & Sweller, J. (2007). Redundancy in foreign language reading comprehension instruction: Concurrent written and spoken presentations. *Learning and Instruction, 17*(1), 78-88.
- Dufour, J. C., Cuggia, M., Soula, G., Spector, M., & Kohler, F. (2007). An Integrated approach to distance learning with digital video in the French-speaking Virtual Medical University. *International Journal of Medical Informatics, 76*(5), 369-376.
- El-Sayed, R. E. S. H., & El-Raouf, S. E. H. A. (2013). Video-based lectures: An Emerging paradigm for teaching human anatomy and physiology to student nurses. *Alexandria Journal of Medicine, 49*(3), 215-222. doi:10.1016/j.ajme.2012.11.002
- Gerjets, P., Scheiter, K., Opfermann, M., Hesse, F. W., & Eysink, T. H. (2009). Learning with hypermedia: The Influence of representational formats. *Computers in Human Behavior, 25*(2), 360-370.
- Hakkara, P. (2009). Designing and implementing a PBL course on educational digital video production: Lessons learned from a design-based research. *Educational Technology Research and Development, 57*(2), 211-228.
- Hartsell, T., & Yuen, S. C. Y. (2006). Video streaming in online learning. *AACE Journal, 14*(1), 31-43.
- Holland, A., Smith, F., McCrossan, G., Adamson, E., Watt, S., & Penny, K. (2013). Online video in clinical skills education of oral medication administration for undergraduate student nurses: A Mixed methods, prospective cohort study. *Nurse Education Today, 33*(6), 663-670.

- Jadin, T., Gruber, A., & Batinic, B. (2009). Learning with e-lectures: The Meaning of learning strategies. *Educational Technology & Society*, 12(3), 282–288.
- Jamet, E., & Le Bohec, O. (2007). The Effect of redundant text in multimedia instruction. *Contemporary Educational Psychology*, 32(4), 588–598.
- Kalyuga, S. (2012). Instructional benefits of spoken words: A Review of cognitive load factors. *Educational Research Review*, 7(2), 145–159.
- Kalyuga, S., Chandler, P., & Sweller, J. (2004). When redundant on-screen text in multimedia technical instruction can interfere with learning. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 46(3), 567-581.
- Keller, J. M. (1983). Motivational design of instruction. In C. M. Reigeluth (Ed.), *Instructional design theories and models: An overview of their current status* (pp. 384-434). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Keller, J. M. (1987). *IMMS: Instructional materials motivation survey*. Tallahassee, FL: Florida State University.
- Klass, B. (2003). Streaming media in higher education: Possibilities and pitfalls. *Syllabus*, 16(11). Retrieved from <http://campustechnology.com/articles/2003/05/streaming-media-in-higher-education-possibilities-and-pitfalls.aspx>
- Koolstra, C. M., & Beentjes, J. W. (1999). Children's vocabulary acquisition in a foreign language through watching subtitled television programs at home. *Educational Technology Research and Development*, 47(1), 51-60.
- Koskinen, P. S., Wilson, R. M., Gambrell, L. B., & Neuman, S. B. (1993). Captioned video and vocabulary learning: An Innovative practice in literacy instruction. *The Reading Teacher*, 47(1), 36-43.
- Kutu, H., & Sözbilir, M. (2011). Öğretim materyalleri motivasyon anketinin Türkçeye uyarlanması: Güvenirlik ve geçerlik çalışması [Teaching materials be adapted to Turkish motivation survey: Reliability and validity]. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi*, 5(1), 292-312.
- Leslie, K. C., Low, R., Jin, P., & Sweller, J. (2012). Redundancy and expertise reversal effects when using educational technology to learn primary school science. *Educational Technology Research and Development*, 60(1), 1-13.
- Linebarger, D. L. (2001). Learning to read from television: The Effects of using captions and narration. *Journal of Educational Psychology*, 93(2), 288-298.
- Mayer, R. E. (2001). *Multimedia learning*. New York, NY: Cambridge University Press.
- Mayer, R. E. (2005). Cognitive theory of multimedia learning. In *The Cambridge handbook of multimedia learning* (pp. 31-48). New York, NY: Cambridge University Press
- Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). New York, NY: Cambridge University Press.
- Mayer, R. E., & Johnson, C. I. (2008). Revising the redundancy principle in multimedia learning. *Journal of Educational Psychology*, 100(2), 380-386.
- Mayer, R. E., & Moreno, R. (2002). Animation as an aid to multimedia learning. *Educational psychology review*, 14(1), 87-99.
- Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational psychologist*, 38(1), 43-52.
- Mayer, R. E., Heiser, J., & Lonn, S. (2001). Cognitive constraints on multimedia learning: When presenting more material results in less understanding. *Journal of Educational Psychology*, 93(1), 187-198.
- Mayer, R. E., Lee, H., & Peebles, A. (2014). Multimedia learning in a second language: A Cognitive load perspective. *Applied Cognitive Psychology*, 28(5), 653-660.
- McNeill, A. L. (2004). *The Effects of training, modality, and redundancy on the development of a historical inquiry strategy in a multimedia learning environment* (Doctoral dissertation, Virginia Polytechnic Institute and State University). Available from ProQuest Dissertations and Theses database. (AAT 3142239)
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis* (2nd ed.). Thousand Oaks, CA: Sage.
- Montali, J., & Lewandowski, L. (1996). Bimodal reading: Benefits of a talking computer for average and less skilled readers. *Journal of learning disabilities*, 29(3), 271-279.
- Moreno, R., & Mayer, R. E. (2002). Verbal redundancy in multimedia learning: When reading helps listening. *Journal of Educational Psychology*, 94(1), 156–163.
- Moreno, R., & Ortegano-Layne, L. (2008). Do classroom exemplars promote the application of principles in teacher education? A Comparison of videos, animations, and narratives. *Educational Technology Research and Development*, 56(4), 449-465.

- Mousavi, S. Y., Low, R., & Sweller, J. (1995). Reducing cognitive load by mixing auditory and visual presentation modes. *Journal of educational psychology*, 87(2), 319-334.
- Nunnally, J. C., & Bernstein, I. R. (1994). *Psychometric theory* (3rd ed.). New York, NY: McGraw-Hill.
- Orey, M., McClendon, V. J., & Branch, R. M. (2006). *Educational media and technology yearbook*. Englewood, CO: Libraries Unlimited.
- Palmer, S. (2007). An Evaluation of streaming digital video resources in on-and off-campus engineering management education. *Computers & Education*, 49(2), 297-308.
- Perez, M. M., Van Den Noortgate, W., & Desmet, P. (2013). Captioned video for L2 listening and vocabulary learning: A Meta-analysis. *System*, 41(3), 720–739.
- Rias, R. M., & Zaman, H. B. (2010). Investigating the redundancy effect in multimedia learning on a computer science domain. In *International Symposium in Information Technology (ITSim)* (Vol. 1, pp. 1-4). doi:10.1109/ITSIM.2010.5561341
- Samur, Y. (2012). Redundancy effect on retention of vocabulary words using multimedia presentation. *British Journal of Educational Technology*, 43(6), 166–170.
- Schunk, D. H. (1996). *Learning theories*. New Jersey, NJ: Printice Hall Inc.
- Schüler, A., Scheiter, K., & Gerjets, P. (2013). Is spoken text always better? Investigating the modality and redundancy effect with longer text presentation. *Computers in Human Behavior*, 29(4), 1590-1601.
- Schwartzman, R., & Henry, K. B. (2009). From celebration to critical investigation: Charting the course of scholarship in applied learning. *Journal of Applied Learning in Higher Education*, 1, 3-23.
- So, W. W. M., Pow, J. W. C., & Hung, V. H. K. (2009). The Interactive use of a video database in teacher education: Creating a knowledge base for teaching through a learning community. *Computers & Education*, 53(3), 775-786.
- Sweller, J., Merrienboer, J. V., & Paas, F. (1998). Cognitive architecture and instructional design. *Educational Psychology Review*, 10(3), 251–296.
- Udo, J. P., & Fels, D. I. (2010). The Rogue poster-children of universal design: Closed captioning and audio description. *Journal of Engineering Design*, 21(2-3), 207-221.
- Whatley, J., & Ahmad, A. (2007). Using video to record summary lectures to aid students' revision. *Interdisciplinary Journal of E-Learning and Learning Objects*, 3(1), 185-196.
- Winke, P., Gass, S., & Sydorenko, T. (2010). The Effects of captioning videos used for foreign language listening activities. *Language Learning & Technology*, 14(1), 65-86.
- Vockell, E. L., & Asher, J. W. (1995). *Educational research*. (2nd ed.). Englewood Cliffs, NJ: Prentice Hall.
- Yüksel, D., & Tanrıverdi, B. (2009). Effects of watching captioned movie clip on vocabulary development of EFL learners. *Turkish Online Journal of Educational Technology - TOJET*, 8(2), 48-54.