The effect of summaries in instructional videos on performance and learning

Bachelor thesis

T.E. Voerman
Onderwijskunde
Faculty of behavioral, management and social sciences

1st supervisor: Dr. Hans van der Meij
2nd supervisor: Dr. Jan van der Meij
University of Twente, Enschede
26-06-2015

UNIVERSITEIT TWENTE.

Abstract

The present study focuses on the integration of summaries in video tutorials (hence "videos") in order to find out the extent to which this enhances performance and learning. Little empirical research about these summaries in videos exists. Therefore, adjacent domains, such as summaries in text, are examined. The underlying rationale is that summaries in text support and enhance cognitive processes such as rehearsal, recall and retention and therefore enhance performance and learning. The limited number of studies done on summaries in videos suggests that this effect of summaries in text is also present in summaries in videos. In the present study, 65 participants of grade 5 and 6, divided into three conditions, got to see nine videos on lay-out tasks in Word 2010, followed by practice. The Control condition got to see the first two parts of a video, the preview and the demonstration. The Summary condition did this as well, but also got to see summaries directly after the demonstration. The Demo Twice condition got to see the preview and then the demonstration part twice. The videos used in the present study have improved the performance and learning of the participants substantially. Contrary to literature, no difference on performance and learning between conditions was found. This may be due to the construction of the experiment and accompanying videos used in the present study.

Introduction

With the rise of platforms like YouTube in 2005, applications like Vine in 2013 and video search databases such as Google Video, video has gained extreme popularity. Its growing popularity is not be restricted to recreational purposes, but is also expanded to other domains, such as education. The use of multimedia, in particular video, for instruction has become more and more implemented in the current classrooms. When it comes to video, this multimedia is likely to manifest itself in video tutorials (from now on simply called "videos"). Since videos are used more and more nowadays, the importance of the quality of these videos has become even more substantial to guarantee these positive effects on performance and learning. To ensure this quality, there is an ongoing demand to improve these videos. The present study tries to contribute to these improvements. Van der Meij and van der Meij (2013) have provided eight guidelines for producing instruction videos for procedural tasks. These guidelines include, for example, finding the ideal speed of the videos or making sure that the learners' attention is drawn towards the most important information. In follow-up studies, van der Meij and van der Meij suggest that the latter improvement can be realized by the use of predefined video summaries (van der Meij & van der Meij, 2015a; van der Meij & van der Meij, 2015b). This is the suggested improvement that the present study will focus on. Millions of learners around the world may experience increased benefits from videos by integrating summaries. The present study is performed to find out to what extent summaries in videos enhance performance and learning.

Unfortunately, little to no empirical research can be found on these summaries in videos for educational purposes. The reason for this is unknown, but the answer might lie in the fact that this domain of wide video access is only ten years old. So, from the point of curiosity, the present study has been conducted to go on a quest into this domain of relatively unexplored branch of educational science. Can brand-new answers be found or is there a specific reason why summaries in videos have been mostly overlooked in literature? To carry out research in this newly discovered domain is a challenge. In science, no stone should be left unturned in order to find out answers to questions that will contribute to the well-being and understanding of the world. Therefore, it is only logical that this field of study needs to be examined. This examining will start with an overview of the existing studies on videos as an instruction medium, summaries in videos and summaries in text, followed by an explanation of the cognitive processes that form the foundations for the effects of these summaries.

Theoretical basis

Videos. Videos as an instruction medium are usually designed to teach procedural knowledge (Ertelt, 2007). This can be taught best by the use of demonstrations, which can be presented in real-life or through the use of recordings (Woolfolk, Hughes & Walkup, 2008). The present study makes use of the latter, since it is directly related to videos. The recorded demonstrations show recorded behaviors and performances in a certain on-screen interface (Plaisant & Schneiderman, 2005). This way, the learners can observe a clear step-by-step example of the procedure and see the desired outcomes for themselves (van der Meij & van der Meij, 2015a). By doing so, the learners do not have to figure out the correct way themselves, which reduces the cognitive load. It is important to keep the cognitive load low in order to enable learners to learn effectively and not be overwhelmed with information that needs to be processed cognitively as is described by the theory of cognitive multimedia learning (Mayer, 2005). Perhaps most importantly, it prevents the learners from engaging in incorrect procedures.

When it comes to software training, videos are an appropriate choice when presenting congruent information in an authentic context (van der Meij & van der Meij, 2015a). Congruent information means that the objects shown in the video and the real life objects are compatible. Videos can create a realistic context for the learners, which can function as a meaningful environment for learning (Ertelt, 2007). In relation to this, videos can help demonstrate content in a context that may be difficult to pursue in real life (Wetzel, Radtke & Stern, in Ertelt, 2007), for example the teaching of first-aid procedures. Furthermore, videos are able to convey large amounts of information in a relatively short period of time (Ertelt, 2007).

From a practical point of view, videos that are recorded demonstrations are relatively easy to produce (Plaisant & Schneiderman, 2005). By the use of screen-recording programs such as Camtasia, anyone who is averagely skilled in using the computer and potentially skilled in video editing can create

these kinds of videos, which enables the practical usage of videos (Plaisant & Schneiderman, 2005). In general, videos are considered to be an excellent medium for instruction and widely accepted to have positive effects on the learners' performance and learning (e.g., Ertelt, 2007; van der Meij & van der Meij, 2015a).

Summaries in videos. Summaries in videos enhance retention (van der Meij & van der Meij, 2015a), because they provide cognitive scaffolds for cognitively rehearsing the learned content, whether this is self-activated or activated by the videos themselves (Leopold, Sumfleth & Leutner, 2013). Summaries in videos provide these scaffolds by structuring the information in a clear procedural way (van der Meij & van der Meij, 2015a).

Sarikcioglu, Senol, Yildirim and Hizay (2011) have found that summaries in the form of videos are widely accepted by the learners, regardless of their individual learning styles. These summaries were presented to the participants at the end of the lesson(s) that they summarized. Sarikcioglu et al. (2011) think summaries in the form of videos will motivate the learners more than summaries without multimedia, due to the entertainment factor of multimedia devices.

When a certain method has been proven effective in one medium, and this medium is similar to another medium, it is likely that this method will be effective in the other medium (Mayer, 2003). Because of this, it is relevant to look into adjacent domains where empirical research on summaries is abundantly present. Doing this will likely compensate for the limited amount of studies on summaries in videos. The most common use of summaries can be found in texts.

Summaries in text. Most texts are given structure by the use of signaling devices, such as headings, previews, typological cues and summaries, to help the reader to not only take note of the main points of the text, but also to remember them (Lorch, 1989). These "signaling" summaries are delimited portions of text and come in all shapes and sizes. Two major distinctions can be made to create categories within these shapes and sizes. The present study focuses on particular categories that are best suitable for the goal of this study.

The first major distinction that can be made between summaries is the position of the summary. Summaries can be positioned before and after the text they represent. The ideal position depends on the role the summary should fulfill.

When summaries are positioned before the text they represent, so-called *begin summaries*, they can help clarify the content of the text to help the learners decide whether they want to read the text or not (Hartley, Goldie & Steen, 1979). Also, when summaries are presented before the text, they can help the learners organize their thoughts about the text (Hartley et al., 1979).

When summaries are positioned after the text they represent, so-called *end summaries*, they aid the recall of the main points of the text (Hartley et al., 1979). End summaries, in contrary to begin summaries, provide scaffolds for the deep cognitive process of storing and/or retrieving information (Leopold et al., 2013; Lorch, 1989). By doing this, end summaries can enhance retention (van der Meij & van der Meij, 2014), which results in higher performance and learning. Since the present study is all about performance and learning, which, in text, can be enhanced by end summaries, the present study will focus on these end summaries only.

The second major distinction that can be made between summaries is the way they are produced. Summaries can be presented as predefined or they can be self-generated by learners. Although some contradicting studies can be found, most studies state that predefined summaries are more effective on performance and learning than self-generated summaries (Leopold et al., 2013). They state this because predefined end summaries provide an overview of the main points of the text (Hartley et al., 1979; Lorch, 1989; Hartley & Trueman, 1982), whereas learners may focus on irrelevant information when self-generating their summaries. By presenting predefined summaries, the learners' attention is guided to the most relevant information of the text (Leopold et al., 2013), which is relevant for the present study. Thus, the present study focuses on predefined summaries, next to end summaries. When the word "summary" is used in the present study, this always refers to a predefined end summary, unless stated otherwise.

Before moving on to the design of the present study, it is necessary to take note of the cognitive processes that are present when learners are confronted with demonstrations and/or summaries.

Demonstration-based training. Since videos are useful for presenting procedural demonstrations in a recorded way, as a form of a perfect example (van der Meij & van der Meij, 2015a), the theory of demonstration-based training (DBT) comes to mind (Rosen, Salas, Pavlas, Jensen, Fu & Lampton, 2010). DBT is the process in which demonstrations convey content for learning (Grossman, Salas & Pavlas, 2013). DBT builds on two major theories: Social cognitive theory of Bandura (1986) and Cognitive multimedia theory of Mayer (2005), the latter of which is briefly described before. The Social cognitive theory is examined here to find out what cognitive processes are going on when learners are confronted with observational learning and summaries.

Social cognitive theory. Bandura (1986) distinguishes four observational learning processes in his social cognitive theory: attention, retention, production and motivation. These processes facilitate observational learning (Bandura 1986) and are therefore relevant to keep in mind when designing the present study.

Attention is the cognitive process of selecting information from a heap of information. The learners can only observe when their attention is focused on the most salient thing to be observed (Rosen et al., 2010; Grossman et al., 2013). Without this cognitive activity, information may be missed. Attention can be enhanced in three ways: by signaling (1), by using narratives (2) and by using summaries (3) (van der Meij & van der Meij, 2015a). These attention enhancers can be present in text as well as in videos, as will be described later.

First, the use of signaling guides the learners to direct their attention to what is relevant (van der Meij & van der Meij, 2014; Plaisant & Schneiderman, 2005), for example by use of annotations. Marking certain content, by using bright colors or arrows for example, helps focus attention on the important information.

Second, attention can also be increased by the use of a narrative (Grossman et al., 2013). The complementary narrative to the visual information provides a parallel presented combination of corresponding verbal and visual information, which enhances recall in particular (Clark & Paivio, 1991) and learning in general (Chandler & Sweller, 1991; Mayer & Moreno, 2002). The explanation for this is that this combination leads to deeper processing and a reduced cognitive load (Chandler & Sweller, 1991; Mayer & Moreno, 2002).

Third, summaries can guide the learners' attention towards the main points of the content (van der Meij & van der Meij, 2015b). More in-depth literature findings on summaries, whether in text or in videos, will be described later on.

Retention is defined by Bandura (1986) as the following: "*retention involves an active process of transforming and restructuring information conveyed by modeled events into rules and conceptions for memory representation*" (p.272). This is fostered by the symbolic transformation of information into mentally rehearsing and coding (Bandura, 1986), to be used in the future (Rosen et al., 2010; van der Meij & van der Meij, 2015b). When mental rehearsal takes place, the stored symbolic information is activated without the task taking place (Rosen et al., 2010). The videos used in the present study are designed to attain the most retention for the learners.

Production is the process by which stored symbolic knowledge is translated into action (Rosen et al., 2010). Here, the learned content and/or the matching knowledge, skills and attitudes are acted out in order to enhance transfer (Ertelt, 2007).

Motivation is "*the organized patterning of three psychological functions that serve to direct, energize, and regulate goal-directed activity: personal goals, emotional arousal processes, and personal agency beliefs*" (Ford, 1992, p.3). When the learners are motivated, it is more likely that they will use stored knowledge in the future than when they are unmotivated (van der Meij & van der Meij, 2014). Motivation can be enhanced by providing reinforcement and/or feedback (Ertelt, 2007).

An important part of motivation is "self-efficacy", which is the extent to which a learner believes he is capable of succeeding in novel tasks (Bandura, 1997). A correlation can usually be found between self-efficacy and the actual performance of the learners. The higher a learner scores on self-efficacy, the more likely it is that this positively influences his performance in terms of persistence (van der Meij &

van der Meij, 2014). For the former reasons, self-efficacy will be measured in the present study. When it is clear what the relation is between self-efficacy and summaries in videos, this relation can be taken into account when designing videos in the future.

Experimental design

As described before, videos are very useful for instruction. The integration of summaries at the end of the videos is a logical suggestion for possible improvement of these videos, due to the possible effect that summaries in text have on performance and learning. Based on these literature findings, it is expected that summaries in videos will focus the learners' attention to the main points of the content, provide scaffolds for cognitive information processing and enhance retention in general. As a consequence, it is hypothesized that summaries in videos enhance performance and learning.

Formulated into a research question, the present study is designed to find an answer to the following question: *To what extent do summaries in videos have influence on performance and learning in software training?*

Formulated into a hypothesis, the present study is designed to find a confirmation to the following hypothesis:
H: Performance and learning in the Summary condition will be higher than in the control groups

The present study focuses on teaching procedural knowledge through recorded demonstrations. The study is distinguished in several phases: pretest, training, posttest, retention test and transfer test. During the pretest and the training, questionnaires are held to measure self-efficacy at both points in the process.

During the training, videos were presented to the participants on learning how to accomplish the procedures taught in the videos. Within each video, various parts can be discerned. All videos consist of a preview and a demonstration. Three conditions were compared. The Control condition (1) got to see the preview and the demonstration. The Summary condition (2) (the experimental condition) was shown the preview and the demonstration, directly followed by a summary, which highlights the most important points of the demonstration.

A difficulty that arises when structuring the present study this way, is that a possible effect of summaries can be due to repeating the main content. To circumvent this effect, a third condition is installed. This Demo Twice condition (3) got to see the preview and the demonstration, followed by a repetition of the demonstration. So to say, the participants in this condition got to see the demonstrational part twice. This condition is a control condition as well. By doing this, a distinction can be made between the effects due to repetition and the effects due to the summaries. The overview of conditions can be seen below:

Control condition: Preview – demonstration
Summary condition: Preview – demonstration – summary
Demo Twice condition: Preview – demonstration – demonstration

Figure 1. Overview of conditions used in the present study

Research design

Participants

The participants of the present study were 65 students of grade 5 and 6 of a Dutch school. Consequently, all materials were in Dutch. The mean age of the participants was 11.53 years old (range 10.4-13.1). All participants were randomly assigned to one of the three conditions, after stratification for classroom. There were no significant differences between conditions when it comes to age or gender.

Initially, 75 students had their parents' permission to participate in the present study. Due to technical problems during the pretest, seven participants have been excluded from the present study.

Another two students have not participated due to sickness on the day of training. Also, one participant with severe dyslexia has been left out of the data analysis.

Materials

Videos. The nine videos used in the present study were designed to teach how to execute lay-out tasks in Word 2010 and were aimed at children in grade 5 and 6. The videos lasted on average 1.58 minutes (range 1.11 – 2.53), measured across all conditions.
The videos were revised based on those that have been used by van der Meij and van der Meij (2015a). An example of this revision is the construction of the videos in the Summary condition, which needed to contain summaries. For this addition of summaries, all other parts of these videos (preview and demonstration) were narrated again to ensure consistency. These re-voiced parts of the video have been used in the other conditions, to ensure consistency and validity between the conditions. All spoken and on-screen text was in Dutch and shared the same female voice-over.

Each video was an on-screen tutorial on how to improve lay-out in Word 2010 documents. Nine videos were constructed and categorized under the following headings: Adjusting margins for the entire text (2 videos); Adjusting margins for pieces of text (4 videos); and Making an automatic table of contents (3 videos).

The videos were presented to the participants through a website. On this website, a table of contents was presented on the left side of the screen. This helped the participant navigate through the videos. Each of the nine categories was split out in subheadings, which were the (names of the) actual videos. The categories and video titles were numbered, so that navigation could be stimulated in an imposed and ideal order.

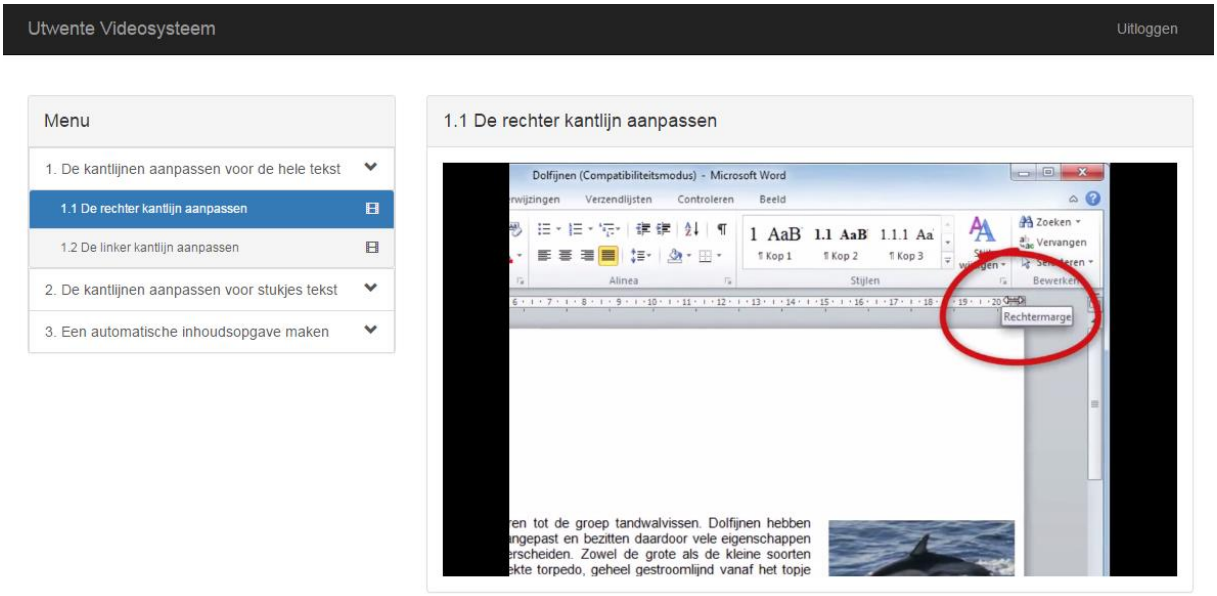

Figure 2. Video as presented on the Dutch website, including an annotation.

Each video could be divided into parts. First of all, each video started off with a preview, which introduced the subject and stated the goals of the demonstration video that follows. This part is introduced by a frame with the word "Preview" (in Dutch) in white letters on a black background at the beginning of the videos. This announcement of parts of the video tutorial prevented the participant from viewing the video tutorial as a continuous source of information.

After the preview followed a demonstration, which was introduced by a frame stating the word "Demonstration" in white letters on a black background. These demonstrations explained the lay-out task. Annotations in red helped guide the viewers' attention to the most important information in the video. These annotations were unique to the demonstration part.

The videos in the Summary condition, closed with a summary. This summary contained the main points of the video and was designed to stimulate remembering the information. Every summary started with: "Remember: …".

The Demo Twice condition contained videos that repeat the demonstration, so that the viewers would first get to see the preview, then the demonstration and finally the demonstration again. The repetition of the demonstration was introduced by a frame saying "One more time" in white letters on a black background.

The videos were designed with the cognitive processes for observational learning that Bandura (1986) distinguishes in mind, to ensure quality of these videos for the purpose of observational learning. Again, these processes are attention, retention, production and motivation (Bandura, 1986).

Attention was stimulated in the present study using signaling, narratives and summaries, in order to enable the learners to distill the relevant information from the dynamic visual information source quickly and effectively (Ertelt, 2007). Signaling was present by use of annotations, such as red markings or arrows, which were visually presented to help guide the learners to important pieces of the content of the video. Also, there was made use of titles of videos and headings in the videos to introduce parts of the videos. The present study made use of spoken narratives by using a standard-accented female voice, synchronized with the demonstration. This combination of verbal and visual information in videos would lead to higher recall (Mayer, 2005). The narratives grabbed the learners' attention and kept the learners engaged to the content that is to be learned (Plaisant & Schneiderman, 2005). Another way of guiding attention in the present study was by using summaries, which were present in the Summary condition and have formed the basis for the present study.

These summaries in videos enhanced *retention* by providing cognitive scaffolds for cognitively rehearsing the learned content (van der Meij & van der Meij, 2015a). The present study allowed for this retention by keeping the cognitive load low. Worked examples in the videos and taking breaks between each part of the videos ensured this.

Production was reflected in the present study in the practice that follows the videos. First, the participants could watch the videos as many times as they want, to make sure they understood the content that was taught. After this, the participants were asked to practice with the learned materials. Here, the participants were no longer allowed to depend on the videos and therefore needed to rely on their memory. It is this point where initial learning took place (van der Meij & van der Meij, 2015a; Rosen et al., 2013; Grossman et al., 2013). This was also the point where transfer of the information to far and unknown domains by generalizing the learned knowledge of, skills on and attitudes towards the content could be enhanced (Ertelt, 2007).

In the present study was self-efficacy measured, by use of questionnaires on this type of motivation. Self-efficacy was enhanced in the present study by guiding and supporting the participants during the experiment. The participants were told to try their best, but not to worry when they failed to perform the tasks correctly. When these participants were made aware that their performance would not be judged or graded, their self-efficacy seemed to rise. Self-efficacy was also enhanced in the present study by telling the learners what the practical use is of the learned content. This was done in the preview of each video. Gaining insight in why the learned content can be useful or relevant would help motivate the learners to gain knowledge, skills and attitudes about the content (Grossman et al., 2013; van der Meij & van der Meij, 2014).

Instruction booklets. To make sure that every participant did as he or she was asked during training, instruction booklets were provided together with the video tutorial. These booklets guided the participants through the present study. They told the participant which Word-document to open at what time and which lay-out tasks they had to execute. This was done by the use of categorizing tasks and labeling these by an image. For example: The participants had to do a reading-task (designated by a picture of a book, as can be seen in Figure 3), then a watch-task (designated by a picture of a computer screen), followed by a practice-task (designated by a picture of a computer keyboard). The instruction booklets were revised based on those that have been used by van der Meij and van der Meij (2015a).

Figure 3. Example of a reading task in the instruction booklets used in the pretest

Practice files. The participants had received Word documents during training to execute the lay-out tasks with. These so-called practice files were the sources out of which all data used in the present study comes forth. These practice files were generally useful, because they eliminated irrelevant information that could confuse the participant. Furthermore, the use of practice files made it possible to compare conditions. These documents could be found on the school server, where each participant had his or her own folder, indicated by their participant number.

The participants had to execute the following lay-out tasks in the practice files:

1.1 Adjusting the margins for the entire text
1.1.1 Adjusting the right margin
1.1.2 Adjusting the left margin
1.2 Adjusting the margins for pieces of the text
1.2.1 Indenting the left side of a citation
1.2.2 Indenting the right side of a citation
1.2.3 Indenting the first line of a subsection
1.2.4 Clarifying an enumeration
1.3 Making an automatic table of content
1.3.1 Assigning a style to chapter titles
1.3.2 Assigning a style to paragraph titles
1.3.3 Making an automatic table of content

Figure 4. Overview of the used practice files

All the lay-out tasks that the participants were asked to execute in the practice files were scored using a scale of 0 to 2. When a participant did not seem to have tried to make any alterations at all, a score of 0 was given to this lay-out task in question. When a participant executed the lay-out tasks in the precise way that was learned in the training, a score of 2 was assigned. A score of 1 was assigned to various situations in which the participant didn't perform in the demonstrated way, but did not fail to make any changes either. Then, the differences in scoring per condition between the tests were analyzed.

Self-efficacy questionnaires. The instruction booklets that each participant worked with in the pretest contained, besides instruction for the lay-out tasks, a question about self-efficacy. The question was: "How well do you think you can solve this problem?" Using a scale of 1 (*very well*) to 7 (*very bad*), the

participants scored their beliefs about their abilities. This data was used to compare to their actual abilities on lay-out tasks in Word 2010.

Directly after the training, the participants were asked to fill out a questionnaire on self-efficacy. This questionnaire contained 9 items on self-efficacy, for example "I am able to create a neat table of contents". The items were scored using the same scale as in the initial self-efficacy questions. The differences between both times of measuring were taken into account during the data analysis.

Procedure

Introduction. As mentioned before, the data collection of the present study was separated in several phases: pretest, training, posttest, retention test and transfer test.

The computer classroom at the primary school that was assigned to the present study could fit 17 participants at the same time. Working internet, a server and plenty of (spare) headphones were available, as well as a digital blackboard at the front of the classroom. Using this digital blackboard, an introduction was held by the research leader at the beginning of each testing phase. During this introduction it was made clear what the participants could expect and how they should behave. For instance, it was emphasized that the participants were to perform the tests on their own and could only ask for help when technical problems were to occur.

Initially, the participants could find the Word documents in which the lay-out changes needed to be made on individual USB-sticks. These USB-sticks proved themselves to be unreliable during the pretest. Many computers failed to recognize the USB-sticks and the ICT-expert of the school was not able to fix this problem. As a solution, the data could be saved on the internal server of the school. In the tests following the pretest, this internal server was used. After each test, the data were transferred so that they could be used for data analysis.

Pretest. The pretest examined the participants' prior knowledge on the usage of lay-out in Word 2010. Before the participants started this test, an introduction was held by the research leader to explain to the participants that they were part of a study on learning with Word 2010. The entire pretest, including the introduction and answering the questions on self-efficacy, took 30 minutes.

Training. The training was held on the same day, a week after the pretest. During the training, the participants were randomly divided into their conditions as they got to see the videos. After watching the videos as in-depth and as many times as they wanted, the participants had to execute the learned content in the practice files. During this "practice", the participants were not allowed to look back at these videos. Depending on their condition, the participants were given 45 to 50 minutes to complete the test.

Posttest. On the same day as the training, after a five minute break and after filling in the questionnaire on self-efficacy, the participants received a posttest which asked the participants to combine their gained knowledge, skills and attitudes and apply them on to a single practice file. During this, the participants were prohibited to consult the videos. This after-training-test took 20 minutes.

Retention test. A week later, a retention test was held among the participants. This test was set to find out to what extent the participants were still able to complete lay-out tasks in Word 2010 and thus could recall the possible gained knowledge, skills and attitudes. Again, no consultation on the videos was allowed. The participants had 20 minutes to complete this test.

Transfer test. Immediately after the retention test was a transfer test presented. This test was set up to find out whether participants could apply the learned knowledge, skills and attitudes to novel situations. Again, the participants had no access to the videos. The transfer test took 20 minutes per class.

Data-analysis

In the present study, mixed methods were applied. First, a literature study was carried out, in which empirical studies were examined on videos as an instructional method, summaries in text, summaries in videos and the transfer between the two domains.

The data that was collected during the experiment at the primary school was analyzed using IBM SPSS Statistics 20. On the basis of the scorings on the practices files earlier, an average of the conditions and the corresponding standard deviation is determined and presented in Table 1, 2 and 3.

Also, a repeated measures test was held in the form of a General Linear Model test, which is an ANOVA test. By using this test, the effect of multiple independent variables could be measured at the same time. This test resulted in the determination of the significance of the differences between conditions on training time, self-efficacy before and after training and performance and learning.

The training time of the participants was measured on basis of the moments in time the practice files were last saved on the server during training. So to say, the point of time at which the participants had finished their trial of executing the tasks among that practice file. The "saving" of the first practice file was subtracted from the saving of the last practice file to calculate *training time* for each participant. These data were compared, analyzed and expressed in minutes.

Results

Training time

No significant differences between conditions are present when it comes to training time (see Table 1, expressed in minutes), $F(2,63) = 0.189$, $p > 0.05$. What can be noted is that the participants on average worked through the training much faster than initially expected.

Table 1

Training time by Condition

Condition	Training time	
	M	(SD)
Control (n = 22)	19.23	(9.42)
Summary (n = 21)	18.95	(4.95)
Demo Twice (n= 21)	20.19	(5.09)
Total (n =64)	19.45	(6.77)

Self-efficacy before and after training

The initial self-efficacy scores of the participants are presented in Table 2. The participants were fairly confident about their abilities to perform the tasks, in all conditions. Directly after training, the self -efficacy scores had increased significantly, $F(2,61) = 89.209$, $p < 0.05$, $d = 1.28$.

The participants in the Summary condition had the strongest increase, but there was no significant difference between conditions.

Table 2

Means for Self-efficacy[a] by Condition

Condition	Self-efficacy			
	Before		After	
	M	(SD)	M	(SD)
Control (n =21/22[b])	4.33	(1.50)	5.91	(1.07)
Summary (n =21/21[b])	4.22	(1.34)	6.24	(0.57)
Demo Twice (n =21/22[b])	4.43	(1.17)	5.90	(1.20)

Total (*n* =63/65)	4.33	(1.32)	6.02	(0.99)

[a] The scale maximum is 7. The higher the score, the higher the appreciation.
[b] The first and second figure represent respectively the number of participants in the before and after measure.

Task performance and learning

Table 3 presents the performance of the participants during the Pretest, Training, Posttest, Retention test and Transfer test by condition. The scores are expressed in percentages.

The participants performed rather poorly in the pretest (only 11.9 percent), but have bettered their performance substantially and significantly in the training compared to the pretest (79.6 percent), $F(2,61) = 526.58$, $p < 0.05$, $d = 4.33$.

The average score on the posttest (62.9 percent), indicates that the participants were able to put the recently learned into practice, $F(2,62) = 236.08$, $p < 0.05$, $d = 3.26$. Compared to the pretest, a substantial and significant difference can be noticed.

Even after a week, in the retention test, did the participants score high on the lay-out tasks (60.9 percent), $F(2,62) = 281.22$, $p < 0.05$, $d = 3.14$. Compared to the pretest, also this is a substantial and significant difference.

The participants have succeeded moderately to apply their learned content to novel situations during the transfer test, as can be seen in Table 3.

When comparing the tests to the conditions, no significant difference between conditions could be found, $F(2,61) = 0.827$, $p > 0.05$.

Table 3

Mean success rates (Standard deviations) for Pretest, Training, Posttest, Retention test and Transfer test by Condition.

Condition	Pretest		Training		Posttest		Retention		Transfer	
	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)
Control (*n* = 22)	9.6	(12.7)	76.1	(18.8)	58.5	(26.5)	55.1	(25.1)	32.9	(33.9)
Summary (*n* = 21)	11.3	(15.2)	79.7	(22.5)	67.2	(26.9)	68.4	(25.8)	29.7	(36.7)
Demo Twice (n=22/21[c])	14.7	(18.7)	83.3	(19.4)	62.5	(29.1)	59.6	(25.8)	28.4	(34.7)
Total (*n* = 65)	11.9	(15.6)	79.6	(20.2)	62.9	(27.3)	60.9	(25.8)	30.3	(34.6)

[c] The first figure represents the number of participants in this condition in the Pretest, Posttest, Retention test and Transfer test. The second figure represents the number of participants in this condition during the Training.

Conclusion and discussion

The present study investigated the extent to which summaries in videos had an effect on performance and learning. In general, it is worth examining how videos can be embedded effectively in education (van der Meij & van der Meij, 2015a), to guarantee the quality of the videos that is demanded because of the current rise of popularity of these videos. Videos can serve as a perfect example of how to execute step-by-step procedures (van der Meij & van der Meij, 2015a). Furthermore, videos can lead to higher recall of the content (Mayer, 2005), are found interesting by many learners (Rieber, in Ertelt, 2007) and are easily accessible by a wide range of people (Plaisant & Schneiderman, 2005). In order to contribute to these effects, summaries in videos were examined, as an improvement for these videos and therefore as an enhancement of their quality. Summaries in text have formed a useful starting point for this relatively novel examination.

Summaries in text are effective to enhance performance and learning (Leopold et al., 2013). They guide the learners' attention towards the main and relevant points of the text and enhance retention (Leopold et al., 2013; Hartley et al., 1979).

Because of these literature findings, it was hypothesized that the Summary condition would have their performance and learning enhanced more than the Control condition and the Demo Twice condition. The results of the present study are not in line with this hypothesis.

No significance between conditions was found. Despite the fact that the videos in the present study all had a positive effect on performance and learning, it seems that the inclusion of a summary or repeated demonstration had no evident additional value. This contradicts expectations and earlier findings, which stated that the effect of enhancing recall and therefore performance and learning seems to be transferrable to summaries in videos.

Observational learning

The presence of all observational learning processes of Bandura (1986) in the present study seems to have contributed to the fact that the videos used in the present study are useful for and effective on observational learning. The results of the present study show that all three conditions have increased their performance and learning during the training. The increase in self-efficacy in all conditions may have contributed to this result. Especially the Summary condition scored high on self-efficacy. Nonetheless, no significant differences between conditions were found, whether on self-efficacy or on performance and learning. This does not mean that there are no differences found between conditions, but apparently there are some factors that have influenced the present study into results that contradict the literature, which states that learners who watch summaries in videos should experience increased performance and learning more than learners who watched videos without the summaries. One major factor that could have influenced the present study is the design of the present study, which may have negatively influenced the results, for which some limitations and explanations are found.

Possible limitations and explanations

The main limitation of the present study is that the data collection took place in a classroom where all the computers were lined up next to each other, up to 17 at a time, instead of in a laboratorial surrounding. A few factors may have been caused by this surrounding, which may have prohibited the present study from proceeding ideally. These factors are distractions (1), internal struggles (2) and cribbing (3).

Before each test, the participants were told to not communicate with each other in any way. Nevertheless, during and after the tests, participants were sometimes chatting or distracting each other. In order to make sure that every participant had their chance to execute the tasks in a quiet area, the research leader had to reprimand participants for distracting others. These reprimands may have disturbed the quietness in the classroom and therefore the concentration of the participants.

Also, the ICT-worker came in to the classroom often to fix technical problems that occurred several times during the data collection. Also the principal and some teachers came to check in now and then, again resulting in disturbances.

Also, before each test, the participants were reassured that it was okay if they failed to execute the tasks that were asked of them. Before actually working with the practice files, the participants scored their self-efficacy averagely 4 out of 7. Straight after the training, this score has risen to an average of 6 out of 7, which suggests that the participants had strong beliefs about their abilities towards the content. Nevertheless, during all tests, except for the training, many participants have seemed to have internal struggles caused by failing to execute the tasks, since they asked the research leader many times for solutions to their tasks at hand, even though when they were told beforehand to not raise their hand to ask the research leader anything but for help when technical problems occurred. Again, disturbances for the participants may have come from this. These internal struggles may have caused the participants' self-efficacy to attenuate, which may have unconsciously lowered their performance and/or learning.

These internal struggles might be the cause that some participants tried to crib the screens of their neighbors, even though they were told beforehand to focus on their own work only. This cribbing may have induced individual performances that participants might not have to this extent when they would have been placed in a laboratorial surrounding. When the cribbing was noticed by the research leader, the participants were reprimanded for doing this, which caused the participants to stop cribbing in some cases, but in other cases, participants had to be reprimanded multiple times, again perhaps resulting in distractions.

To circumvent these events, a laboratorial surrounding is recommended, in which participants perform the test in an individual setting and where distractions are ruled out.

Another limitation of the present study may be the sample size. Where an average of 21 participants per condition was the case in the present study, a larger condition size will reduce the chances of coincidences, which may result in stronger findings.

Another possible explanation for the lack of significant differences between conditions is that the content that was presented and demonstrated in the preview and demonstration may have been sufficient to enhance performance and learning. So to say, the summary may have not been able to make any (large) enhancements, since the previous information was already clear enough to facilitate performance and learning. Further research should be held to find out whether the addition of a summary would have a higher extent of effect on performance and learning when the preview and the demonstration were moderately or barely effective on performance and learning.

Another possible explanation for the low extent of effect that is found is that the presentation of the preview, demonstration and the summary or repeated demonstration simply may present a large amount of seemingly repetitive information. This apparent repetition can be explained by the limited amount of information that was present in each video. The videos are relatively short (M = 1.58, SD = 0.43, expressed in minutes over all conditions), which is necessary to engage the learners to the videos and to reduce the cognitive load (van der Meij & van der Meij, 2013). This short length of the videos may lead to the problem where there is simply not that much to summarize, resulting in information that seemingly is repetitive quickly after each other. This seemingly quick repetition of content may also be due to the fact that the pauses between the parts of the videos lasted a second and a half. In order to let the content sink in, these pauses between the parts of the videos should be two to five seconds (van der Meij & van der Meij, 2013). This may have caused the participants to be overwhelmed by the information presented so soon after each other. Futures studies should stick to this guideline for duration of pauses in order to slow down the pace of the information (van der Meij & van der Meij, 2013).

The seemingly quick repetition of the content in the videos may have caused the participants' attention to be reduced towards the videos in the present study, for the participants may have watched the videos absentmindedly or incompletely. This was not measured specifically by the present study. Integrating a manipulation check or focusing more specifically on the participants' beliefs about the apparent repetition would have improved the present study and is recommended for further research.

Final recommendations

The literature findings described in the present study state that summaries in videos are effective on performance and learning. The present study states that the inclusion of summaries in videos is not necessarily more effective than the exclusion of summaries in videos. More research is necessary to find truth in this contradiction. Future research should exclude the previews from the videos in order to check if these are what is prohibiting the present study from finding results that are more in line with the literature. Also, future research should take place in a laboratorial surrounding, to avoid distractions for the participants and to enhance validity in the present study. Furthermore, future research should measure the specific viewing times of the participants and their actions on the toolbar of the videos. Doing so will provide clarity on the actions of the participants during the tests, which data can be taken into account when designing studies in the future. More data about the self-efficacy of the participants can improve the design of future studies as well.

Taking everything into consideration, it can be concluded that the videos used in the present study are in general highly effective on performance and learning. These videos can be used as an example in future studies. Also, the videos can be implemented in educational settings directly, in order to allow Dutch-speaking learners learn about lay-out tasks in Word 2010. To improve these videos, one should take into account that the breaks between each part of the video should be at least two to five seconds (van der Meij & van der Meij, 2013). Doing so will enhance the effect on performance and learning even more.

Since the domain of summaries in videos is this relatively new, the intuition is present that there is much more to gain from research into this domain than that what is already performed. More research

on summaries in videos may improve videos as an instructional method. When these videos are improved, it is more likely that they can attribute to modern education, which can lead to benefits for millions of learners worldwide.

References

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NJ: Freeman

Chandler, P., & Sweller, J. (1991). Cognitive load theory and the format of instruction. *Cognition and Instruction, 8*(4), 293–332.doi:10.1207/s1532690xci0804_2

Clark, J.M., & Paivio, A. (1991). Dual coding theory and education. *Educational Psychology Review, 3*(3), 149–210.doi:10.1007/BF01320076

Ertelt, A. (2007). *On-screen videos as an effective learning tool. The effect of instructional design variants and practice on learning achievements, retention, transfer, and motivation.* (Doctoral dissertation), Albert-Ludwigs Univerisät Freiburg, Germany

Ford, M.E. (1992). *Motivating humans: Goals, emotions and personal agency beliefs*. Calif: Sage Publications

Grossman, R., Salas, E., Pavlas, D., & Rosen, M.A. (2013). Using instructional features to enhance demonstration-based training in management education. *Academy of Management Learning and Education, 12*(2), 219–243.doi:10.5465/amle.2011.0527

Hartley, J., Goldie, M., & Steen, L. (1979). The role and position of summaries: some issues and data. *Educational Review, 31*(1), 59–65.doi:10.1080/0013191790310107

Hartley, J. & Trueman, M. (1982). The effects of summaries on the recall of information from prose: five experimental studies. *Human Learning, 1*, 63-82.

Mayer, R.E. (2003). The promise of multimedia learning: using the same instructional design methods across different media. *Learning and Instruction, 13*, 125–139.doi:10.1016/S09594752(02)00016-6

Mayer, R.E. (2005). Cognitive theory of multimedia learning. *The Cambridge Handbook of Multimedia Learning*, 31–48.doi:10.1207/s15326985ep4102_2

Mayer, R.E., & Moreno, R. (2002). Animation as an aid to multimedia learning. *Educational Psychology Review, 14*(1), 87–99.doi:10.1023/A:1013184611077

Leopold, C., Sumfleth, E., & Leutner, D. (2013). Learning with summaries: Effects of representation mode and type of learning activity on comprehension and transfer. *Learning and Instruction, 27*, 40–49.doi:10.1016/j.learninstruc.2013.02.003

Lorch, R.F. (1989). Text-signaling devices and their effects on reading and memory processes. Educational Psychology Review, 1, 209-234.doi:10.1007/BF01320135

Plaisant, C., & Shneiderman, B. (2005). Show me! guidelines for producing recorded demonstrations. *Proceedings - 2005 IEEE Symposium on Visual Languages and Human-Centric Computing, 2005*, 171–178.doi:10.1109/VLHCC.2005.57

Rosen, M.A., Salas, E., Pavlas, D., Jensen, R., Fu, D., & Lampton, D. (2010). Demonstration-based training: a review of instructional features. *Human Factors*, *52*, 596-609.doi:10.1177/0018720810381071

Sarikcioglu, L., Senol, Y., Yildirim, F.B., & Hizay, A. (2011). Correlation of the summary method with learning styles. *Advances in Physiology Education*, *35*, 290-294.doi:10.1152/advan.00130.2010

van der Meij, H. & van der Meij, J. (2013). Eight guidelines for the design of instructional videos for software training. *Technical Communication*, *60*(3), 205–228.

van der Meij, H. & van der Meij, J. (2015a). The effects of reviews in video tutorials. Manuscript submitted for publication, University of Twente, Enschede, the Netherlands

van der Meij, H. & van der Meij, J. (2015b). Do reviews enhance learning from video? Manuscript submitted for publication, University of Twente, Enschede, the Netherlands

van der Meij, J. & van der Meij, H. (2014). A test of the design of a video tutorial for software training. *Journal of Computer Assisted Learning*, 1–17.doi:10.1111/jcal.12082

Woolfolk, A., Hughes, M. & Walkup, V. (2008). *Psychology in Education*. Harlow: Pearson.