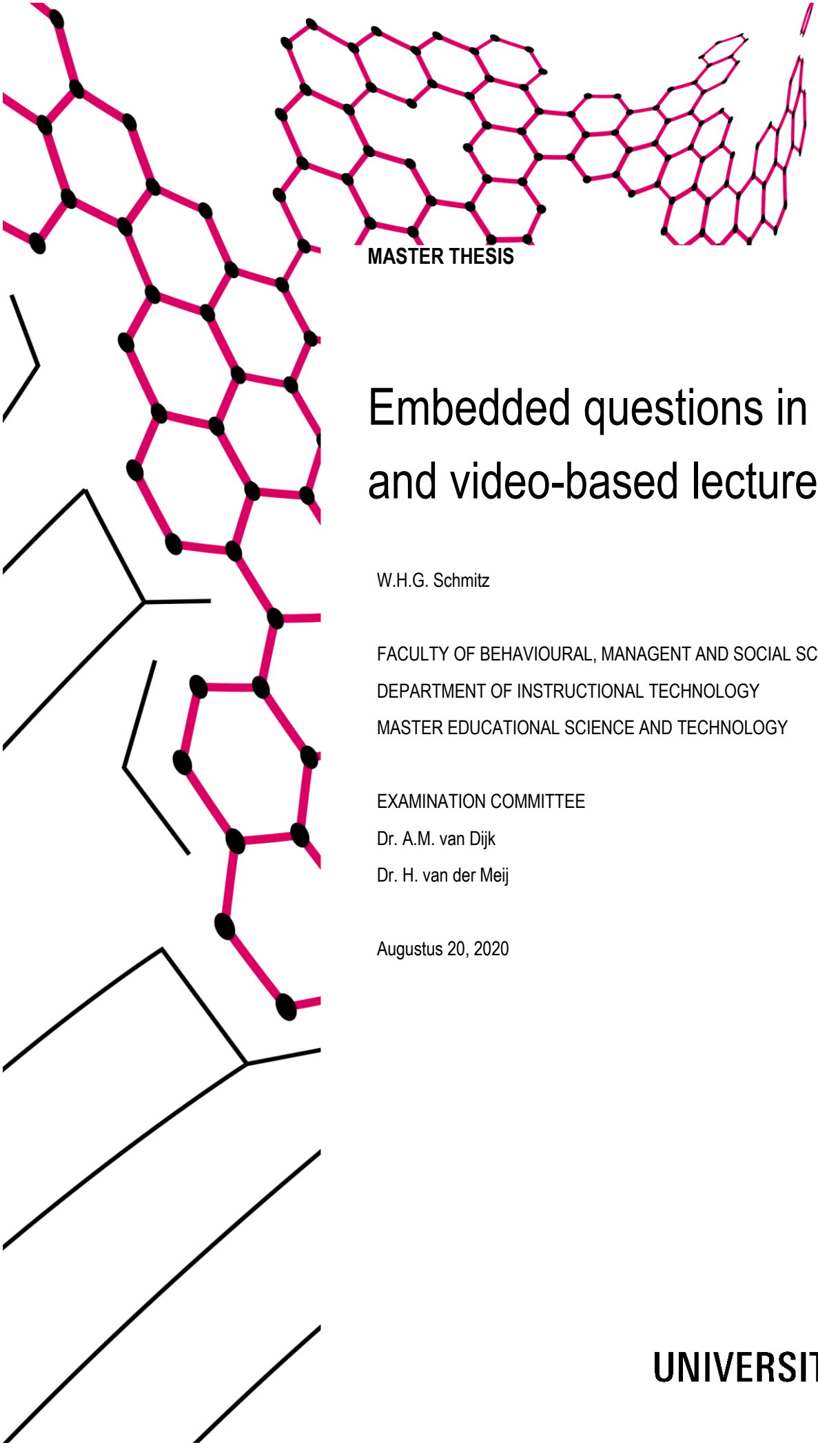

MASTER THESIS

Embedded questions in text and video-based lectures

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Abstract

Digitalization of our world has been a forward march for years now. Within education it is important to prepare students for current and future technologies. As digitalization creates multiple new opportunities to digitalize teaching and learning.

Due to COVID-19, educational institutes are forced to implement digital transformation within teaching rapidly. Classic teaching methods are digitalized into digital lectures. Biggest challenge with digital lecture is to prevent passive learning as this is one of the risk shown using digital lectures.

Embedded questions stimulate active processing and potentially lower the risk of passive learning. Due to the lack of research and knowledge on this topic, educators do not know what is the most efficient way of setting up digital lecture.

In this study the answer on the following question is being researched: “What is the effect of embedded questions on engagement, technology acceptance and learning? A total of 161 Bachelor students of the school of Human Movements and Sports were included in this study. In this study, an experimental study with three conditions was conducted. Students were randomly assigned to condition embedded questions with feedback, condition embedded questions, or condition control group. Students in all groups received a segmented video lecture that accompanied reading materials. Only the videos in the experimental conditions contained embedded questions.

The data showed that participants in the experimental groups with and without feedback spent significantly more time on the digital lecture than the control group. The scores for technology acceptance (i.e., usefulness, ease of use and satisfaction) were uniformly positive for all three conditions. No significant difference in scores between conditions was found on the knowledge post-test.

The conclusion of this research is that embedded questions, both with and without feedback, lead to a rise in engagement of the student. However, no positive effect on learning results is reported. To accentuate the complexity alternative causes for these effects are discussed in the thesis but further research on the topic is needed to clarify the unexpected findings. However, this study has contributed to a new line of research about embedded questions text and in videos-based lectures.

Keywords: embedded questions, digital lecture, technology acceptance.

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1. Introduction

In the past few years, technology has an important role in education (Gilboy, Heinerichs & Pazzaglia, 2015) and since the coronavirus outbreak in 2019-2020 the educational sector has been forced to rapidly develop digital lectures. There is a large variety of digital lectures e.g. recorded lectures given live to students in a classroom, or a PowerPoint where the teacher comments the slides, online lessons where students have to elaborate on questions based on a study text or even combinations of digital lectures with text, video and embedded questions. In this research a digital lecture is defined as a lecture containing written text as well as video material with embedded questions.

Multiple researchers have argued that during digital lectures there is a chance that students only process the learning content passively (Chi, 2009; Dunlosky, Rawson, Marsh, Nathan & Willingham, 2013; Mayer et al., 2009; Mayer, 2014) and that this might reduce the learning effect and active processing which is needed to boost learning. Adding embedded questions to a digital lecture might stimulate active learning. Results from multiple studies showed that students who had the chance to practice before a test with embedded questions in the digital lecture scored better on the test than students who only read the content they needed to learn multiple times (Adesope, Trevisan, & Sundararajan, 2017; Fiorella & Mayer, 2018; McDaniel, Agarwal, Huelser, McDermott & Roediger, 2011). A possible explanation for this could be that the embedded questions stimulate students to connect prior and new knowledge, because embedded questions make active retrieval processing possible (e.g. Mayer et al., 2009; Smith & Karpicke, 2013). Moreover, embedded questions make it possible that students receive feedback on their answers, as feedback is essential element of embedded questions (Hattie & Timperley, 2007; Shute, 2008).

That students receive feedback on their answers is an essential element of embedded questions (Hattie & Timperley, 2007; Shute, 2008). Feedback is important to enhance learning (Hattie & Timperley, 2007). Feedback is the information the student gets after completing an assignment, task or test (Narcis, 2008; Narcis & Huth, 2004; Hattie & Timperley, 2007). The goal of feedback is to change the student's behavior and thinking to improve the achievement of the student (van Berkel, Bax & ten Brinke, 2014; Shute, 2008). Feedback may increase learning, decrease the fear of failure and also motivate students (Torrance & Pryor, 2001) and student have enough time to answer the embedded questions (Roelle, Rahimkhani-Sagvand & Berthold, 2017).

Because adding embedded questions to a digital lecture to provide feedback to

students seems promising, the main aim of this study is to find out whether there is an effect of embedded questions on engagement, technology acceptance and learning of the students.

However, because research results about feedback in digital lectures are at variance, this study will include a group with feedback and a group without feedback. Furthermore, three conditions will be included in this research: a condition with embedded questions with feedback, a condition with embedded questions without feedback and a control group. This study included a control group, because many variables play a role in this research (Bruns, 2017). Not only the learning results of the students is important, but the engagement and technology acceptance will be included as well, because students might be more motivated for this digital lecture, because it is a new and maybe therefore exciting learning activity.

2. Theoretical framework

2.1 Embedded questions in digital lectures to enhance student learning

If student process the content passively, learning will not take place. Active processing is necessary to enhance learning (Mayer et al., 2009; Mayer, 2014). Dunlosky et al., (2013) studied extensively the ten different ways of processing the learning content. Their research shows that practice testing is a learning activity that students value highly, and is effective, because it stimulates this active processing. Practice testing in this research was created by adding embedded questions to the digital lecture.

Embedded questions are questions that appear in segmented digital lectures (Tweissi, 2016). They can lead to tot low-stakes or no-stakes learning activities that encompass any form of formative practice testing that students should engage in on their own (Dunlosky et al., 2013). They are different kinds of embedded questions e.g. short-answer, multiple choice and hybrid questions (e.g. Smith & Karpicke, 2013).

According to the literature, there are three main explanations for the positive effect of embedded questions to enhance learning, namely active process processing, retrieval practice and testing effect.

Active processing

Active processing is the process in which the student selects relevant information, organizes the available learning material and then integrating prior knowledge with the new learning material (Mayer et al., 2009; Wittrock, 1989).

According to the SOI- model of Mayer (2014) the first mechanism of *selecting* the relevant information takes place when the student concentrates on the text and images of the learning material. In this way, the external information becomes a part of the working memory component of our cognitive system. The second mechanism, *organizing* the available learning material, also takes place in the working memory component of our cognitive system and provides the student with seeing the relationships between the elements of the learning material. The last mechanism is the process in which the student activates prior knowledge from the long-term memory and by bringing this back into the working memory, prior and new learning are connected and the active learning takes place. An embedded question may support this process, the following example explains this. First, the student studies a segment

of the digital lecture and sees the embedded question, this helps the student to select parts of the learning content. Second, the student reads the question and tries to remember about which learning content it is about in the digital lecture. To answer the question, the student will try to organize the learning content in a structured way, so that the student can retrieve this knowledge when they need it. Third, inside the brain of the student the prior and new knowledge are connected and saved into the long term memory (Mayer, 2014).

Retrieval practice

The learning strategy retrieval practice describes how prior knowledge is activated in the long term memory through active processing (Karpicke & Blunt, 2011).

From a meta-analysis of 118 studies, Adesope, Trevisan and Sundarajan (2017) concluded that testing is better than studying the learning material multiple times and better than other learning activities in comparison. This effect was found for different types of tests, for example cued recall, free recall, short-answer question and multiple choice questions, and for all ages, grades, subjects and student characteristics.

Retrieval practice through testing has three advantages: (1) embedded questions provide another way of studying the learning material than for example rereading the learning material (McDaniel, Anderson, Derbish, & Morisette, 2007), (2) embedded questions provide students with a selective way of learning the material (Mayer et al., 2009), because they show the students what the main points of the learning material are, and moreover (3) embedded questions that give feedback also provides the student with feedback about what part of the learning material they yet master and which they still have to learn (Fiorella & Mayer, 2015; McDaniel et al., 2011). Therefore, the embedded questions help the students to remember the right learning content (Agarwal, Karpicke, Kang, Roedinger III, & McDermott, 2008).

Testing effect

From cognitive learning psychology it is known that tests and embedded questions during lectures can enhance the learning process (e.g. Roediger III & Karpicke, 2006). This is called the testing effect (Carpenter, 2009). The testing effect arises because students use the embedded questions to retrieve prior knowledge (Carpenter, 2009). The access to knowledge in the memory becomes better and they can remember knowledge better (Pashler et al., 2007; Kester & van Merriënboer, 2013). This increases learning (e.g. Mayer, 2014).

There is a connection between retrieval practice and the testing effect, namely the

success of the retrieval practice depends on the testing effect and vice versa. Practice tests have a positive effect on the amount and quality of retrieved knowledge (e.g. Carpenter, 2009; Roediger III & Karpicke, 2006). Therefore, the testing effect is important for the amount and quality of the retrieved learning content. The more times you are able to retrieve knowledge, the better you remember information and the better the test results are (Glover, 1989; Pavlik & Anderson, 2005; Vaughn & Rawson, 2011). Retrieval practice and the test results are dependent on the frequency and spreading of the tests (e.g. Karpicke & Roediger III, 2007).

Multiple studies show that the testing effect is still detectable a week to a few months afterwards (Butler & Roediger 2007; Carpenter, 2009; McDaniel et al., 2007). The testing effect is usually higher if the test is postponed, testing after a minimum of a week, than testing that takes place directly after the lecture (Roediger III & Karpicke, 2006). Moreover, if the spreading between tests is bigger, the test is more effective (Karpicke & Roediger III, 2007).

Also, multiple studies have shown that when there are more tests the learning results are better (Glover 1989; Pavlik & Anderson 2005; Vaughn & Rawson, 2011).

Students who have the possibility to practice for a test with embedded questions have high test results than students who only read the learning content multiple times (Adesope et al., 2017; Fiorella & Mayer, 2018; McDaniel et al., 2011).

It is also important to mention that student score higher on a similar questions than other questions of the test (Chan, 2009, 2010; van der Meij & Böckmann, 2020; Shapiro, 2009). This might be explained by the students learning the right answer by heart for specific questions (Chan, 2009). This is however a less desirable outcome (Thomas, Weywadt, Anderson, Martinez-Papponi & McDaniel, 2018). Therefore, teachers should be careful not to take test questions which are identical to previous tests (Wooldridge, Bugg, McDaniel & Liu, 2014).

2.2 Embedded questions and empirical research

One of the most frequent way of implementing retrieval practice in classrooms is to have students answer questions (McDaniel et al., 2011; Smith & Karpicke, 2013). There have been many empirical studies conducted about the effect of multiple-choice questions in digital lectures (Rawson & Dunlosky, 2012). Unfortunately, not many empirical studies have been conducted to research the effect of open-ended questions in digital lecture. However open-ended questions are more suitable for learning than multiple-choice questions, because open-ended questions rely more on retrieval than on recall (Butler & Roediger 2007; McDaniel et

al., 2011; Rawson & Dunlosky, 2012; Karpicke, 2017; Smith & Karpicke, 2013). This is the reason why in this research open-ended questions were used and not multiple choice questions.

Two of the few recent studies about open-ended questions, are the studies by Thomas et al., (2018) and Smith and Karpicke (2013). Thomas et al., (2018) investigated in two experiments (n=152) the effects of question format (i.e., short-answer vs multiple-choice) and level (factual versus application of fact). Students followed an digital course with chapter quizzes, review quizzes and unit exams. In the experiment students received the answers and feedback to the questions after the test was completed. In experiment two the students received the answer and feedback directly after answering the question. After looking at this feedback the students continued with the next question. In this research the conclusion was that the advantages of embedded questions with feedback could not be attributed to remembering the quiz feedback or identical answer options for the correct answers on the test. Furthermore from the research of Thomas et al., (2018) it was apparent that embedded questions not only improve the answers of the same sort questions but of all different types of questions. Smith and Karpicke (2013) investigated in four experiments (n=372) the effects of different questions formats; short-answer, multiple-choice, hybrid questions and no questions. Students read a text and practiced by answering question and after a week students took a final test. The findings showed that practicing retrieval in all question conditions enhanced retention in comparison to a study-only (control condition). However, in three experiments there were little to no advantages of answering short-answer or hybrid format questions over multiple-choice questions. In the last experiment, using shorter texts than the previous experiments, there was an advantage of answering short-answer or hybrid questions over multiple-choice questions. According to Smith and Karpicke (2013) these results support the conclusion that short-answer questions produce the best learning, due to increased retrieval effort or difficulty and demonstrate the importance of retrieval success for retrieval-based learning activities.

In the present study, the experiment focused on embedded questions within a digital lecture with three conditions embedded questions with feedback, condition embedded questions and condition control group. To the researchers' knowledge, until now such a research has not been performed yet. In the present study a control group was included, this is different from the research performed by Thomas et al., (2018).

Moreover, the current situation is different than that of Smith and Karpicke (2013) because only short-answer questions were used and in one of the conditions feedback was

given. Also Smith and Karpicke (2013) studied questions to a text and not a video. In addition to that, the present study is different from that of Smith and Karpicke (2013), because they only used short-answer questions and for one of the conditions feedback was used. Moreover, Smith and Karpicke (2013) studied questions that were provided to a text and not a video including text. Feedback is an essential part of embedded questions (Hattie & Timperley, 2007; Shute, 2008).

2.3 Embedded question and feedback

Feedback

In education feedback is usually used to enhance learning (Hattie & Timperley, 2007). Feedback is that information that the student gets after completing an assignment or test (Narcis, 2008; Narcis & Huth, 2004; Hattie & Timperley, 2007). This is called formative feedback and is used to encourage the students behavior and thinking of the student to improve learning (van Berkel, Bax & ten Brinke, 2014; Shute, 2008). Feedback can give the student insight about their existing knowledge from the learning content (Bledsoe & Baskin, 2014).

Positive and negative effects of feedback

Students may profit from feedback in three ways: (1) enhanced learning, (2) test anxiety and (3) higher motivation. How feedback has a positive effect on learning was also described in the previous section. Feedback informs the students about what part of the learning content they know and do not know. This enhances learning and may give the student a feeling of control, and this may decrease their fear of the test (Bledsoe & Baskin, 2014). Students may experience embedded questions without feedback as very stressful (Attali & Powers, 2006).

Feedback can contribute to increased motivation in students (van Berkel et al., 2014; Narcis & Huth, 2004; Narcis, 2008). One of the most known motivational theories is the self-determination theory, which describes competence, autonomy and relatedness are basic psychological needs (Ryan & Deci, 2000). When one of these basic needs are not fulfilled it can hinder learning in a way that it may not take place (van Berkel et al., 2014). For that reason it is important that active participation of the students is central in the learning process (Clark, 2012). Feedback will help the student to develop self-regulation in the learning

process. Sadler (1989) describes explicitly that assessment skills are important for self-regulated learning. The system of instruction and learning should provide students with the possibility to develop these skills, so that they are not only dependent on the feedback and opinions of the teacher, but develop self-regulation.

Many studies show that feedback has a positive effect on the learning process (Fiorella & Mayer, 2018: Narcis, 2008; Narcis & Huth, 2004; Hattie & Timperley, 2007; Shute, 2008). However, some studies show a negative effect of feedback on the learning process, because the feedback causes the student to spend less time on answering the questions and decreases the amount of learning (Roelle et al., 2017). When this context is neglected, feedback may have a negative effect on the learning process (Torrance & Pryor, 2001).

Six types of feedback

The purpose of feedback is to reduce discrepancies between current understandings to enhance learning (e.g. Fiorella & Mayer, 2018; Hattie & Timperley, 2007; Sadler, 1989). There are several types of feedback. Narcis (2008) describes the following types of feedback: (1) "Knowledge of performance" (KP) gives the student insight about the result of a test or task. This is for example the amount of mistakes made or a percentage of questions answered correctly. (2) "Knowledge of result" (KR) gives the student insight what part of the test or task was done right or wrong. An example is: question 1 the answer was right, question 2 and 3 are wrong. (3) "Knowledge of the correct response" (KCR) gives the student feedback what the right answer to the question is. (4) "Answer-until-correct" (AUC) gives the student feedback if the answer is right or wrong and give the student the opportunity to change the answer. (5) "Multiple-try feedback" (MTF) gives the student feedback if the answer is right or wrong and gives the students a limited amount of tries to get the answer right for one question. (6) "Elaborated feedback" (EF) gives the student knowledge of result (KR) and knowledge of correct response (KCR) and extra information. An example is: read the text on page 10 of the book, you can find the answer here and try again to formulate the right answer.

In higher education the types of feedback that are usually being used are knowledge of performance (KP), Knowledge of result (KR) and Knowledge of the correct response KCR. Knowledge of performance (KP) in combination with Knowledge of result (KR) is being used mostly during summative testing. Student get test results, for example a score or mark (KP), and when they check their test, they can ask the teacher for the right question (KCR). Knowledge of the correct response (KCR) is given by formative testing. The teacher discusses the answers with the students in class or the students can access the answers online and read

them independently.

To summarize, if feedback is integrated in the digital lesson then it can increase learning (e.g. van Berkel et al., 2014), decrease the fear of failure (Bledsoe & Baskin, 2014) and enhance motivation (e.g. Narcis & Huth, 2004). In education, the feedback types KP, KR and KCR and mainly being used. In this study three conditions will be created: condition embedded questions with feedback, condition embedded questions and condition control group, because the literature is not consistent about the positive or negative effect of feedback on learning. The type of feedback is KCR feedback in this study.

2.4 Digital lecture and Technology Acceptance

In general, students have a positive appraisal on digital lectures (Baker, Demant & Cathcart, 2018; Burgoyne & Eaton, 2018; Spanjers et al., 2015; van de Meij & Böckmann, 2020). Next to that embedded questions in a digital lecture can play a role in activating the cognitive process, it is important that de student is willing to accept the technology (Venkatesh & Davis, 2000). Important variables to predict the acceptance of technology are usefulness, ease of use and satisfaction of the Technology Acceptance Model (TAM) (Davis, 1989; Davis, Bagozzie, & Warshaw, 1989; Joo Lee & Ham, 2014; van der Meij & Böckmann, 2020). Usefulness was defined as how much the student thinks that the digital lecture helped the learning process (Davis, 1989; Joo, et al., 2014; van der Meij & Böckmann, 2020). Ease of use is the way that the student thinks that watching a digital lecture requires not so much effort (Davis, 1989; Joo et al., 2014; van der Meij & Böckmann, 2020). Satisfaction was described as the student's positive emotions while watching the digital lecture (Joo et al., 2014; van der Meij & Böckmann, 2020).

Usefulness and ease of use have been found to have a direct effect on technology use (Davis & Venkatesh, 1996; Davis et al., 1989; Šumak, Hericko, & Pusnik, 2011; Venkatesh & Davis, 2000) and on user satisfaction (Chiu, Hsu, Sun, Lin & Sun, 2005; Davis 1989; Joo, Lim & Kim, 2011). In addition, a meta-analysis showed that embedded questions had a positive effect on satisfaction of digital lectures (Spanjers et al., 2015).

Concluding, out of practical reasons it is for teachers and instructional designers important to know what the usefulness and ease of use is according to the users, to aim at making the digital lecture so that the cognitive process is activated as effectively as possible to make learning as effective as possible.

To the knowledge of the researcher, there has not been any research conducted to study the effect of usefulness and ease of use on condition embedded questions with feedback, condition embedded questions and condition control group. However, it is important to know, because teachers and instructional designers can design a digital lecture which is as effective as possible. No specific hypothesis was tested for the constructs usefulness and ease of use.

It was expected that condition embedded questions with feedback and condition embedded questions would score higher on the constructs satisfaction than condition control group, because embedded questions have a positive effect on satisfaction (Spanjers et al., 2015).

3. Research questions and hypotheses

In this study, an experimental research design with a randomized controlled trial was conducted. Students in all groups received a segmented digital lecture that accompanied reading materials and videos. Students were randomly assigned to condition embedded questions with feedback, condition embedded questions or condition control group.

The general research question is:

What is the effect of embedded questions on engagement, technology acceptance and learning?

Hypothesis 1: Embedded questions enhance engagement.

Participants must engage with the digital lecture sufficiently in order for the digital lecture to affect motivation and learning (e.g. Shinaberger, 2017; van der Meij & Dunkel, 2020). Based on the literature study engagement with the digital lecture was expected to be higher in the experimental conditions (condition embedded questions with feedback and condition embedded questions). To obtain insight into this prerequisite, the Total time of the digital lecture (see Method) was recorded.

Hypothesis 2: Embedded questions in text and video-based digital lecture improves learning outcomes.

There is a considerable body of research that shows that embedded questions with lectures raise learning (Adesope et al., 2017; Fiorella & Mayer, 2018; McDaniel et al., 2011). Empirical research shows that the presence of feedback provides a higher learning outcome than without feedback (e.g. Fiorella, & Mayer, 2018). Accordingly, it is expected that the highest learning outcome appears in condition embedded questions with feedback, then condition embedded questions and finally condition control group.

Hypothesis 3: Repeated embedded questions yield the highest learning outcomes.

Based on the literature study (e.g. Fiorella & Mayer, 2015; Thomas et al., 2018; Shapiro, 2009) students better remember material on which they have been tested, because the tested questions act as motivators to retrieve information from long-term memory.

Hypothesis 4: Digital lectures (video + text materials) are perceived as useful, easy to use and satisfying.

Embedded questions has been found to have a positive effect on satisfaction of digital lectures (Spanjers et al., 2015). Therefore, it was expected to be higher in the experimental conditions (condition embedded questions with feedback and condition embedded questions). There was no specific hypothesis for the constructs usefulness and easy to use.

4. Method

4.1 Participants & Design

A total of 161 Bachelor students of the school of Human Movements and Sports were included in this study. However, due to a technical problem during the experiment data from 32 participants was missing. This led to a sample of 129 students of the Bachelor's program Physical Education (n= 68), Psychomotor Therapy (n=32), and Sports Management (n=29). The mean age of the 67 males and 62 females was 19,05 years (*SD* = 1.77). Before the start of the experiment the students were asked consent to use the data being collected for this research study (see Appendix B). Data from students who refrain from consent were not used in the study. Further was participation in the experiment voluntary and students could opt to leave at any time during the digital lesson. No course credits were given for participation. Students were randomly assigned to one of the three conditions: condition embedded questions with feedback (n=46), condition the embedded questions (n=41) or condition control group with only the digital lesson group (n=42).

The ethics committee of the University of Twente has given permission for this research.

4.2 Instructional instruments

Digital lecture

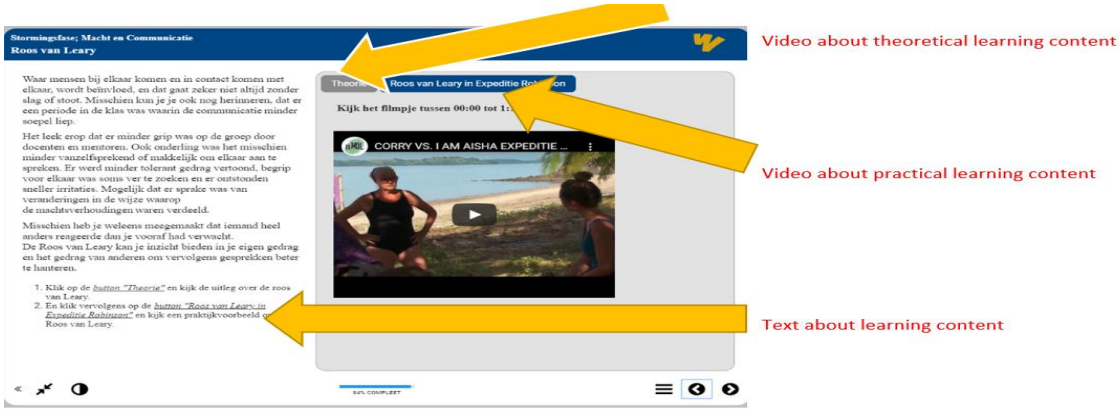
The digital lecture was designed for the course "Influences strategies in movements and sports" or the first year students of the School for Human Movement and Sports. This course is a social science course. The students received the digital lecture at school in a normal classroom. Normally, the class lasts for 1,5 hours and is a combination of instruction and group work.

The theme for this digital lecture was the "storming stage of group dynamics". The concepts of power and communication were the most important. The lecture started with a short introduction to explain the learning goals and the different chapters. After the introduction, the 5 segmented chapters were explained. Each segmented chapter was followed by questions on that chapter. Every segmented chapter consisted of text, with a minimum of

76 words and maximum 273 words, including 2 videos. Figure 1 shows chapter 1. On the left side are two buttons, when students click on these buttons, the videos appear.

Figure 1

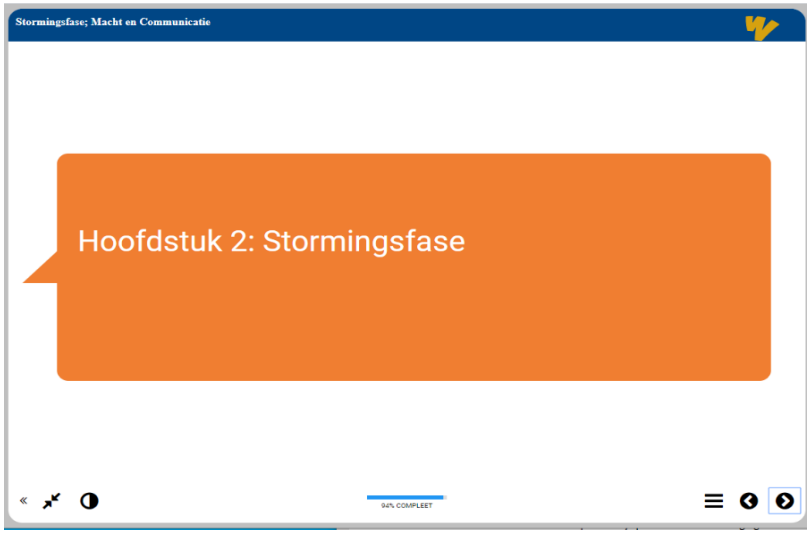
Overview chapter 1



The videos last between 1:23 and 6:50 minutes per chapter. The total time of the videos (20:15 minutes) including text (5-15 minutes, depends on condition) 30:15 minutes. Before every new chapter all groups saw an orange slide with the next chapter number and title (see Figure 2). The goal of segmenting the chapters was to create clarity for the students and to make sure that the students can oversee the learning content.

Figure 2

Overview next chapter



Chapter 1 is about the Rose of Leary. The Rose of Leary is a model, which shows how people may influence each other and why this influencing sometimes does not work. The 2

videos in this chapter last in total 3:58 minutes. Chapter 2 described the storming phase from the Tuckman model. In the storming phase, communication and power are the key words, where the people express their difference in opinions. The two videos in this chapter last in total 3:09 minutes. Chapter 3 explains power sources and tools. The two movies in this chapter last in total 2:22 minutes. Chapter 4 explains the theory of the model of Thomas and Kilmann about five different styles of conflict management. The movies in this chapter last 6:51 minutes in total. The last chapter shows the messages in communication. Two levels of messages are being discussed: the level of content and the level of relationship. Also, the four aspects of the message are being explained (objective, expressive, relationship based and to appeal). The videos in this chapter last 3:35 minutes in total.

Embedded questions and feedback

The questions were designed in collaboration with the teachers of the course and are about the content of the digital lecture. The embedded questions consisted of twelve short answer open-ended questions: four retention and eight comprehension questions. An example of an embedded retention question is: *"Name 2 of the 5 styles of conflict management according Thomas and Kilmann"*. Example comprehension question is: *"Which type of behaviour, according to the Rose of Leary, is Aisha showing*"? (see Figure 3 question and see Figure 4 for feedback).

Figure 3

Example question

Figure 4

Example feedback

4.3 Research instruments

User logs

The digital lecture was presented on a specially created website connected to a logging instrument that recorded time-stamped viewer actions for the activities on each page. The instrument recorded the total time of video playing (in minutes). Plays, replays and pauses were all included. The engagement measure is a proxy for viewing (van der Meij & Dunkel, 2020). Due to software problems other engagement measures could not be computed.

Technology acceptance survey

The TAM questionnaire consisted of a total of 18 statements. There were five items per construct and three distractor items. The three constructs are: usefulness, ease of use and satisfaction. Usefulness was defined as how much the student thinks that the digital lecture helped the learning process (Davis, 1989; Joo, et al.,2014; van der Meij & Böckmann, 2020). Examples of usefulness questions are: *"Digital lectures like these are useful for studying" and "Digital lectures like these are important for studying".* Ease of use is the way that the student thinks that watching a digital lectures requires not so much effort (Davis, 1989; Joo et al., 2014; van der Meij & Böckmann, 2020). Example questions are: "*I think the length of the digital lecture is perfect"* and *"Digital lectures require less effort to follow than real lectures".* Satisfaction was described as the student's positive emotions while watching the digital lesson (Joo et al., 2014; van der Meij & Böckmann, 2020). For satisfaction, questions such as "*I enjoyed the digital lecture"* and *"The digital lectures was a satisfying experience"* were presented.

Responses could be given on a 7-point Likert scale with the response anchors strongly disagree (1) to strongly agree (7). Reliability analyses revealed that there were good

Cronbach's Alpha scores for the three constructs (usefulness = 0.862; ease of use = 0.758; and satisfaction = 0.879).

Knowledge test after the digital lecture

Just like the embedded questions, the questions of the knowledge test about the content of the digital lecture have been designed together with the teachers of the course. The questions related to all segments of the lesson. The knowledge test measured retention and comprehension, reflecting the understanding and apply levels in Bloom's taxonomy (Anderson & Krathwohl, 2000). The knowledge test contained 12 short answer questions, with 9 open-ended retention questions and three open-ended comprehension questions. Example retention question of the knowledge test is: *"Name two of the five styles of conflict management according to Thomas and Kilmann".* Example comprehension question is: *"You notice that a fellow student has an angry attitude towards another student during a game of soccer. Which aspect is used by this student within his/her message? Explain why".* The maximum score on the total test was 18. Scores were converted into percentages.

The knowledge test repeated two embedded questions. The maximum score on these items is four. Scores were converted into percentages. In the code book (see Appendix D) the answers to these questions are available.

4.4 Procedure

Students in each of the three conditions received a digital lecture existing of segmented video including text, either included embedded questions with feedback or embedded questions or no questions and were allowed unlimited opportunities for viewing the videos and reading the written lesson materials.

During the digital lecture the engagement time was being measured. Directly after the digital lecture, the student took a knowledge test and filled out the questionnaire about technology acceptance.

Before the experiment was done there was a pilot test with 1 class of 26 participants and this took place during a normal class in the classroom at school. This test was done to determine the approximate duration of the experiment and to ensure content validity.

The participants were acquired through the researcher's work environment. Within the subset of bachelor students of the School of Human and Sports convenience sampling was used to select participants who all attended the same classes, which was essential as the

intervention was part of the school curriculum of the students. The participants were randomly distributed over the three conditions.

The experiment took place in an ecologically valid setting, namely during students' regular lesson in the classroom. The students received an email one week before the experiment with the instruction to bring a laptop with headphones to the experiment. However, the researcher also had 8 extra laptops with headphones, in case some students forgot to bring one.

After coming in to the classroom the students received a letter of instruction with a personal login code and the link to the digital lecture. After being seated, the researchers asked the students to turn the laptop on with the headphones plugged in. The researcher started the short instruction with a maximum of 10 minutes (see Appendix B) and after this instruction, the participants started with the digital lesson.

After the digital lecture the students filled out the TAM questionnaire and they took the knowledge test. Each lecture included approximately 25 students and the mean total time to completion was approximately 45 minutes.

4.5 Data analysis

The three conditions were first tested for the presence of any differences on their demographics. Assumption testing was done to verify that the data was normally distributed (Kolmogorov-Smirnov) and the variances were homogeneous (Levene). For the non-normal distributions Kruskal-Wallis test was used. For other comparisons, ANOVAS could be used. Testing was two-tailed with α set at 0.05. If there was a significant difference between the conditions Post Hoc scores gave more detail on the differences. In the following section, the data analysis for the four hypotheses will be discussed separately.

To test Hypothesis 1: *"Embedded questions enhance engagement*" the average total time a student spends to a digital lecture is calculated per condition, including SD, to subsequently compare the conditions. After that the three groups are compared. Given a normal distribution and equal variances for the groups an ANOVA is administered. If this does not apply a Kruskal Wallis is used as an alternative. When significant differences appear a post-hoc test is used to identify in detail which significant differences there are.

To test Hypothesis 2: *"Embedded questions in text and video-based digital lecture improves learning outcomes"* and Hypothesis 3: "*Repeated embedded questions yield the highest learning outcomes"* data need to be prepared to be analysed in SPSS. First the scores

of the total knowledge test per participant are calculated (see Appendix C) exhibits the scoring table). Subsequently this is done for the scores of the quizzed items and the non-quizzed items per participant. Then for each condition is calculated what the scores are for the quizzed items, non-quizzed items and the total knowledge test. These scores are represented in percentages, to make visible the percent of success in the test.

Finally the three groups are compared. Given a normal distribution and equal variances an ANOVA is applied. If not, a Kruskal-Wallis test. When significant differences appear a post-hoc test is used to identify specific significant differences.

To test Hypothesis 4: *"Digital lectures (video + text materials) are perceived as useful, easy to use and satisfying"* the average and SD per construct will be calculated per condition for comparison in order to draw conclusions about differences between the three conditions on the three constructs (useful, easy to use and satisfying). A Kruskal-Wallis test is applied to test the significance of differences between conditions for usefulness, ease of use and satisfaction. Finally a Mann-Whitney test is applied to test significance of differences between the three constructs and three conditions.

5. Results

5.1 Distribution of demographics

A Chi-squared test showed that conditions did not differ for gender ($\chi 2$ (2) = 1.1146; p = .564), type of education ($\chi 2$ (4) = .577; p = .966) or prior education ($\chi 2$ (6) = 6.975; p = .323). In addition, age (F(2)=.621; p = .539) did not differ across conditions.

Table 1

Distribution of demographics among age and gender

Group	Age		Man	Female
	M	*(SD)*	*(freq.)*	*(freq.)*
Embedded Questions with FB (n = 46)	19.22	1.97	21	25
Embedded Questions (n = 41)	19.12	1.78	23	18
Control (n = 42)	19.22	1.97	23	19
Overall (n =129)	*19.05*	*1.77*	*67*	*62*

5.2 The effect of embedded questions on video engagement

In this paragraph results related to hypothesis 1: *"Embedded questions enhance engagement"* are reported. Table 2 presents the data for Total Time of the digital lecture. The Table 2 shows that condition embedded questions had spent most time processing the videos, followed by conditions embedded question with feedback and condition control group. From the ANOVA test shows that there was a significant difference between conditions (F(2, 126) = 19.159; p = <.001). The Post Hoc Tuckey test indicated that both experimental conditions differed significantly from the control (p = <.001), but that there was no difference between experimental conditions (p = .919).

Table 2

Means (and standard deviation) for Total Time of the digital lecture per Condition

Condition	Total Time	
	M	*(SD)*
Embedded Questions with FB (n = 46)	41.5	7.09
Embedded Questions (n = 41)	42.02	5.80
Control (n = 42)	33.89	7.23
Overall (n =129)	*39.17*	*7.66*

5.3 The effect of embedded questions on knowledge test

In this paragraph results related to Hypothesis 2: "*Embedded questions in text and video-based digital lecture improves learning outcomes*" and Hypothesis 3*:* "*Repeated embedded questions yield the highest learning outcomes"* are reported". Table 3 presents the data on the knowledge test. From the ANOVA test shows that there was no significant difference between conditions on the overall knowledge test ($F(2, 126) = .421$; $p = .657$), on the quizzed items ($F(2, 126) = 0.170$; $p = 0.844$), and on the non – quizzed items ($F(2.126) = 0.387$; $p = 0.680$).

Table 3

Means (and standard deviation) for Knowledge Test items per Condition

Condition	Quizzed items *M (SD)*	Non-quizzed items *M (SD)*	Total test *M (SD)*
Embedded Questions with FB (n = 46)	67.5% (1.2)	50% (2.9)	54.4% (3.5)
Embedded Questions (n = 41)	65% (1,3)	46% (2.8)	50.6% (3.5)
Control group (n=42)	67.5% (1.3)	49.3% (2.5)	53.3% (3.2)
Total (n=129)	*67.5% (1.2)*	*48.6%(2.7)*	*52.8% (3.4)*

5.4 The Scores of digital lecture on TAM

In this paragraph results related to Hypothesis 4: *"Digital lectures (video + text materials) are perceived as useful, easy to use and satisfying"* are reported. Table 4 show the mean scores and standard deviation for the technology acceptance constructs. The scores were uniformly positive and above the mid-scale value of 4. The Kruskal-Wallis test revealed the presence of a statistically significant difference between conditions for usefulness ($H(2) = 8.9$; $p = .012$), ease of use ($H(2) = 7.9$; $p = .019$), satisfaction ($H(2) = 7.1$; $p = .029$). The Mann-Whitney Test showed a significance difference for usefulness between the condition embedded questions with feedback and condition embedded questions (U= 688; z = -2174, *p*

= .030) and between condition embedded questions and condition control group (U = 539, z = -2994, *p* = .003). No significant difference was found between condition embedded questions with feedback and condition control group (U = 912, z= -.453, *p* = .651).

The Mann-Whitney Test showed a significant difference for ease of use between the condition embedded questions and condition control group (U = 561, *z*= -2.740; *p* = .006). and between the condition embedded questions with feedback and condition embedded question (U= 695, *z*= -2.113, *p* =.035). No significance difference was found between condition embedded question with feedback and condition control group (U = 925, *z*=-.343, *p* = .731).

Finally the Mann-Whitney Test showed a significant difference for satisfaction between the condition embedded questions and condition control group (U= 565, z -2.701, *p* = .007). No significant difference was found between condition embedded questions with feedback and condition embedded questions (U= 768, *z*=-1,490, *p* = .136) and condition embedded questions with feedback and condition control group (U= 829.5, *z*= -1.142; *p* = .253).

Table 4

Means (and Standard deviation) for Usefulness, Ease of Use and Satisfaction per Condition

Condition	Usefulness	Ease of use	Satisfaction
	M (SD)	*M (SD)*	*M (SD)*
Embedded Questions with FB (n = 46)	5.00 (0.94)	5.00 (0.95)	4.55 (1.09)
Embedded Questions (n = 41)	4.48 (1.06)	4.60 (1.00)	4.25 (1.01)
Control group (n=42)	5.15 (0.70)	5.14 (0.74)	4.81 (0.89)
Total (n=129)	*4.88 (0.95)*	*4.92 (0.93)*	*4.54 (1.02)*

Note. Scales values range from 1-7, with higher values meaning a more positive rating

6. Discussion and conclusion

The goal of this research was to answer the question: "*What is the effect of embedded questions on engagement, technology acceptance and learning?"* In this chapter the research question is answered. This includes also discussion of the hypotheses. It will conclude with implications and limitations of the research and recommendations for further research.

6.1 Answer research question

Engagement

First, this study investigated the influence of embedded questions in digital lectures on video engagement, because students must engage with the recorded lecture effectively for it to influence learning outcomes (van der Meij & Dunkel, 2020). Participants in the experimental groups spent significantly more time in minutes on the digital lecture than the control group. These findings are aligned with the results in other empirical studies on digital lectures (Guo, Kim & Rubin, 2014; Cummins, Beresford and Rice, 2016; van der Meij and Böckmann 2020; & Vural, 2013).

However, although the condition embedded questions with feedback and condition embedded question have a higher engagement time than condition control group, they have no higher learning effect than the control group. This result was not expected, because from multiple studies it was apparent that a higher engagement time would lead to higher learning outcomes (e.g. van der Meij & van Dunkel, 2020; Morris, Finnega, & Wu, 2005; Wei, Peng, & Chou, 2015).

High drop-out rates are indicated as disadvantage of digital lectures in comparison with classical classroom teaching (van der Meij & van Dunkel, 2020). Drop-out rate is state in the percentage of students not finishing the digital lecture (Kim et al., 2014). This directly impacts the knowledge level of the students on this content. Therefore the challenge to keep these drop-out rates as low as possible to reach a high engagement within a digital lecture (van der Meij & van Dunkel, 2020). In this study, for all the conditions the drop-out level was extremely low. The drop-out rate is lower than the drop-out rate in earlier studies (e.g. Kim et al, 2014). As this study differs on some factors in comparison to the other study (Kim et al, 2014), explanation for this outcome should be found in the environmental factors of the experiment and teacher and researcher presence during the experiment.

In this experiment we were unable to monitor all screens on students computers and fully exclude other activities during this experiment.

Technology acceptance

This study also investigate the technology acceptance of the digital lecture. The scores of usefulness, ease of use and satisfaction were uniformly positive. Participants experienced the digital lecture generally as a useful activity for studying, easy to process and yielding a satisfying experience. These findings are in line with a large number of studies that have reported positive students appraisals of digital lectures (Baker et al., 2018; Burgoyne & Eaton, 2018; Spanjers et al., 2015; van der Meij & Böckmann, 2020).

The students in condition control group score significantly higher on usefulness than the students in condition embedded questions. The embedded questions may have caused this, because this is the only difference between condition embedded questions and condition control group. Students in the embedded questions with feedback condition have a significantly higher score than students in the embedded questions condition. A possible explanation may be that without feedback, students become insecure because they do not know which knowledge they might have or not. A possible consequence is that they fail to complete the other questions correctly as well. And possibly students find the digital lecture less useful for this reason. It is remarkable that there is no significant difference between condition embedded questions with feedback and control group.

Another possible explanation for the high usefulness of the digital lecture in all conditions is that the lesson was new for all students. Furthermore, the students had a choice if they could join the lesson or not, increasing the students' autonomy.

Learning outcomes embedded questions

Contrary to expectations (e.g. Adesope, et al., 2017; Fiorella & Mayer, 2018; McDaniel et al., 2011) there was no significant difference between conditions on the overall knowledge test. Possible explanations include diverse subjects or a combination of (1) spreading and the time between the digital lesson and the knowledge test, (2) the type and context of the feedback, (3) motivation of the students.

The knowledge test was performed directly after the digital lecture. According to Roediger III & Karpicke (2006) the testing effect is often bigger when the test is postponed (testing after a minimum of one week). This might explain that no significant effect could be found in this study.

Empirical studies show that increasing the amount of tests might improve learning

results (Glover, 1989; Pavlik & Anderson, 2005; Vaughn & Rawson, 2011). That this study only included one test, might have influenced the result. Also, the test was performed directly after the digital lecture. Multiple studies show that the testing effect is still detectable a week to a few months afterwards (Butler & Roediger, 2007; Carpenter, 2009; McDaniel et al., 2007).

The second possibility is the type and context of the feedback. Most studies show that feedback has a positive effect on learning (Fiorella & Mayer, 2018: Narcis, 2008; Narcis & Huth, 2004; Hattie & Timperley, 2007; Shute, 2008). In this study this effect was not seen, but this could have been dependent on the type of feedback the students had or that the feedback was not extensive enough. Another reason could be that the student saw the feedback before filling out the answer and therefore, active processing did not that place and no learning.

Providing good feedback is difficult and dependent on the context of education. The feedback could possible not have been suitable for this student population.

The third possibility is that the student was not highly motivated for the test, because they did not receive a score or credit for this test. According to McDaniel et al., (2011) this may motivate the student and influence the testing results. Also, the students were maybe demotivated to make a test after watching a digital lecture of 40 minutes. The students are very active sportive people that might not have the concentration span for this. Further research could show if this changes when students receive a score or credit for the test.

Learning outcomes repeated embedded questions

Contrary to the expectations, that repeated embedded questions yield the highest learning outcomes (Chan, 2009, 2010; van der Meij & Böckmann, 2020; Shapiro; 2009), there was no significant difference between conditions on the knowledge test regardless of it being a repeated or new question. A possible cause for this might be that the student did not receive a score or credit for the knowledge test and were therefore less motivated and serious (McDaniel et al, 2011). Students of condition control group finished earlier then students from the experimental conditions, it might have decreased motivation to continue working when the other students are already walking out of the classroom. Also, only one repeated questions have been used.

6.2 Implications

In this research teachers helped to develop the digital lecture and therefore gained knowledge about the effectivity of embedded questions and how to design a digital lecture with the help of design guidelines. Also, digital lectures were proved to be effective and in a time of a pandemic very applicable, when offline education is impossible. Designing the lesson cost time and money. This is important for managers in education, so that they can support teachers when they expect them to design digital lectures with a team or independently.

This research shows that a digital lecture may be effective in stimulating the learning of the student and can be implemented as a learning activity to create more effective lectures. The scientific impact of this study is that it was the first study to include video and text on the same page in the digital lecture. Most studies have been performed with just a text or a recorded lesson.

6.3 Limitations

The technical limitations prohibited to use all the information from the log registration. Therefore, the information about student time spent on reading and answering the questions and the percentage of students that looked at a page or video could not be used for this study. It was also not possible to analyse if students used the feedback button and how long they looked at the feedback. This could have given more information about the active knowledge processing which could improve the learning results.

Another limitation is the short time in which the experiment took place. The digital lecture was only one lecture of the course: “Influences strategies in movements and sports” and the other classes were live and face-to-face. There was also only one knowledge test, directly after the digital lecture and this may also have influenced the results. The testing effect is usually bigger if the test is postponed than testing that takes place directly after the lesson (Roediger III & Karpicke, 2006). Multiple studies have shown that when there are more tests the learning results are better (Glover 1989; Pavlik & Anderson, 2005; Vaughn & Rawson, 2011). Also multiple studies show that the testing effect is still detectable a week to a few months afterwards (Butler & Roediger 2007; Carpenter, 2009; McDaniel et al., 2007). Moreover, if the spreading between tests is bigger, the test is more effective (Karpicker & Roediger III, 2007).

The absence of a pre-test is another limitation of this research. The pre-test was not performed, because the risk of interaction-effect of testing and treatment was supposed to be avoided (Campbell & Stanley, 1963). This means that the students know from the pre-test which parts of the digital lecture are essential and what they should focus on.

6.3 Future research

The students took the digital lecture in the classroom. The end goal is that they will use the lecture independently at home. The question is of student will have enough motivation to take the lecture when they have to do that independently (Cardall, Krupat & Ulrich, 2008) and how much time they will spend on the lesson. Further research in this area should be done to analyze this.

The scientific impact of this study is that it was the first study to include video and text on the same page in the digital lecture. Most studies have been performed with just a text or a recorded lesson. The results of this study can be used to do further research to improve the use of embedded questions in a digital lecture.

I recommended that in following studies interview with the students are done to get more insight on the motivation of students for digital lectures and what they see as advantages and disadvantages of the digital lecture in contrast to a lecture in the classroom.

6.4 Conclusion

In conclusion, students who took a digital lecture with embedded questions spend more time than students who take a digital lecture without an embedded question. However, it has not resulted in higher learning outcomes. However, participants experienced the digital lecture generally provide as a useful activity for studying, easy to process and yielded a satisfying experience.

References

Adesope, O. O., Trevisan, D. A., & Sundararajan, N. (2017). Rethinking the use of tests: A meta-analysis of practice testing. *Review of Educational Research, 87*(3), 659-701. https://doi.org/10.3102/0034654316689306

Agarwal, P. K., Karpicke, J. D., Kang, S. H., Roediger III, H. L., & McDermott, K. B. (2008). Examining the Testing Effect with Open- and Closed-Book Tests. *Applied Cognitive Psychology, 22*(7), 861-876. https://doi.org/10.1002/acp.1391

Anderson, L.W., Krathwohl, D.R., & Bloom, B.S. (2001). *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives.* Longman. https://www.uky.edu/~rsand1/china2018/texts/Anderson-Krathwohl%20-%20A%20taxonomy%20for%20learning%20teaching%20and%20assessing.pdf

Attali, Y., & Powers, D. (2009). Immediate Feedback and Opportunity to Revise Answers to Open-Ended Questions. *Educational and Psychological Measurement, 70*(1), 22–35. https://doi.org/10.1177/0013164409332231

Baker, P. R. A., Demant, D., & Cathcart, A. (2018). Technology in public health higher education. *Asia-Pacific Journal of Public Health, 30*(7), 655-665. https://doi.org/10.1177/1010539518800337

Bledsoe, T. S., & Baskin, J. J. (2014). Recognizing Student Fear: The Elephant in the Classroom. *College Teaching, 62*(1), 32-41. https://doi.org/10.1080/87567555.2013.831022

Bruns, S. B. (2017). Meta-Regression Models and Observational Research. *Oxford Bulletin of Economics and Statistics, 79*(5). https://doi.org/637–653. 10.1111/obes.12172

Burgoyne, S., & Eaton, J. (2018). The partially flipped classroom: The effects of flipping a module on "Junk Science" in a large methods course. *Teaching of Psychology, 45*(2), 154-157. https://doi.org/10.1177/0098628318762894

Butler, A. C., & Roediger, H. L. (2007). Testing improves long-term retention in a simulated classroom setting. *European Journal of Cognitive Psychology, 19*(4-5), 514-527. https://doi.org/10.1080/09541440701326097

Cardall S, Krupat E, & Ulrich M. (2008). Live lecture versus video-recorded lecture: Are students voting with their feet? *Academic Medicine, 83*(12), 1174–1178. https://doi.org/10.1097/ACM.0b013e31818c6902

Carpenter, S. K. (2009). Cue strength as a moderator of the testing effect: the benefits of elaborative retrieval. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *35*(6), 1563. https://doi.org/10.1037/a0017021

Chan, J. C. K. (2009). When does retrieval induce forgetting and when does it induce facilitation? Implications for retrieval inhibition, testing effect, and text processing. *Journal of Memory and Language*, *61*, 153–170. https://doi.org/10.1016/j.jml.2009.04.004

Chan, J. C. K. (2010). Long-term effects of testing on the recall of non-tested materials. *Memory*, *18*, 49–57. https://doi.org/10.1080/09658210903405737

Cheon, J., Crooks, S., & Chung, S. (2014). Does segmenting principle counteract modality principle in instructional animation? *British Journal of Educational Technology, 45(1),* 56- 64. https://doi.org/10.1111/bjet.12021

Chi, M. T. (2009). Active-Constructive-Interactive: a conceptual framework for differentiating learning activities. *Topics in Cognitive Science, 1*(1), 73-105. https://doi.org/10.1111/j.1756-8765.2008.01005.x

Chiu, C. M., Hsu, M. H., Sun, S. Y., Lin, T. C., & Sun, P. C. (2005). Usability, quality, value and e-learning continuance decisions. *Computers & Education, 45*(4), 399–416. https://doi.org/10.1016/j.compedu.2004.06.001

Clark, I. (2012). Formative assessment: Assessment is for self-regulated learning. *Educational Psychology Review, 24*(2), 205–249. https://doi.org/10.1007/s10648-011-9191-6

Cummins, S., Beresford, A. R., & Rice, A. (2016). Investigating engagement with in-video quiz questions in a programming course. *IEEE Transactions on Learning Technologies, 9*(1), 57-66. https://doi.org/10.1109/TLT.2015.2444374

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. https://doi.org/10.2307/249008

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35(8*), 982- 1003. https://doi.org/10.1287/mnsc.35.8.982

Davis, F. D., & Venkatesh, V. (1996). A critical assessment of potential measurement biases in the technology acceptance model: three experiments. *International journal of human-computer studies*, *45*(1), 19-45. https://doi.org /10.1006/ijhc.1996.0040

Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest,14*(1), 4-58. https://doi.org/10.1177/1529100612453266

Fiorella, L., & Mayer, R. E. (2018). What works and doesn't work with instructional video. *Computers in Human Behavior*, *89*, 465-470. https://psycnet.apa.org/doi/10.1016/j.chb.2018.07.015

Gilboy, M. B., Heinerichs, S., & Pazzaglia, G. (2015). Enhancing student engagement using the flipped classroom. *Journal of nutrition education and behavior*, *47*(1), 109-114. https://doi.org/10.1016/j.jneb.2014.08.008

Glover, J. A. (1989). The" testing" phenomenon: Not gone but nearly forgotten. *Journal of Educational Psychology*, *81*(3), 392. https://doi.org /10.1037/0022-0663.81.3.392

Guo, P. J., Kim, J., & Rubin, R. (2014, March). How video production affects student engagement: An empirical study of MOOC videos. In *Proceedings of the first ACM conference on Learning@ scale conference* (pp. 41-50). https://doi.org/10.1145/2556325.2566239

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of educational research*, *77*(1), 81-112. https://doi.org/10.3102%2F003465430298487

Joo, Y. J., Lee, H. W., & Ham, Y. (2014). Integrating user interface and personal innovativeness into the TAM for mobile learning in Cyber University. *Journal of Computing in Higher Education*, *26*(2), 143-158. https://doi.org/10.1007/s12528-014-9081-2

Joo, Y. J., Lim, K. Y., & Kim, E. K. (2011). Online university student's satisfaction and persistence: Examining perceived level of presence, usefulness and ease of use as predictors in a structural model. *Computer & Education*, *57*(2), 1654–1664. https://doi.org/10.1016/j.compedu.2011.02.008

Karpicke, J. D. (2017). Retrieval-based learning: A decade of progress. In J. H. Byrne (Ed.), *Learning and memory: A comprehensive reference* (2nd ed., pp. 487-514). Academic Press. https://doi.org/10.1016/B978-0-12-809324-5.21055-9

Karpicke, J.D., & Blunt, J.R. (2011). Retrieval practice produces more learning than elaborative studying with concept mapping. *Science (New York, N.Y.), 331(6018)*, 772-775. https://doi.org/10.1126/science.1199327

Karpicke, J. D., & Roediger lll, H. L. (2007). Expanding retrieval practice promotes short-term retention, but equally spaced retrieval enhances long-term retention. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *33*(4), 704–719. https://psycnet.apa.org/doi/10.1037/0278-7393.33.4.704

Kester, L. & Merriënboer, J. van. (2013). Effectief leren van multimediale leerbronnen. 4W. Weten Wat Werkt en Waarom, 2(4), 14-51. https://www.kennisnet.nl/app/uploads/kennisnet/publicatie/4w/4w_magazine_2013-4.pdf

Kim, J., Guo, P. J., Seaton, D. T., Mitros, P., Gajos, K. Z., & Miller, R. C. (2014). Understanding in- video dropouts and interaction peaks in online lecture videos. *Paper presented at the L@S '14, Atlanta, GA* March 4-5. https://doi.org/10.1145/2556325.2566237

Mayer, R. E. (2014). *The Cambridge handbook of Multimedia learning* (5th ed.). Cambridge University Press.

McDaniel, M. A., Agarwal, P. K., Huelser, B. J., McDermott, K. B., & Roediger, H. L. (2011). Test-enhanced learning in a middle school science classroom: the effects of quiz frequency and placement. *Journal of Educational Psychology*, *103*(2), 399-414. https://doi.org/10.1037/a0021782

McDaniel, M. A., Anderson, J. L., Derbish, M. H., & Morrisette, N. (2007). Testing the testing effect in the classroom. *European Journal of Cognitive Psychology*, *19*(4-5), 494-513. https://doi.org/10.1080/09541440701326154

Narciss, S. (2008). Feedback strategies for interactive learning tasks. *Handbook of research on educational communications and technology, 3*, 125-144. https://doi.org/10.1007/978-1-4419- 1428-6_283

Narciss, S., & Huth, K. (2004). *How to design informative tutoring feedback for multimedia learning*. In H. M. Niegemann, D. Leutner, & R. Brunken (Ed.), *Instructional design for multimedia learning* (pp. 181-195). Waxmann.

Pashler, H., Bain, P.M., Bottge, B.A., Graesser, A., Koedinger, K., McDaniel, M. & Metcalfe, J. (2007). *Organizing instruction and study to improve student learning* (NCER 2007-2004). Washington, DC: National Center for Education Research, Institute of Education Sciences, U.S. Department of Education. http://ncer.ed.gov.

Pavlik Jr, P. I., & Anderson, J. R. (2005). Practice and forgetting effects on vocabulary memory: An activation-based model of the spacing effect. *Cognitive Science, 29*(4), 559-586. https://doi.org/10.1207/s15516709cog0000_14

Rawson, K. A., & Dunlosky, J. (2012). When is practice testing most effective for improving the durability and efficiency of student learning? *Educational Psychology Review*, *24*, 419-435. https://doi.org/10.1007/s10648-012-9203-1

Roediger III, H. L., & Karpicke, J. D. (2006). Test-enhanced learning: Taking memory tests improves long-term retention. *Psychological science, 17*(3), 249-255. https://doi.org/10.1111%2Fj.1467-9280.2006.01693.x

Roelle, J., Rahimkhani-Sagvand, N., & Berthold, K. (2017). Detrimental effects of immediate explanation feedback. *European Journal of Psychology of Education, 32*, 367-384. https://doi.org/10.1007/s10212-016-0317-6

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist*, *55*(1), 68. https://psycnet.apa.org/doi/10.1037/0003-066X.55.1.68

Sadler, R. D. (1989). Formative assessment and the design of instructional systems. *Instructional Science, 18*, 119–144. https://link.springer.com/article/10.1007/BF00117714

Shapiro, A. (2009). An empirical study of personal response technology for improving attendance and learning in a large class. *Journal of the Scholarship of Teaching and Learning*, *9*(1), 13-26.

Smith, M. A., & Karpicke, J. D. (2013). Retrieval practice with short-answer, multiple-choice, mand hybrid tests. *Memory*, *22*(7), 784–802. https://doi.org/10.1080/09658211.2013.831454

Shinaberger, L. (2017). Components of a flipped classroom influencing student success in an undergraduate business statistics course. *Journal of Statistics Education*, *25*(3), 122-130. https://doi.org/10.1080/10691898.2017.1381056

Shute, V. J. (2008). Focus on formative feedback. *Review of Educational Research, 78*(1), 153-189. https://doi.org/10.3102/0034654307313795

Spanjers, I. A. E., Könings, K. D., Leppink, J., Verstegen, D. M. L., de Jong, N., Czabanowska, K.,& van Merriënboer, J. J. G. (2015). The promised land of blended learning: Quizzes as a moderator. *Educational Research Review*, *15*, 59-74. https://doi.org/10.1016/j.edurev.2015.05.001

Spanjers, I. A. E., van Gog, T., & van Merriënboer, J. J. G. (2012). Segmentation of worked examples: effects on cognitive load and learning. *Applied Cognitive Psychology, 26*, 352-358. https://doi.org/10.1002/acp.1832

Šumak, B., HeričKo, M., & PušNik, M. (2011). A meta-analysis of e-learning technology acceptance: The role of user types and e-learning technology types. *Computers in Human Behavior*, *27*(6), 2067-2077. https://doi.org/10.1016/j.chb.2011.08.005

Thomas, R. C., Weywadt, C. R., Anderson, J. L., Martinez-Papponi, B., & McDaniel, M. A. (2018). Testing encourages transfer between factual and application questions in an online learning environment. *Journal of Applied Research in Memory and Cognition*, *7*(2), 252-260. https://doi.org/10.1016/j.jarmac.2018.03.007

Torrance, H., & Pryor, J. (2001). Developing formative assessment in the classroom: Using action research to explore and modify theory. *British Educational Research Journal*, *27*(5), 615– 631.

Tweissi, A. (2016). *The effects of embedded questions strategy in video among graduate students at a middle eastern university* [Doctoral dissertation, the Department of Educational Studies and The Patton College of Education]. Ohio University, Athens. https://etd.ohiolink.edu/pg_10?::NO:10:P10_ETD_SUBID:119049

van Berkel, H., Bax, A., & Joosten-ten Brinke, D., (2014). Formatief toetsen. In D. Joosten-ten Brinke & Dominique Sluijsmans (Reds.) *Toetsen in het hoger onderwijs* (derde, geheel herziene druk*)* (pp. 81-91). Houten, Nederland: Bohn Safleu van Loghum.

van der Meij, H., & Dunkel, P. (2020). Effects of a review video and practice in video-based statistics training. *Computers and Education, 143.* https://doi.org/10.1016/j.compedu.2019.103665

van der Meij & Böckmann, (2020). *Embedded questions in recorded lectures.* [Manuscript in preparation]. Department of Instructional Technology, University of Twente.

Vaughn, K. E., & Rawson, K. A. (2011). Diagnosing criterion-level effects on memory: What aspects of memory are enhanced by repeated retrieval? *Psychological Science, 22*(9), 1127-1131. https://doi.org/10.1177%2F0956797611417724

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management science*, *46*(2), 186-204. https://doi.org/10.1287/mnsc.46.2.186.11926

Vural, O. F. (2013). The Impact of a Question-Embedded Video-based Learning Tool on E-learning. *Educational Sciences: Theory and Practice*, *13*(2), 1315-1323.

Wittrock, M. C. (1989). Generative processes of comprehension. *Educational psychologist*, *24*(4),345-376. https://.org/10.1207/s15326985ep2404_2

Wooldridge, C. L., Bugg, J. M., McDaniel, M. A., & Liu, Y. (2014). The testing effect with authentic educational materials: A cautionary note. *Journal of Applied Research in Memory and Cognition, 3(*3). 214-221. https://doi.org/10.1016/j.jarmac.2014.07.001

Appendixes

Appendix A - TAM vragenlijst

Usefulness

1. Ik vind deze digitale les bruikbaar voor mijn opleiding.
2. Ik vind deze digitale les nuttig voor mijn opleiding.
3. Ik vind dat deze digitale les belangrijk is voor mijn opleiding.
4. Ik vind deze digitale les onbelangrijk voor mijn opleiding.
5. Ik vind dat deze digitale les een aanvulling is voor de reader
6. Ik vind dat deze digitale les een aanvulling is voor de klassikale les

Ease of use

7. Ik vind dat deze digitale les het leren van een bepaald onderwerp vergemakkelijkt.
8. Ik vind deze digitale les gemakkelijker te volgen dan een klassikale les.
9. Ik vind deze digitale les gemakkelijk te gebruiken.
10. Ik vind de lengte van deze digitale les perfect.
11. Ik vond het gemakkelijk om te concentreren tijdens deze digitale les.
12. Ik wist wat ik moest doen tijdens deze digitale les.

Satisfaction

13. Ik ben tevreden over de digitale les.
14. Ik vind de digitale les saai.
15. Ik heb genoten van de digitale les.
16. Ik vind de digitale les leuk.
17. Ik voel mij voldaan door het bekijken van de digitale les.
18. Ik ben content met de digitale les.

	Vraag
U1	Ik vind deze digitale les bruikbaar voor mijn opleiding.
E7	Ik vind dat deze digitale les het leren van een bepaald onderwerp vergemakkelijkt.
S17	Ik voel mij voldaan door het bekijken van de digitale les.
E12	Ik wist wat ik moest doen tijdens deze digitale les.
S15	Ik heb genoten van de digitale les.
U2	Ik vind dat deze digitale les nuttig voor mijn opleiding.
E8	Ik vind deze digitale les gemakkelijker te volgen dan een klassikale les.
U3	Ik vind dat deze digitale les belangrijk is voor mijn opleiding.
S14	Ik vind deze digitale les saai.
E10	Ik vind de lengte van deze digitale les perfect.
U5	Ik vind dat deze digitale les een aanvulling is voor de reader
E11	Ik vond het gemakkelijk om te concentreren tijdens deze digitale les.
U6	Ik vind dat deze digitale les een aanvulling is voor de klassikale les
S18	Ik ben content met de digitale les.
S16	Ik vind de digitale les leuk.
U4	Ik vind deze digitale les onbelangrijk voor mijn opleiding.
S13	Ik ben tevreden over de digitale les.
E9	Ik vind deze digitale les gemakkelijk te gebruiken.

Appendix B - Procedure en instructie

Het experiment vindt plaats in het klaslokaal op de Hogeschool. Elke student heeft een zelf meegenomen laptop met koptelefoon. De onderzoeker heeft 8 laptops met koptelefoons achter de hand voor het geval een aantal studenten de laptop met koptelefoon zijn vergeten. Studenten worden random ingedeeld.

In het klaslokaal staan de tafels in bus opstellingen. Studenten zitten met het gezicht naar het bord.

Als de studenten op hun plek zitten, vraagt de docent aan alle studenten hun laptop te openen en de koptelefoon ingeplugd in de laptop en op tafel neer te leggen. De docent geeft de volgende **instructie.**

"*Vandaag krijgen jullie een digitale les. Deze les gaat over het hoofdstuk stormingingsfase macht en communicatie. Deze les bereid je voor op het tentamen.*
Tijdens deze les doe je mee aan een onderzoek. De onderzoeker zal jouw gegevens vertrouwelijk verwerken. Dit betekent dat jouw naam met gegevens niet terug te vinden zijn. De onderzoeker ziet alleen jouw nummer, maar kan dit dus niet koppelen aan een naam. Jouw persoonlijke gegeven worden ook niet doorgegeven aan de docent. Wil je niet deelnemen tijdens dit onderzoek, dan heb je vanaf nu de tijd om zelfstandig aan het hoofdstuk te werken. Hiervoor kun je de reader gebruiken.
Tijdens deze les heb je je laptop met koptelefoon nodig. Open je laptop en plug je koptelefoon in je laptop. Leg je koptelefoon op tafel.
Op je tafel ligt een briefje met jouw inlogcode en jouw nummer. De opdrachten verschillen. Dit betekent dat je buurman of buurvrouw eerder klaar is dan jou. Dat is geen probleem. Nadat je bent ingelogd krijg je losse lesonderdelen te zien. Bestudeer die allemaal.

Aan het eind van de les krijg je een aantal vragen over hoe je de digitale les hebt ervaren. Daarna krijg je een toets over de losse lesonderdelen .

Als laatste nog even iets heel belangrijks. Aan het eind krijg je een lijst met scores.

Klik op PDF opslaan en verzend het naar xxxxxxx@xxxxxxxx.nl. Vervolgens krijg je nog een eindtoets. Vergeet niet na de eindtoets op SUBMIT te klikken. Voordat je klaar bent, laat je alle tabbladen open en steek je je vinger op.

Nu aan het werk. In de linkerbovenhoek zie je een persoonlijk briefje. Volg wat daar op staat. Succes

Appendix C - Antwoorden embedded questions (groep a en b)

Vraag	hoofdstuk Bloom vraag	Kennisvragen tijdens les	Antwoord	punten
E.1 E.2	<u>Roos van Leary</u> Apply Apply	Deze vraag hoort bij het voorgaande filmfragment "Expeditie Robinson". Welk type gedrag, volgens de Roos van Leary neemt Aisha in? Deze vraag hoort bij het voorgaande filmfragment "Expeditie Robinson".Welke type segmenten van de Roos van Leary passen hier bij?	Aisha neemt een tegen-boven positie Type segmenten: offensief / aanvallen &-concurrerend	2 2 **Totaal 4**
E3	<u>Stormingsfase</u> Understand	Beschrijf 2 kenmerken van de stormfase van het gedrag van groepsleden	De storm- of conflictfase kenmerkt zich door het volgende gedrag van groepsleden: ● Overtuigingen worden uitgesproken ● De rolverdeling wordt opnieuw bepaald. ● Een groepslid gaat het groepslidmaatschap positief of negatief waarderen. In het geval van een negatieve waardering, kan iemand besluiten om bij een andere groep aan te sluiten of zich terug te trekken. ● Mogelijke uiting van meningsverschillen	Per goed genoemd antwoord 1 punten. **Totaal 2**

			● Gedrag vertonen ten behoeve van het uitvoeren van de taak of juist het voorkomen van conflicten binnen de groep.	
E4 E5 E6 E7	<u>Machtsbronnen en machtsmiddelen</u> apply apply apply apply	Noem 1 **machtsbron** die de trainer inzet. Noem 1 **machtsbron** die meester Mark inzet. Noem 1 **machtsmiddel** dat de trainer inzet. Noem 1 **machtsmiddel** dat meester Mark inzet?	Trainer: ● Machtsbron: positie, legitieme macht – beloningsmacht en bestraffingsmacht ● Machtsmiddelen: regels stellen, methoden hanteren, straffen en belonen Meester Mark ● Machtsbron: Persoonlijk kwaliteiten, deskundigheidsmacht – relationele macht ● Machtsmiddelen: kennis en vaardigheden, steun geven, positieve e noprechte aandacht geven, boeiend presenteren,	Per goed genoemde antwoord 1 punt **Totaal 4**
E8 E9	<u>Conflicthantering</u> Understand Understand	Noem 2 van de 5 stijlen van conflicthantering volgens Thomas en Kilmann. Geef 1 voorbeeld van elke stijl.	Foceren (doordrukken) : het eigenbelang voorop. Als er ‘harde’ actie nodig is, of als het gevaarlijk wordt kan deze stijl effectief zijn. De valkuil is dat je je afsluit voor de ander. De kans op escalatie neemt daardoor toe. Toegeven: het belang van de ander staat voorop. Deze stijl is effectief als het onderwerp belangrijker is voor de ander dan voor jezelf, als je zelf niet gelijk hebt of als je krediet wilt opbouwen bij de ander. De valkuil is dat je je eigen belang opzij zet. Vermijden geen enkel belang staat voorop. Je kunt het onderwerp van	Per genoemde stijl 1 punt. **Totaal 2**

E10	apply	Welke stijl van conflicthantering volgens Thomas en Kilmann laat Rico zien in het filmpje "Rico".	conflict ontwijken door over iets anders te gaan praten, door te zwijgen of zijdelings te reageren. Deze stijl kan gebruikt worden om spanningen terug te brengen of als uitstellen leidt tot betere lange termijn doelstellingen of als iets moeilijk of niet te veranderen is. Een valkuil is dat het conflict wordt ontkend terwijl het wel blijft bestaan. Compromis sluiten Deze stijl kenmerkt zich door ‘geven en nemen’. Deze stijl kan ingezet worden als er een (tijdelijke) oplossing mogelijk is. De valkuil is dat je een middenpositie inneemt waardoor een betere oplossing wordt gemist. Exploreren (samenwerken Met deze stijl wordt naar oplossingen gezocht die beide belangen zo goed mogelijk recht doen. Dit leidt tot een win-win situatie. De valkuil is dat het te lang duurt (omdat het tijd kost) waardoor een oplossing uitblijft. Forceren – doordrukken	Per vb 1punt. **Totaal 2** Goed genoemde stijl rico à 1 punt **Totaal 1**
E11	Boodschap binnen communicatie Understand	Er zijn in een gesprek vier aspecten van een boodschap die tegelijkertijd spelen en elkaar beïnvloeden. Een van de aspecten is het expressief	<u>Aspect niveau boodschap:</u> Zakelijk inhoudsniveau Relationeel betrekkingsniveau Appelleren betrekkingsniveau	Per aspect 1 punt + per niveau 1 punt

E12	apply	aspect. Noem 2 andere aspecten In het filmpje Elyza, heb je gezien dat er vanuit verschillende aspecten gecommuniceerd werd. Beschrijf 1 moment uit het filmpje dat er door Elyza werd gecommuniceerd op het expressieve aspect en leg uit waarom jij dat vindt.	Voorbeelden zijn: ● gooien met de stoel --> haar lichaamstaal laat zien dat ze boos is ● uitschelden van haar moeder --> ze schreeuwt tegen haar moeder ● duwt haar zusje van de bank --> haar lichaamstaal laat zien dat zij de baas is	Max 1 punt voor een goed goed voorbeeld **Totaal 3**
				Totaal 18

Appendix D - Knowledge test, vragen en antwoorden

Vraagnr.	**Hoofdstuk + Bloom vraag**	**Kennisvragen eindtoets**	**antwoord**	**punten**
K10	Roos van leary Understand Retention	Uit welke 4 typen gedrag bestaat de Roos van Leary?	Boven onder, samen, tegen	2 **Totaal 2**
k11	Roos van leary Apply Comprehension	Een student staat voor het eerst voor de klas. Hij staat wat in elkaar gedoken en spreek zachtjes en langzaam. In welke type segment van de Roos van Leary bevindt deze student zich?	Terugtrekken	2 **Totaal 2**
K12	Stormingsfase Understand	Beschrijf 2 kenmerken tijdens de stormingsfase van het gedrag van groepsleden	De storm- of conflictfase kenmerkt zich door het volgende gedrag van groepsleden: ● Overtuigingen worden uitgesproken ● De rolverdeling wordt opnieuw bepaald. ● Een groepslid gaat het groepslidmaatschap positief of negatief waarderen. In het geval van een negatieve waardering, kan iemand besluiten om bij een andere groep aan te sluiten of zich terug te trekken. ● Mogelijke uiting van meningsverschillen ● Gedrag vertonen ten behoeve van het uitvoeren van de taak of juist het voorkomen van conflicten binnen de groep.	Per goed genoemde antwoord 1 punten. **Totaal 2**

			• Subroepen, strijdje en beperkende oplossingen • Tegenafhankelijk houding t.o.v. leidinggevende • Lang overleg door strijdjes • Reactie op kritiek hoor je: “ja en jij dan”	
K13	Stormingsfase Understand	Beschrijf 2 kenmerken van de rol van de begeleider tijdens de stormingsfase.	• De rol van de groepsbegeleider is in deze fase lastig, omdat de onrust nodig is voor de groepsvorming. • De begeleider moet de ruimte geven om zowel op inhoud als op taakniveau de conflicten bespreekbaar te maken en rust te creëren. • De kunst voor de begeleider is om in het hier en nu sturing te blijven geven en te kunnen wisselen tussen verschillende rollen en interactiestijlen.	Per goed genoemde antwoord 0,5 punten. **Totaal 1**
K14 a K14 b	Machtsbronnen en machtsmiddelen Understand Understand	Noem 2 machtsbronnen Geef bij elke bron 1 voorbeeld	Positie, Legitieme macht, Belonings en bestraffingsmacht • Regels stellen, mehtoden hanteren, belonen en straffen Persoonlijke kwaliteiten, Deskundigheidsmacht, Relationele macht • kennis en vaardigheden, steun geven, positieve aandacht, boeiend presenteren	Per bron 1 punt. Per vb 1 punten. **Totaal 4**
K15 a k15 b	conflicthantering Understand Understand	Noem 2 van de 5 stijlen van conflicthantering volgens Thomas en Kilmann. Geef 1 voorbeeld van elke stijl.	5 stijlen Foceren (doordrukken) : het eigenbelang voorop. Als er ‘harde’ actie nodig is, of als het gevaarlijk wordt kan deze stijl effectief zijn. De valkuil is dat je je afsluit voor de ander. De kans op escalatie neemt daardoor toe.	Per genoemde stijl 1 punt. **Totaal 2**

			Toegeven: het belang van de ander staat voorop. Deze stijl is effectief als het onderwerp belangrijker is voor de ander dan voor jezelf, als je zelf niet gelijk hebt of als je krediet wilt opbouwen bij de ander. De valkuil is dat je je eigen belang opzij zet. Vermijden (ontwijken) geen enkel belang staat voorop. Je kunt het onderwerp van conflict ontwijken door over iets anders te gaan praten, door te zwijgen of zijdelings te reageren. Deze stijl kan gebruikt worden om spanningen terug te brengen of als uitstellen leidt tot betere lange termijn doelstellingen of als iets moeilijk of niet te veranderen is. Een valkuil is dat het conflict wordt ontkend terwijl het wel blijft bestaan. Compromis sluiten Deze stijl kenmerkt zich door ‘geven en nemen’. Deze stijl kan ingezet worden als er een (tijdelijke) oplossing mogelijk is. De valkuil is dat je een middenpositie inneemt waardoor een betere oplossing wordt gemist. Exploreren (samenwerken Met deze stijl wordt naar oplossingen gezocht die beide belangen zo goed mogelijk recht doen. Dit leidt tot een win-win situatie. De valkuil is dat het te lang duurt (omdat het tijd kost) waardoor een oplossing uitblijft.	Per vb 1 punt. **Totaal 2**

K16 a K16 b	Boodschap binnen communicatie understand understand”	Er zijn in een gesprek vier verschillende aspecten van een boodschap die op een bepaald niveau betrekking hebben. Noem 2 aspecten. Geef bij elk aspect aan wat het niveau van de boodschap is.	Aspect niveau boodschap Zakelijk inhoudsniveau Expressief betrekkingsniveau Relationeel betrekkingsniveau Appelleren betrekkingsniveau	Per aspect 0,5 punt, per niveau 0,5 punt **Totaal 2**
K17a K17b	Boodschap binnen communicatie Apply Apply	Tijdens een potje voetbal zie jij dat een medestudent zich groot maakt en boos kijkt naar zijn tegenstander. Welk aspect van een boodschap gebruikt deze medestudent? Leg uit waarom dat zo is.	Expressief, omdat hij met zijn lichaamshouding de taal aangeeft / zich uit.	0,5 punten voor juiste aspect 0,5 punten voor verantwoording **Totaal 1**
				Totaal 18

Appendix E - Overzicht vragen tijdens en na de videolecture

Bloom vraag	Vragen tijdens video lecture	Bloom vraag	Kennisvragen eindtoets
		Understand Roos van leary	Uit welke 4 typen gedrag bestaat de Roos van Leary?
Apply Roos van Leary	Deze vraag hoort bij het voorgaande filmfragment "Expeditie Robinson". Welk type gedrag, volgens de Roos van Leary neemt Aisha in? En welke type segmenten van de Roos van Leary passen hier bij?	Apply Roos van leary	Een student staat voor het eerst voor de klas. Hij staat wat in elkaar gedoken en spreek zachtjes en langzaam. In welk segment van de Roos van Leary bevindt deze student zich?
Understand stormingsfase	Noem 2 kenmerken van de stormfase van het gedrag van groepsleden	Understand stormingsfase	Noem 2 kenmerken tijdens de stormingsfase van het gedrag van groepsleden
		Understand	Wat is de rol van de begeleider tijdens de stormingsfase?
apply Machtsbronnen en machtsmiddelen	Noem 1 **machtsbron** die de trainer inzet en 1 **machtsbron** die meester Mark ingezet ? Noem 1 **machtsmiddelen** die de trainer inzet en 1 **machtsmiddel** die meester Mark inzet?	Understand Machtsbronnen en machtsmiddelen	Noem 2 machtsbronnen.
Understand Conflicthantering	Noem 2 van de 5 stijlen van conflicthantering volgens Thomas en Kilmann. En noem van elke stijl 1 kenmerk.	Understand conflicthantering	Noem 2 van de 5 stijlen van conflicthantering volgens Thomas en Kilmann. En noem van elke stijl 1 kenmerk.
understand”	Er zijn in een gesprek vier aspecten van een boodschap die tegelijkertijd spelen en elkaar	Apply	Er zijn in een gesprek vier aspecten van een boodschap die tegelijkertijd spelen en

Boodschap binnen communicatie	beïnvloeden. Een van de aspecten is het expressief aspect. Noem de andere 3 aspecten en geef bij elk aspect aan wat het niveau van de boodschap is.	Boodschap binnen communicatie	elkaar beïnvloeden. Tijdens een potje voetbal zie jij dat een medestudent zich groot maakt en boos kijkt naar zijn tegenstander. Welk aspect van een boodschap gebruikt deze medestudent?

De vragen die in beide toetsen komen zijn:

- Noem 2 kenmerken tijdens de stormingsfase van het gedrag van groepsleden
- Noem de 2 van de 5 stijlen van conflicthantering volgens Thomas en Kilmann. En noem van elke stijl 1 kenmerk.

Appendix F - Logdata collected during the digital lesson HF 3.4

Variables collected during the during lecture using logfiles Name	Description	Value
User ID	Personal ID used for all offline and online tests	1 letters + 2 numbers
User type	Condition the student participated in: A: embedded questions with feedback B: embedded questions C: control group	A / B / C
Total play time	percentage van de bekeken digital lecture	Percentage
Page time	aantal seconden dat gespendeerd is per pagina	Seconds
Question time	aantal seconden per question.	Seconds
Total times in minutes	aantal minuten dat gespendeerd is aan de gehele digital lecture. Plays, replays and pauses are all included.	Minutes
Answer EQ	Answer to the quiz item as provided by the student	Answer
Answer Knowledge test	Answer to the quiz item as provided by the student	Answer