1. Project Title and Applicants

Title: Intermittent quizzes in video lectures: Making sure they work

Main applicant

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The project team consists of two researchers from the Human-Technology Interaction (HTI) group at Eindhoven University of Technology, Daniel Lakens and Chris Snijders. Both lecturers have received awards as best teachers of a bachelor course at Eindhoven University of Technology (2014 and 2006, respectively). We will receive assistance from the HTI technical staff (Lab manager: Martin Boschman) and two student assistants. The team has excellent teaching experience, and has received previous grants to implement ICT innovations in teaching (a Kennisnet Grassroots grant for ICT innovations in Education awarded to Daniel Lakens in 2006 and a Kennisnet grant "The impact of social media integration in Dutch high schools: from 'one size fits all' to student integration" awarded to Chris Snijders, with Uwe Matzat).

2. Background and justification

Online lectures provide many benefits to students. Students are more flexible in when and where they learn, and they can go through the material at their own pace. However, online lectures also provide challenges. Research examining how students learn has revealed that online education critically depends on self-control skills (Schacter & Szpunar, in press). Self-control fosters the ability to stay on-task when our minds would rather wander. It allows people to restrain momentary desires or distractions to reach long-term goals. One of the biggest challenges students face during lectures is to prevent mind-wandering, and to keep paying attention to the lecture. It is well known that students find it difficult to keep paying attention the longer a lecture takes, and that mind-wandering negatively affects how much students learn from a lecture.

Psychological research has found that one way to prevent mind-wandering during online lectures is to **provide short quiz questions throughout an online lecture**. Recent studies show that including such short quiz questions improve performance on tests about the lecture content (Soderstrom & Bjork, 2014; Szpunar, Khan, & Schacter, 2013).

In addition to trying to prevent mind-wandering, self-regulated learning requires other meta-cognitive processes. One of these is monitoring how well students understand the contents of the lecture. In classrooms, students can ask clarifying questions (either to fellow students or the lecturer), but this is not possible in online lectures. Intermittent quizzes in video lectures can provide students feedback on how well they understand the lecture content, and have been found to reduce students' anxiety about the final test for a course (Schacter & Szpunar, in press).

Making online lectures more attractive and easier to set one's mind to is of special importance in the TU/e context, where the number of courses with substantial numbers of students is large, online lectures are offered more and more, but the attendance to standard online video lectures is low (Gorissen, Van Bruggen, & Jochems, 2012).

These studies provide a clear indication that introducing short quiz questions during video lectures can help to improve students' performance. However, there are a number of important questions that need to be addressed before these insights can be applied in education. These questions are both theoretical and practical in nature, as we outline below.

3. Objectives

In the proposed project, the goal is to examine both the practical aspects of implementing quizzes in online environments (so that responses can easily be stored and analyzed by the lecturer), as well as the theoretical aspects of when quizzes work optimally, and what their long-term effects are.

When intermittent quizzes are used in online lectures, one important question is how performance on these quizzes can be tracked. While it is relatively easy to introduce quizzes and questions in online lectures where performance is not tracked (e.g., 'please pause this video and answer this question for yourself, then continue the video') actively taking part in quizzes where performance is not tracked is in itself a self-regulation challenge. A further reason to keep track of students' performance on quizzes during online lectures is that it allow lecturers to easily keep track of topics that require additional clarification during contact hours.

Thus, it is important to examine how we can create quizzes where the performance is tracked, preferably by integrating quizzes in web lectures that are integrated in the Learning Management System(s) used at our university. One of the objectives of this project is to find the best (existing) software to achieve this, and work out the practical details to implement this software in our Learning Management Systems (LMS). We will focus on SCORM compliant solutions (the standard for web-based electronic educational technology) to make sure our solution will work with other (or future) learning management systems, and such that even if proprietary software that is not SCORM compatible would be used at the TU/e in the future, teachers can easily use free open software LMS solutions (e.g., MOODLE) to implement intermittent quizzes in video lectures. The practical aim is that any lecturer with a basic understanding of computer software should be able to add quizzes to online videos and analyze the results, as effortlessly as possible.

A more theoretical question is where the trade-off lies between the use of quiz questions to increase students' attention, and their disruptive effect on the flow of a lecture. Little is known on the number of quizzes to be used to achieve optimal efficiency, and whether this optimum purely depends on the duration of a lecture, or on its content (e.g., density of information, topic, etc.). A second theoretical question is to what extent the beneficial effects

of quizzes that have been observed in recent experiments depend on their novelty (e.g., students trying out something novel) and how well these effects hold up in online lecture series that continue for several weeks. A third theoretical question is whether only knowledge and insight (as has been demonstrated in the literature), or also practical skills can be tested. We aim to examine these theoretical questions in our student population.

4. Expected outcomes

The project has two expected outcomes. On the one hand, we aim to work out the practical details of how to create online quizzes in video lectures, providing teachers with the know-how of which software to use, and a practical 'how-to' explaining step-by-step how to create such quizzes, and make sure students' scores are accessible in whichever Learning Management System the TU/e will choose to use.

On the other hand, we aim to examine whether online quizzes are actually beneficial in our student population. We will look at whether and how much memory for lecture content will improve, as well as the relation with performance on exams. We are especially interested in whether there are long term effects, and what a good frequency of the number of quizzes is, as a function of the duration of the lecture. We will use the quizzes to test general knowledge and insight (in the introduction to psychology course 0HV10), but also practical skills (in the statistics course 0HV110). Finally, we will evaluate students' attitudes towards the use of quizzes through questionnaires administered at the end of the course. This should help teachers to decide whether the use of quizzes in video lectures is beneficial or not, and provide some guidelines about how many quiz questions should be used.

We will provide a step-by-step guide (in English) to create online quizzes in the software that turns out to meet our requirements best (as detailed in Work Package 1 below). Furthermore, we will summarize our findings as to whether students improve when video lectures contain intermittent quizzes, as well as their attitude towards these quizzes, and share both on the 3TU.CEE website, as well as in the scientific literature.

5. Project Design & Management

To achieve our goals, we will start by investigating different tools to create interactive quizzes in online video lectures. Essential requirements are that the software is easy to use by teachers without having to rely on technical support, and that the software can create quizzes with a range of different questions types (multiple choice, open questions) that are compliant with the Learning Management Systems used across the 3TU, and compatible with the SCORM standard to guarantee use in possible future learning management systems.

For example, both Adobe Captivate and Camtasia Studio allow users to create SCORM compatible video lectures with online quizzes whose answers are automatically stored in for example the open-source learning platform Moodle, used at TU/e. We will evaluate the available open source and commercial software packages based on their features, and examine their perceived ease of use (personally, but also in a sample of lecturers at the 3TU). Note that we do not intend to write new software but seek to find clever use of existing packages instead.

When a choice for a specific software package has been made, we will implement quizzes in online video lectures, and experimentally examine their long-term effects, as well as the optimal number of quizzes s a function of the duration of the lecture. We will do so based on performance measures (most notably, students' results on exams), but at the same time examine subjective experiences of students through questionnaires aimed at understanding their attitudes towards and satisfaction with intermittent quizzes.

Description of work

The project will last for 12 months and consists of Work Packages (WPs):

1. WP 1: Identifying suitable software packages and technical realization
2. WP 2: Developing and testing effect of intermittent quizzes in online lectures

Work Package 1

Our technical support staff at the HTI department will create an overview of the top software packages that meet our requirements (both technical, in terms of allowing users to create interactive quizzes in online video lectures that can integrate with Learning Management Systems, as practical, in terms of the type of questions we want to be able to ask). They provide an initial evaluation of the different software packages based on cost, flexibility, and ease of use. Subsequently they will pick a top 3 of software packages that meet our needs, search for (or create) a quick guide to creating quizzes in the specific software package, and together with Daniel Lakens and a research assistant, ask a representative sample of lecturers at the 3TU to give feedback about the software package they prefer. Finally, after choosing the software we will use together with Daniel Lakens and Chris Snijders, the technical support team will create a step-by-step guide on how to create quizzes (and how to update quizzes in future years, without having to re-record the lectures) and a step-by-step guide on how to deliver the video lectures within the Learning Management Systems used in the 3TU. The goal is to pick a software package that most lecturers can easily work with, and make it as easy as possible for lecturers to use the software in their video lectures.

Work Package 2

To examine the long term effects of intermittent quizzes (testing both knowledge and insight, as practical statistical skills) in video lectures, determine the optimal number of quizzes as a function of the duration of the quiz, and investigate the subjective attitudes of students towards the quizzes, Daniel Lakens and Chris Snijders will create video lectures for two different courses. Video lectures will be created for 0HV110 (Behavioral Research Methods 3, a third year bachelor course on statistics and research methods) and 0HV10 (Introduction to Psychology and Technology). The two courses differ in number of students (in 2015, 56 for 0HV110, 199 for 0HV10) and in content (applied statistics for 0HV110, theory for 0HV10). Using these two courses allows us to examine whether there are differences in the course characteristics that determine the usefulness of intermittent quizzes, or whether the possible benefits of intermittent quizzing apply more generally. We will vary the presence (vs. absence) of quizzes in video lectures, as well as the number of quizzes per lecture, and compare recall of the course material at the end of each lecture. We will similarly compare recall of the course content with normal lectures, during which live (clicker) quizzes will be administered, or not. These lectures will be distributed evenly over the 8 weeks of a course to examine the long term effects, as well as the general benefit of quizzes on test performance. In addition, we will administer an evaluation form at the end of each course in

which we will examine the students attitudes towards the intermittent quizzes in the video lectures, and ask for suggestions for improvement (if they have any). Two student assistants will assist with the investigation.

6. References

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