CHALLENGES AND OPPORTUNITIES WHEN INTEGRATING VIDEOS IN COURSE DESIGN

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ABSTRACT

Due to the pandemic, universities were challenged to switch into distance mode, causing teachers to make pedagogical adjustments. One adjustment was the use of pre-recorded videos applied as complement in the education. However, a pedagogical miss-match arises, as course designs often are based on face-to-face (F2F) teaching, while videos are designed for self-education. Consequently, there is a need to understand what challenges, but also what opportunities appear as videos are integrated into course design. The purpose of this paper is hence to *describe challenges and opportunities when integrating pre-recorded videos in course design in traditional campus teaching.* An interview study with teachers and a survey to capture the student perspective have been carried out. The results of the teacher perspective highlight opportunities and challenges when it comes to the technical and content as designing videos as well as design of the lectures concerned. Learned from the students´ opinion videos need to be purposeful designed, and the information included need to be well thought through. When videos are used, the design of lectures becomes more important since the F2F interactions are reduced. This challenge teachers in their design of activities and for students to adequately prepare for F2F activities. At the same time, with videos available, students can pause and rewind if needed, and the potential to learn more basic facts from the videos. If F2F activities are purposefully designed, there is the potential for students to deepen their understanding, achieve greater learning outcomes and to increase progression. Videos also increase flexibility for students by possibility to shape their own learning opportunity and how it suits them and their everyday life. The findings from the study are related to several of the CDIO standards, mainly Standard 8, 6, and 10 by Active Learning, Engineering Workspaces, and Enhancement of Faculty Teaching Competence.

KEYWORDS

Educational videos, Course design, Learning outcomes, Challenges, Opportunities, Standards: 6, 8, 10

INTRODUCTION

Educational videos have for some time been an important pedagogical tool and a part of higher education (Brame, 2016). With the Covid-19 pandemic, universities were challenged to switch into distance mode, causing teachers to make pedagogical adjustments. One adjustment

made by many was the use of videos, applied as a complement in the education. The pandemic thus fuelled an increase in the use of videos in higher education.

Videos can come in different forms and for different reasons, such as pre-recordings of lectures or recorded instructions (i.e. tutorials) (see e.g. Noetel et al. 2021). They can for example be a part of traditional courses on campus or the primary educational tool for online courses, and they can be used for lectures as well as tutorials (Noetel et al., 2021; Brame, 2016). This paper focusses on pre-recorded videos used in teaching, as opposed to videos that are a recording of lectures that are first held live (see e.g. Gorissen et al, 2013). As for these pre-recorded videos (henceforth videos), they can be of different types, such as skills demonstration or pre-recorded lecture (Noetel et al., 2021). This paper addresses a variety of types of videos, as long as they are of the pre-recorded.

Benefits of using videos in teaching include enhanced learning and test scores (Noetel et al., 2021; Kay et al., 2012), and appreciation from students (Kay et al., 2021). With the digitalisation as a result of the pandemic, there is now a greater longing for videos to be a larger and a natural part of the traditional campus teaching. Teachers of traditional campus courses can, however, face challenges in the adoption of videos such as course designs are often based on face-to-face (F2F) teaching, while videos are designed for self-education. Consequently, there is a need for redesign of course materials and teaching activities correlating to the video material, which can have larger consequences for the design of courses. To gain a wider perspective of the opportunities and challenges related to the integration of videos, the purpose of the paper is to *describe challenges and opportunities when integrating pre-recorded videos in course design in traditional campus teaching.*

This paper relates to several of the twelve CDIO standards, of which number 8, 10 and 6 are the most relevant. Standard 8 includes active learning methods, and enabling such learning is one of the challenges with incorporating videos in traditional campus courses.

THEORETICAL CONSIDERATIONS

Educational videos

Educational videos can be divided into different categories, for example, Noetel et al. (2021) distinguish between learning context (e.g. lectures, tutorials, homework), interventions (description, duration, level of active learning, type of video, where the latter relates to e.g. skills demonstration or recorded lectures).

There are several potential reasons why videos have become an important part of higher education. For example, based on a systematic literature review, Noetel et al. (2021) find that student learning is enhanced by adding videos to the educational tools in courses. This was found to be true for a wide variety of settings and results even pointed to that teaching by videos was superior to F2F classes. There are, however, also challenges identified in previous research. For example, Kay et al. (2021) divides such challenges into reasons not to use (e.g. technical problems, lack of time), attitudes (videos seen as add-ons at best), behaviors (lower attendance at lectures, self-discipline issues) and learning performance (no improvement in test scores).

Regarding if, and how, students use videos for learning, there are some insights from previous research. Gorissen et al. (2013) focused on lectures that were available online after first being

live lectures. They found a span of student behavior, from some that only watched the beginning of the recorded lecture, others looked at parts of the lectures, while some watched almost the complete recorded lecture. This diversity poses a challenge for teachers when they design their courses. Gorissen et al. (2012) also noted thirteen reasons for viewing recorded lectures, and of these making up for a missed lecture, preparing for the exam and improving test scores were three of the highest ranked reasons.

Brame (2016) argue that teachers should consider three elements when using videos as an educational tool: cognitive load (i.e. memory-related), elements that impact student engagement, and elements that promote active learning (as opposed to passive learning). Keeping these three elements in mind, Brame (2016) arrives at some general recommendations for using videos in teaching:

- Videos should preferably be kept brief and relate to learning goals.
- Audio and visual elements should preferably be combined to explain targeted issues.
- Signaling, i.e. text or symbols, can be used to highlight important ideas or concepts.
- Engagement can be enhanced through a conversational, enthusiastic style in the videos.
- Facilitate active learning by combining videos with guiding questions, interactive elements, or associated homework assignments.

Marketing literature and teaching

A concept coined in the marketing literature by e.g. Grönroos (2011) is creation of value by combining the provider (of a product or service) sphere with the customer sphere. In service logic, providers offer value proposition in terms of service, and they can be viewed as a value facilitator to the value created in the customer spere (Vargo & Lusch, 2008). Furthermore, there is also interaction where the two spheres overlap, i.e. joint value creation process. Providers participate together with the customers in this interaction and providers can therefore be viewed as a co-producer of value (Grönroos, 2011).

With inspiration from the spheres presented in Grönroos (2011), similar logic can be applied to education. The provider sphere (creation of the offer) can be translated to teachers that design courses and course materials (e.g. recording videos). The customer sphere is the students who use the course materials at their own time (e.g. watching the videos). The overlap between the spheres is when teachers and students interact, for example at F2F activities.

METHOD

This paper is part of a one-year long pedagogical development project that targeted the use of videos in teaching and how they can be used for preparation before F2F activities. Two separate methods were used, semi-structured interviews with teachers who were also course coordinators (i.e. responsible for the course design) and a survey capturing the student perspective. All data were collected from courses in logistics management or quality management and the courses are mainly for engineering students at master level.

Interviews were selected since it made it possible to adapt questions, something that is highlighted as a benefit with interviews by Bryman and Bell (2015). This was important as there was a need for adaptation based on how videos had been used in the courses. To secure a

high dependability, the same interview guide was used for all interviews (see e.g. Halldorsson & Aastrup, 2003). The questions in the interviews targeted for example how videos had been used, what effects videos had on course design, and teachers´ perceptions of effects on learning outcomes for the students. In total, eleven teachers were interviewed, which encompasses 20 courses. Two researchers were present for all interviews, with one in charge of questions and one responsible for taking notes. The length of the interviews was about 45 minutes. To increase credibility, the notes were later summarized and discussed between the researchers to ensure that no information was missed or misunderstood.

A survey has the benefits of reaching a high number of respondents and creating a broad view of a subject (Visser *et al.*, 2000), something that was of relevance in this case since the aim was to create a view on e.g. how students use videos when they study. A total of 15 questions were formulated in the survey and they were a mix of questions with a five-point Likert scale, given alternatives, and open-ended questions. The questions in the survey were tested and reviewed by two teachers and two students to ensure that the survey was comprehensible. The survey was sent out to all students that had taken any of the courses that were included in the interview study (in total 751 students in year 3, 4 or 5 in engineering education). The survey was provided in both Swedish and English, which enabled the respondents to choose preferred language. A total of 166 out of 751 students, i.e. 22%, answered the survey and a large number of comments were submitted which provided a more multifaceted view of the results of the survey. The question with the most comments got 77 unique comments (i.e. 46% of the students that answered the question left a comment)

EMPIRICAL RESULTS - INTEGRATING AND INTEGRATED VIDEOS IN COURSE DESIGN

Results from the interviews

Interesting insights were found about how teachers integrated videos in course design based on the 20 courses included in the study. For example, videos had been used as self-education material or as preparation material for different types of F2F teaching (question time, seminar, lecture developing the video content, interactive lecture adding new content, tutorials or labs).

Redesigning of course structure when using videos

When redesigning courses, the teachers' considerations foremost concerned the links between the content of the course, course objectives and examination. Additional considerations were about the rhythm of the course (when learning activities are to be performed and when to release videos), and about the fact that it is time-consuming to create and distribute videos. Four different methods of redesigning courses to fit the new course material of video were identified:

- *Straight transformation*: former F2F lectures turned into a video with only minor adjustments.
- *Selected transformation:* basic knowledge cut out from F2F lectures and turned into video; remaining content highlighted in F2F occasions as prior to change.
- *Total redesign:* redesigned content and course design, thorough reworking of the course structure where some parts are video (e.g. literature areas or lab instructions), other course elements are updated or redesigned
- *Instructions:* instructions formerly in text or oral (e.g., labs, tools, formulas, instructions for a specific task or specific element such as Excel tutorials) turned into videos.

Designed support for processing the content of videos

Another theme found from the interviews shows how teachers designed support for processing the content of videos by adding new activities into the courses. Four different supporting activities were identified:
• *Simpler processing of the content:* reconciliation by quizzes or polls
• *Slot for questions:* more or less structured question time concerning the content of the video
• *Seminars:* planned opportunity for discussion and further analysis of the video content, possible preparation by varied level of threshold
• *Specific tasks:* specific individual or group assignment

There were also examples of no designed support for processing the content, thereby leading to one-way communication as the students process the videos themselves without feedback on their learning.

Added interaction activities

Several teachers added F2F interaction activities (nonmandatory) by discussion and analysis beyond consolidate the video content rather develop and add further dimensioned to the content as well as challenging the students' mindsets were also discovered through the interviews. The common question seemed to be what the students should be told in the video and not how to nudge them to reflect about a certain content to properly be prepared for the F2F teaching. There was also a consensus regarding the importance of a clear and limited task with a reasonable scope for the students to prepare based on a video to achieve good interaction at F2F activities. It thus turned out that teachers often struggled to get students to participate in the interactive activities. To attract students the teachers designed the videos to breed curiosity so that the students must attend the lecture to hear what the others have to say about a certain question or tried to attract the students by pointing at the exam where there would be reasoning and analyzing questions. The interactive activities were carried out in particular by *controlled discussions* and *prepared questions,* for example by:
• news articles linked to some theme from videos
• extended theory review
• repeat certain parts of the video and question the content
• open broad discussion, but through preparation from the teacher, the discussion narrows down to manageable
• specific questions to start a discussion prepared by teachers
• prepared questions by students, specified topic
• prepared answer matrix with pros and cons for students to try to fill in boxes
• simple questions as: what was the most challenging from the movies? What do you want more detail described?
• polls with basic knowledge or concepts

Results from the survey

How videos have been used by students

When it comes to how students are using videos, 75% of the students answered that they watch videos more than one time, and the reason was foremost to repeat specific parts of videos throughout the course (85%) or repeat in close connection to exams (36%). From the comments, multiple respondents noted that they had the opportunity to repeat specific parts that were more difficult to understand. To be able to listen to the lecturer's explanation was

viewed as a great complement to the slides and other course materials. Furthermore, it was also noted that being able to pause and rewind the videos reduced the stress for the students.

Regarding when students watch videos, 54% answered that they watch the videos continuously during the course, 42% only watch when recommended by the teachers, and 56% answered that they watch them in relation to assignments or exams. Based on the comments from the respondents, two types of groups exist in relation to the question. One group that appreciates the flexibility with videos and that they can watch it anytime and do not see the need to have watching videos scheduled. While the other group requested planned times in the schedule to watch videos since the students are usually fully booked.

Preferred type of videos

If traditional lectures/activities (typically 90 minutes) are replaced or complemented with videos, there is a need to understand how the students view alternatives. Table 1 below shows the distribution of the answer, and as can be seen the most popular answer was that the lecture was to be broken down into several shorter videos that focus on specific topics. When it comes to teaching activities that were preferred to be transformed into videos, 82% of the respondents answered that they preferred instructions for e.g., a computer program to be recorded.

Table 1. Distribution of preferred alternatives

Preferred alternative if a traditional lecture is transformed into videos	
Several shorter videos	82
Two videos, 45 minutes each	41
A 90-minute video	37
Other	4
Do not know	2

Based on the comments, it was highlighted that a video takes longer time to watch, compared to live lectures, since students often pause and rewind. Teachers often did not take it into account and students ended up spending more time than was planned.

Students' view of F2F activities

On the question how students viewed interactive activities (an example of F2F activity) as part of their education, 3,91 out of 5 (Likert-scale) noted that they desired interactive activities with both other students and teachers. However, students preferred, to a larger degree, to not go to the campus if the most important course materials were available on videos (2,97 out of 5 points). Furthermore, 103 out of 166 (62%) noted that interactive activities are important to gain new insights and 72 (43%) noted that interactive activities are important to achieve learning outcomes. Lastly, 26 (16%) students answered that they do not like interactive activities and want to learn by themselves. The comments indicate that interactive activities can look vastly different, and this also affects the students' view of them. Examples of interactive activities brought up were discussions in smaller groups during lectures, scheduled QnA, and seminars focusing on specific parts.

DISCUSSION - CHALLENGES AND OPPORTUNITIES

Pre-recorded videos as course material provide opportunities, while at the same time there are several challenges in dealing with an additional form of teaching. This study observed challenges for both teachers and students from their perspective.

For teachers

Video design

Both challenges and opportunities arise when you separate the teaching from the meeting between student and teacher. The aspect of eternity is markedly present when designing and recording a video for teaching in contrast to traditional live lecture where the teacher's words are deleted at the same time as they were uttered. It seems to be a “forced” course development as the material is more processed and the video content maybe thereby also is more concentrated and maybe more adequate for the content of the course, course objectives and examination. The students also seem to take everything in the videos as equally important thereby forcing teachers to deliver more concentrated content and to make it explicit. Videos are used as "fact boxes", jeopardizing the discourse, how things are connected and the total picture. Is the video a new kind of compendium instead of reading? Another concern is the pedagogical ability to create teaching via video for different types of learning.

A technical aspects of video construction have also been recognized. The students describe that video takes longer time to watch in contrast to a live lecture since they use the opportunity to re-watch and pause when needed in addition to the difficulties of maintaining concentration when watching videos. However, like Gorissen et al. (2013) found there is a span of watching behaviors and Gorissen et al. (2012) thirteen reasons for viewing videos also were detected in the included student survey. This diversity poses a challenge for teachers and a need to adapt the video design to this knowledge about students´ watching behavior. In line with Brame (2016), students in this study preferred shorter videos with content divided into segments.

Creating purposeful videos always takes time and focus and challenges the educator (Brame, 2016). A video can potentially be reused over and over, thus creating economies of scale. However, questions arise about the actual efficiency in reusing since the recurring distribution also must be included as well as questions about how self-critical you can be, how time independent the content is, and if it is acceptable to use videos made by former colleagues.

Lecture design

The F2F activities have a more important role when videos are used, since some of the interaction that happens naturally during regular lectures is removed. This points to the need for thought-through F2F activities. Depending on the content and the role of the videos, different challenges arise when integrating videos in the F2F teaching. When the video is used for instructions to an assignment or a tool (e.g., calculation in Excel) or laboratory work, it seems to be quite unproblematic with designing the F2F. Although, when the purpose is interaction, to consolidate the knowledge or to improve the students´ ability to analyze or increase the insights, it seems to become more problematic.

One challenge concerns the separation between basic facts presented in videos, and the discussions, and reasoning (higher learning taxonomy) taking place at lectures. Videos are

more available for students but risk fewer coming to F2F, while at the same time creating opportunities for higher qualitative discussions and analyses when students are prepared at lectures via videos. Do we risk isolation of basic facts in monologue for self-studies and only interaction for ambitious students? Though, it can lead to increased progression since the course materials are treated in different stages and at different levels. In accordance with Grönroos (2011), the teacher can actively affect the students and hence the potential for learning. An additional challenge is the lack of possibility to get feedback from the students to develop content, structure, or technical aspects in producing teaching videos as teachers are not present when students consume videos.

The former standard time for a lecture, e.g., 2x45 minutes, can now be questioned as some teaching takes place via videos. Is watching videos self-study or is it to be compared to a scheduled lecture? Depending on the answer, it affects the scheduled time for F2F teaching. The restructuring of learning activities by isolating the teaching monologue to videos leads to new demands on the lecture design. Is it for example still acceptable to have a teacher monolog when lecturing? How to attract students to participate at the interactive moment was a challenge raised by the teachers, and Kay et al. (2021) also reported such behavioral challenges (e.g. lower attendance on lectures and self-discipline issues). Time, focus, and creativity are invested in attracting students to interact and to attend lectures. Perhaps the teacher's identity is challenged when students can consume lectures by videos. The joint value creation process described by Grönroos (2011) in this interaction the teacher can participate together with the students and be a co-producer of learning. But teach without meeting, who am I as a teacher then?

Further opportunities and challenges are due to the issue of responsibility and commitment. At the same time as teachers are to produce pedagogical, informative, and content-relevant videos, teachers can teach but not learn for the students since they are the ones who learn by them self. A balancing act where teachers cannot take the necessary commitment in learning from the students by making it unrealistically easy for them nor transfer the pedagogy responsibility to the students by abandon them with videos. Gorissen et al. (2012) found that students´ perception of courses´ importance for their studies could impact the way in which students engage in watching videos. The video can thus be seen as a trigger for learning and the interaction in F2F depending on how well videos are integrated in the course design.

For Students

Capture the advantages of videos

One of the main advantages of videos is the possibility to pause and rewind the videos, something that can make the content more understandable and easier to digest. With the videos available during courses, there is also the potential to repeat the content as preparation for exams or to rewatch something during the course. The survey showed that this was highly desired by the students and is in line with the results from Gorissen et al. (2012). When it comes to the type of course materials that students preferred to be recorded on videos, a large majority wanted instructions or tutorials. This is not surprising, especially if this includes tutorials for some type of computer application. Having the opportunity to rewatch certain segments and at your own pace go through the same steps as the teacher can be very beneficial. By eliminating or simplifying certain thresholds connected to applications, students can instead focus on deepening their understanding in relation to courses' learning objectives.

Basic knowledge of videos

As the results from the interviews with teachers show, videos can be incorporated in different ways in the course design, and this affects the type of impact it has on the students' learning outcomes. Examples from the empirical data show that videos can be used to present more basic knowledge or information that is needed to understand the next step. By doing this, there is the possibility to evoke students' interest, making them more involved, and the possibility for them to reflect on the course material. Basic knowledge is the first step, the next step is to deepen students' understanding, for example, during F2F activities with both students and teachers. By having watched videos and hopefully created a basic knowledge of the subject, the F2F activities can be designed in a different way and not focus on more basic knowledge.

Flexibility when to watch

The nature of videos implies that they can be watched anytime, which also means that there is great flexibility. In line with Gorissen et al. (2012), the results from the survey showed that students appreciate this flexibility. As many as 75% of the students in the survey noted that they watched the videos more than once, and often at different times during a course. However, flexibility also has its downsides, for example, when there is the opportunity to watch videos anytime, there is also the risk of postponing, especially if there is no follow-up or teaching activity that requires students to have watched the videos. When there are lectures live in classes, students know that this is the sole opportunity to receive the course material orally, a vast difference compared to videos. Furthermore, even if videos can lead to more flexibility and some of the learning is moved from lecture halls to students' homes, there is a risk that students will not travel to campuses to the same degree. Kay et al. (2021) describes such challenges as behavior problems with lower attendance at lectures and self-discipline issues among students. This can possibly also negatively affect students' social connections, reduce crosstalk between students, and their motivation.

CONCLUSIONS

There are lots of challenges and opportunities associated with integrating pre-recorded videos in course design in traditional campus teaching. This paper describes three thematic areas concerning these topics for both teachers redesigning courses and implementation as well as students who experience it attending the courses: technical issues, increased flexibility, and digital paradigm shift.

Technical issues concern designing and recording videos. It takes time and focus to do that, and this study provides insight into students' viewing behavior and wishes about how videos are structured in terms of both content and form. However, to achieve economies of scale or at least not increase the need for resources, videos should be able to be reused or used in more than one course. When videos become a part of the course material it affects the remaining learning activities, requiring a need for redesign and probably changed pedagogy. The potential for tutorials and similar interventions seems higher and less problematic than separating course material within current lectures. Moreover, from a student's perspective it is also time consuming to watch videos duo to the possibility of rewind and review, like reading a text over again. Hence, an updated study techniques to highlight the most important things and not to fall into the time devastating everything-is-important-trap seems to be a necessary development.

As for increased flexibility, videos give the students an opportunity to shape their own learning opportunity and thus learn individually according to what suits them. Flexibility in everyday life and the student themselves customize learning. Students have an increased opportunity to plan their own time for group work, laboratory work, lectures, etc., and can consume the videos in a way they prefer on an individual level. In a larger sense, collection of videos can be combined into modules and the modules can be used in a larger context than just one course. This has the potential to increase flexibility even more, where students can pick relevant modules and individualize their learning experience. Additionally, the former standard time and concept of lectures can now be questioned and provide more flexibility for the teachers as well.

The third area is digital paradigm shift. The digital transformation in society affects both teachers, students, and the meeting between them. This journey has just begun, and it is an exciting paradigm shift we are all in. It is similar, in fact, as when the art of printing made books available to the public. However, all available information and knowledge, such as lessons on YouTube, are available to the public. A free knowledge society, but is that free? New abilities in navigating and valuing knowledge then become more important. We teachers also contribute to the abundance of information and videos can help us in condensing the messages and knowledge we want to convey. Nevertheless, one of the downsides of using videos is the risk of students relying too much on them and not, to the same extent, using other course materials. This can negatively affect students' learning outcomes since textbooks and articles usually go more in-depth of the subjects than what is possible on videos. Furthermore, by tying information into videos, there is a risk that this affects students' ability to find information themselves in either textbooks or other media. There is also a risk of students' skills of independently questioning and critically reviewing material being affected. This further points to the need for teachers to not just record videos, but also have a well thought out plan on how the videos are integrated into the course.

The paper relates to the CDIO standards in primarily three ways. Standard 8 includes active learning methods, and enabling such learning is one of the challenges with integrating videos in traditional campus courses. The findings correlate to CDIO standard 10, as they can have a direct impact on teachers' competence and ability to develop courses that include the benefits of videos, without jeopardizing the learning of the students. As for CDIO standard 6, which relates to engineering workspaces, the paper contributes by identifying how students gain knowledge, and also where (through videos or other teaching activities) such learning occurs.

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