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Successfully planning and implementing peer-to-peer lecture films – "Making it work"

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Abstract

Since summer 2015 lecture videos are implemented in "inverted classroom" teaching scenarios to teach material science to first year students studying mechanical and automotive engineering at HTW Berlin. Lecture videos so far cover subjects such as material testing, corrosion, composites, defects in crystals, hardening mechanisms and materials families. These videos were initially inspired by students. Each semester a set of lecture videos is conducted during a one term semester project supervised by lecturers and film experts (peer-to-peer approach). The peer-to-peer approach is an important aspect because students` needs and their perspective on teaching material is directly included in the videos. Recordings of lectures were also successfully implemented teaching general phase diagrams and the iron-carbon-phase diagram. Both, lecture films and recordings of lectures were used to study themes after class, prepare for classes (inverted classroom scenarios) and the final exam. Students are familiar with videos as learning source, enjoyed to work independently and not only according to contact hours and were generally more active and better prepared during class resulting in better grades. The teaching method "inverted classroom" and class results directly relate to the quality of the video material. Practice examples introduce the teaching method and evaluation of both, videos and teaching method.

Keywords: *lecture films, peer to peer approach, inverted classroom, first year students, material science.*

1. Introduction

Lately, there has been a great deal of interest in using various types of media in conjunction with more traditional teaching methods. One type of media is the use of audio or video recordings comprising at least 5 different techniques: Crooka (2017), the other is establishing short lecture videos of relevant course material: Pfennig (2016). Video provides an audio and visual stimulus covering different learning methodologies.

There is questioning whether both lecture videos and video lectures might outgrow traditional teaching methods. However, lecture videos are definitely a reinforcement, rather than a replacement for lectures: Havergal (2015) so long as any video included is analogous to the desired learning outcomes of the lecture: Al-Jandan (2015). Students place significant value on the use of videos: Gulley (2016), Kon (2015) and viewed them as easy to use and effective learning tools: Kay (2012). Regardless of lecture technique (in-front teaching or video support: Saun (2017)) lectures demonstrating practical work enhance learning outcome: Sarıhan (2016). Lecturers must be aware that students tend to be overconfident in their learning from video-recorded modules. Interpolated questions within online videos were preferred by students and may increase the learner's engagement with the material: Rose (2016) and help to boost actual performance: Szpunar (2014).

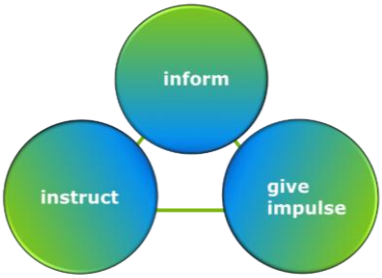
Material Science for mechanical engineering students at HTW Berlin is taught via the "design-led" teaching approach: Ashby (2013), Pfennig (2016) following the "inverted classroom" teaching scenario: Berret (2012), Pfennig (2016), Pfennig (2017-1/2) having positive effect on self-efficacy beliefs and intrinsic motivation in a blended learning setting: Thai (2017).

Class results indicate that involving students directly into teaching activities (preparation of lecture videos) can be very effective in getting students to engage in critical thinking: Colorado State University (2015), Lord (2012); thus, producing deeper learning outcomes: Goto and Schneider (2010). Well known methods are for example peer instruction: Ware (2015), reciprocal peer tutoring: Simon et. al. (2010) or undergraduate teaching assistance: Fingerson and Culley (2001). Therefore peer-to-peer lecture videos are successfully implemented in teaching scenarios of the first year materials science course at HTW Berlin.

2. Concept of film making – the peer-to-peer approach

As "peer-to-peer": Ware (2015) literally means "from students for students" this concept was applied for planning and completing lecture videos. Since 2014 the 3I-model has been developed at HTW Berlin: OLP Online Lehre Plus /Online Teaching Plus (2016). This model defines video as a channel in teaching by its intention:

inform, instruct, give impulse



Information

Short video inputs to replace the traditional frontal type of teaching basic knowledge for inverted classroom setups: Ashby (2013)

Instruction

"How-to videos" to qualify students to work with machines/setups respectively theoretical models for quantitative or qualitative research.

Impulse

Short documentary videos for advanced students serve as an additional motivation and affirmation. These videos encourage the individual to critically examine his or her own views and promote cross-border collaboration.

Fig. 1. 3I Model Overview

All the teaching benefits are included when students are involved in the film making according to the peer to peer teaching approach which applies well for films as lecture. Effective operation of the lecture films is based on student`s experience and their special needs when preparing for graded lab courses and specific topics in material science. Based on students` initiative films (lecture videos not video lectures) were produced to make materials science lectures come to life. Up to now there are 43 lecture films ready available on Moodle HTW and YouTube for students enrolled in material science classes. Therefore 4-6 students worked on a full concept and implementation and integration of three to six lecture films, each of two to eight minutes long. Different film formats are chosen, such as: power point, comic, swipe-technique or animation. The lecture screen play was proof read carefully by lecturers, because each word has its weigh and needs to be fully correct. The overall sense of sentences has to be clear and precise enough to be understood without pictures. The film making was supervised by an OLP-film team of the HTW OLP Online Lehre Plus /Online Teaching Plus (2015).

3. Setting the scene - lecture films in material science

Students enrolled generally come from multiple different educational backgrounds, which is a benefit and a great challenge at the same time. For all students is necessary to study the scientific background of material properties in order to understand the material behavior in a mechanical design. Discussions are encouraged, but each student is responsible for her/his own learning process with a great variety of teaching material being provided: Pfennig (2016), Pfennig (2017-2). Still, so far students did not find these appealing enough to study properly so that courses were very challenging, often chewy and disappointing for lecturers. Starting winter semester 2015, lecture videos -appealing to all students- had to be prepared via self-studying according to the inverted classroom scenarios. Interpolated tests along with lecture videos, micro-lectures and group homework accompanied by many other teaching resources: Pfennig (2017-2) helped students prepare for the specific topics. In class questions were answered and hands-on problems were solved preparing students for graded activities adding to the entire course grade: Pfennig (2017-2).

It is very important to outline the inverted classroom method, course rules and the assessment of lectures and lecture videos beforehand. So students were instructed in how to work with the Moodle-course, what impact teaching sources may have on their learning outcome and what was expected from their self-study periods right from the beginning of the course. A summary of graded activities was given to the students so that they were able to know exactly what percentage of the grading the particular lecture video test will have and when it had to be taken. The plenum agreed on night exams contributing to the individual study time of the class setting the time from 4 pm to 2 am the next morning.

The following lecture scenarios were chosen because these were stand-alone topics with no accompanying lecture before or after.

3.1. Lecture scenario: Fiber reinforced polymers

Fiber reinforced polymers (frp) were introduced to first year students using 6 lecture films using Moodle to provide the films and communicate with the students in winter semester 2015/16 as a voluntary study topic:

https://www.youtube.com/playlist?list=PLUOlZMSZYz5y8XYE1S09HlH60tSxlUERe

Groups of 4 students had to prepare one lecture film being able to explain the scientific background properly. Other lecture films were subject of own responsibility accompanied by voluntary lectures and small quizzes. In class questions were answered in plenum and the open-source software "invote": invote (2016), Simon et al. (2010), was used for peer reviewing. In a first session students, who prepared the same lecture film worked as one of six group given 30-40 minutes to summarize the main points of the lecture film on a special template. During this time the lecturer was open for all questions arousing in the teams answering those properly and helping to understand complicated scientific backgrounds. This guaranteed the correctness of the teams` final summary which was copied for all students in class and uploaded in Moodle as a summary worksheet to prepare for the nightly exam. In a second session students were divided into groups with 6 students each, so that each team had one expert for each of the lecture film topics. All students were then asked to briefly present their most important issues for the other team members and explaining open question arousing from the summary sheets.

The voluntary nightly online exam via Moodle gave the opportunity to gain extra credits to the course and was taken by 19 students out of 36. All students taking the exam passed. 20% of the students scored with 70% or more (Figure 2) which accounts for a very good result considering that this test was voluntarily.

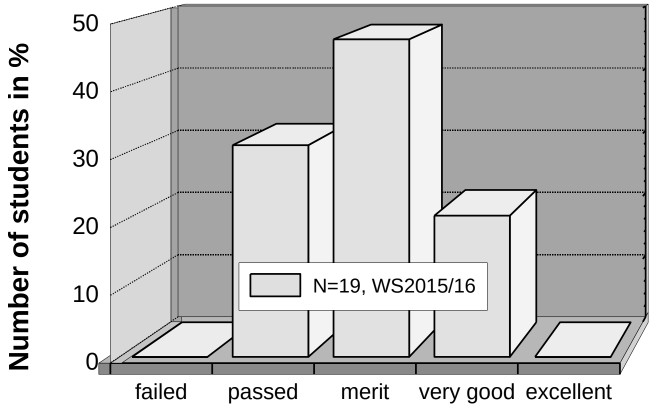


Figure 2. Results of voluntary nightly online exam on fiber reinforced polymers.

3.2. Lecture scenario: polymer structures

Polymer structures are only briefly discussed in a first year material science course for mechanical engineers. However, students feel the need to study the differences compared to metals more in depth. Therefore polymer structures was included in the curriculum, but declared as self-study lectures based on lecture videos (Figure 3):

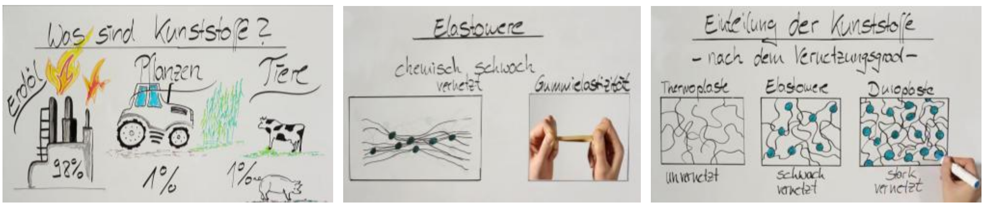


Figure 3. Lecture films: fiber reinforced polymers (6 lecture films) (35:31 min), (https://www.youtube.com/playlist?list=PLUOlZMSZYz5y8XYE1S09HlH60tSxlUERe)

In class questions were answered in plenum and the open-source software "invote": invote (2016), Simon et al. (2010), was used for peer reviewing. The compulsory nightly online exam via Moodle (open until 2 am the next morning) added to the credits of the course (2 out of 60 possible grade points). In general most students passed the exam and more than 60% of the students score very good or excellent accounting to their good study skills and deep learning outcome (Figure 4).

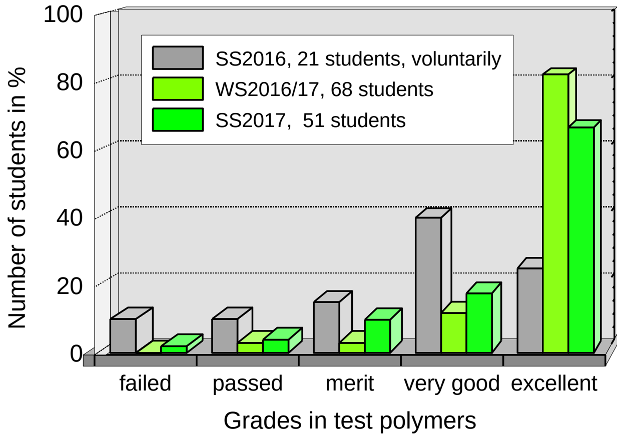


Figure 4. Results of voluntary nightly online exam on polymer structures.

Students working on the lecture films found themselves deeply involved in polymers, fiber reinforced polymers and film making techniques, both skills never being part of the official curriculum. Thus contributing to high learning outcome and self attentiveness.

4. Evaluation and Discussion

Lecture videos appeal to many students and are therefore a probate media to encourage students to self-study und gain good results for material science courses. These films may also provide excellent requirements when inverting the classroom. Watching introductory videos for lab courses and lecture videos to prepare different topics seem to lead to more download activity and actual studying of the lectures. Notes and handwritten summaries were brought along, mind maps and summary sheets were downloaded and memorized. The additional learning material helped the students to understand the science behind the results introduced in class or produced in the lab. Pre-test results (classroom response) were partly improved and during group work groups worked homogenously with lots of inspiration. Students asked important questions, initiated discussions, were eager to dispose their knowledge and learn more of the details and even those students, who did not attend the lecture classes increased their understanding of complicated correlations.

Since most lecture films are strictly under 5 min lack of interest was not an issue. E.g. 24 students averagely clicked 68 times on the polymer lecture films indicating that they watched every lecture video approximately 3 times. Moreover, once the students started to watch the films they completed it – with exception of the end titles.

Students involved in the making of the film found that they gained substantial knowledge in material science. The students found themselves capable of analyzing and applying the suitable parameters to give profound information on mechanical properties. Moreover the students were able to explain why materials behaved in a certain way, which they have not been able to earlier when taking the traditional material science course.

5. Conclusion

Different lecture film formats were produced as guided student projects preparing necessary self studying teaching material for “inverted classroom” lecture scenarios in an interdisciplinary concept of teaching materials science. This peer-to-peer approach of involving students into the implementation of teaching material was assessed as beneficial in terms of student grades, concentration and attentiveness as well as ongoing lecture procedures during class. Students were generally well prepared and able to work on strategies to solve hand-on problems. The growing procedure of film making requires dedicated students and lecturers, a very good concept and screen play as well as professional guidance in film making. Students involved in the making of the film gained substantial knowledge in material science.

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