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

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Abstract

Videos implemented in higher education are widely used by students and provide an audio and visual stimulus covering different learning methodologies. Lecture videos that are analogous to the desired learning outcomes of the lecture are considered a reinforcement. These videos covering scientific background on short sequences need to be of a certain standard to gain students` interest and become a fully accepted learning material. 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. These videos were initially inspired by students resulting in the conduction of a set of lecture videos during a one term semester project each semester. The "making-of" is 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 included directly in the videos. Because we were asked many times: what does it take to prepare successful peer-to-peer lecture films this paper practically contributes to those who are thinking about producing lecture videos and implementing these in face-to-face lectures or online/blended learning scenarios.

Keywords: *lecture films, making of, peer to peer, material science.*

1. Introduction - Setting the scene

Material Science is taught to first year mechanical engineering students at HTW Berlin via the "design-led" teaching approach: Ashby (2013), Pfennig (2016). In the blended learning setting implementing lecture videos into "inverted classroom" teaching scenarios: Berret (2012), Pfennig (2016), Pfennig (2018-1/2) has a positive effect on self-efficiancy beliefs and intrinsic motivation: Thai (2017). In general students viewed lecture videos as easy to use and effective learning tools: Kay (2012) and place significant value on the use of videos: Gulley (2016), Kon (2015). Videos provide an audio and visual stimulus covering different learning methodologies. Presupposed the video included is analogous to the desired learning outcomes of the lecture: Al-Jandan (2015) lecture videos are definitely a reinforcement, rather than a replacement for lectures: Havergal (2015). Note, that there is a difference between audio or video recordings of lectures and short lecture videos of relevant course material: Pfennig (2016). This "making-of"-paper deals with the latter only with students being involved according to the peer-to-peer approach: Ware (2015) where 4-6 students worked on a full concept and implementation and integration of three to six lecture films, each averagely two to six minutes long.

2. Getting started

Because the workload is quite high to our experience the production of lecture films is only profitable for content that is not subject to change over at least a medium period, such as basic scientific knowledge. The authors want to state that you do not have to have professional skills or professional technical equipment to produce good lecture videos. Most important is that the aim of the lecture video is included into the learning outcome ot the course and that the content is clear and well prepared.

At HTW Berlin lecture films are content of a voluntary semester project during the 5th semester of mechanical engineering (5 ECTS = 180 hours of workload). The highly motivated students generally have no skills in film making. Required average outcome is 4-5 minutes video of high quality per student. This appears to be little, but it is a very good output measured by the sum of work packages comprising of:

1. Writing a script / screeplay
2. Preparation of assets e.g. illustrations
3. Text / Voice-over recording
4. Camera setup and shoot
5. Editing and post-production
6. Finish and delivery

Usually one student has illustrating skills. Voice recording is done by interested students and all project members usually learn filming and cutting throughout the project.

In a kick-off meeting all the boundary conditions, such as deadlines, length of films, content and type of lecture video, composition of the script, etc. are explained in detail. Children books help students understanding the necessity of the correlation between text and illustration, with text explaining exactly what the viewer sees in the picture. Complicated scientific background knowledge has to be explained in a simple – but not trivial – way and at the same time visualized in detail. For example: "Lattice defects raise the strength of an engineering material". Here not only the defect has to be illustrated because the increased strength is the more important detail (Figure 1).

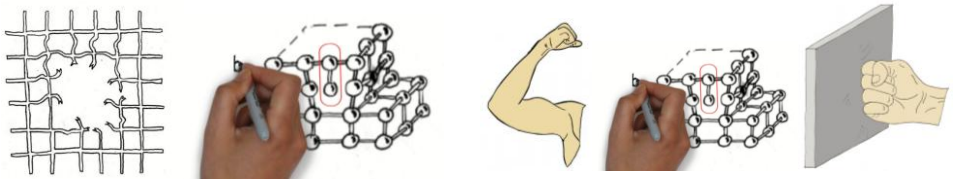

Illustration of defects

Illustration of defects and increase in strength

Fig. 1. Illustrative interpretation of the text: "Lattice defects raise the strength of an engineering material"

3. "Making-of" peer-to-peer lecture videos

3.1. Equipment

Concerning all studio and production equipment we promote the KISS ("Keep it simple, stupid") principle, reducing overall costs and efforts. In our projects we try to focus on the product not on production where ease of use of the equipment is most important. Even a smartphone, maybe with a dedicated photo/filming app, can be sufficient. Good content makes a good film, picture quality is secondary.

Camera: To recommend a specific camera model would be inappropriate. Basic demands at the time of writing are (most modern smart phone cameras meet these requirements):

- Aspect ratio of 16:9
- Picture size of at least HD 720p (1280 x 720 pixels).
- Recording of standard formats, that are transerable to a PC for post-production
- A framerate of at least 25 frames per second (fps)
- Compression rates not too high. A higher bitrate means better picture quality. YouTube recommends 5 Mbps for 720p and 8 Mbps for 1080p footage.

Stabilising the camera is of great importance. When doing a cutout animation you usually have a so called top shot, which means the camera is filming a table from the top. You can help yourself and realise a top shot with a camera on a side arm with a standard tripod and basic tools from a hardware shop (Figure 2).

Fig. 2. DIY setup of a top shot

Software: The set of features needed for simple post production tasks is pretty straightforward: e.g. transitions, filtering and basic color correction, text tools, maybe time lapse and slow motion, simple animation of graphical content, audio syncing and editing, and finally the export into popular end formats for delivery. The learning curve in using the editing software shouldn't be too steep. There are products on the market aiming towards exactly these users, and most of them are reasonably priced. We have been using several software solutions in post production. A good option is Black Magics DaVinci Resolve. Being a professional colorist tool, the recent versions have been extended with editing tools and the basic version is even free of charge.

Lighting: Lighting the scene is important because, if a set is well illuminated any filming can be done with a faster shutter speed, i.e. shorter exposure times, which lead to less motion blur. The effect is quite subtle, but a picture with more contrast is simply more interesting than a flat picture. Expensive lighting equipment isn't necessary. The smart use of available light like daylight is one trick to get this done. Any set of strong lamps can be suitable as long as they match in colour; a mix of differently coloured light sources is not recommended. Setting white balance correctly during production is very important. Trying to match recorded material with different white balances in post production is very tedious.

3.2. Treatment and Script

Words before picture! This order produces a successful lecture video meaning that the script becomes the most important vulnerable and agile part in the "making-of" production pipeline. Once the text has been recorded, changes that have to be done in the post production are time consuming, often of minor quality and a hassle throughout the entire workflow, leaving students motivation behind. Our advice is to thoughtfully take care of the development of the script and only accept it if all criteria of the lecture videos content is met.

It helps the student group to consider the script as means to deliver a podcast where the overall sense of sentences has to be clear and precise enough to be understood without explaining pictures. Language has to be clear, sentences rather short than convoluted, easy words and extra explanations for technical terms are highly advised. The lecture screenplay is proof read carefully by lecturers, because each word has its weigh and needs to be fully correct. Abbreviations should be avoided because an external voice-over artist not emerging from the student group only reads what is written.

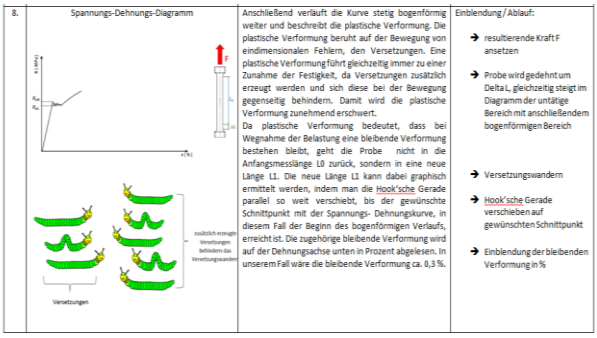

Fig. 3. Typical script, here: stress-strain-diagram

The script itself contains the content, the setting of the scene, embedded texts and drafts of the illustrations as well as the time of the scene (Figure 3). This helps the students to focus on the text, but already visualize roughly how they want to produce a scene. Documenting the time, actually measuring the time while reading the text out loud, helps to stay focused on the 5 minute limit and the most important contents.

3.3. Voice-over

The text and its content sets the frame and the pace of the film. Therefore the use of plain, concise language while not speaking too fast or too slowly is highly recommended. Having a great script read by a boring voice would be a waste. This doesn't mean you have to hire a

professional voice actor. The genuineness of an amateur who is all over into the topic can radiate a lot of sympathy. Sympathy is one important key to the audiences attention and therefore to the audiences willingness to learn about the content. When redording voice overs in the studio there are some things to keep in mind:

1. The text printed out for a voice-over recording should use font size (16 pt) to guarantees better readability. Pauses should be indicated by blanks.
2. For the recording understandability - not the perfection - is most important. We used a semi-professional plug & play USB large diaphragm microphone Rode NT-USB.
3. When choosing a room for recording, most important features are as little reverb and ambient noise as possible. A rather small room with carpet and curtains, upholstered furniture and maybe some soft material, like foam material on the wall as sound absorbers will do the trick.

3.4. Production – The film shoot

Depending on how streamlined pre-production is and how efficient post-production is, the shoot itself seldomly eats more than 40 % of the overall time budget. However, anything that hasn't been planned, wasn't paid attention to, misjudged, forgot in pre-production will slow down, delay the production even to a degree where it comes to a standstill. Having to do a pickup shot can be tedious, and a re-shoot is in most cases awfully painful, sometimes even impossible. Therefore it's highly important to not only stick to the script 100% and execute it well, but to double check, wether something is possibly missing in the script. Always do alternate takes, just to have a choice later in post production.

Having a dedicated studio gives you more freedom and planning security and therefore makes production processes smoother. We had to set up the scene for every film series separately on different locations. This is not ideal, but doable. We did film shoots in sprints in rather short time frames. It's just a lot more efficient, especially if you produce more than one film in one go. Once the scene setup has been done, we recommend to leave it as is, until the shoot is done. Setup and deconstruction during a production is counterproductive.

4. Examples of lecture film techniques and evaluation

Up to now there are 43 lecture films ready available on Moodle HTW and YouTube for students enrolled in material science classes. These comprise of different film formats, such as: power point, paper cutout animation, comic, swipe-technique or animation (Figure 4):

How-to	Cutout animation digital colour	Cutout animation hand drawn black/white	Stop motion hand drawing
https://www.youtube.com/playlist?list=PLUOlZMSZYz5wHGs9vEu-5DWqmsktUvtx7	*https://www.youtube.com/playlist?list=PLUOlZMSZYz5zu5oBgrsbpySESNdJ3Cupx*	*https://www.youtube.com/playlist?list=PLUOlZMSZYz5y8XYE1S09HlH60tSxlUERe*	*https://www.youtube.com/playlist?list=PLUOlZMSZYz5wUlfwge0VTxKokobD_OOK7*

Fig. 4. Film formats realized at HTW Berlin according to the peer-to-peer approach.

Based on our experience Table 1 summarizes the needs and the chance of success in the procedure on deciding on the film format:

Table 1: film formats realized at HTW Berlin according to the peer-to-peer approach.

Film format	**Set up and production**	**Recommended content**	**Definitely requires**			
			Illlustr. Phot.	**Speak.**	**Cut.**	**Dir.**
Cutout animation	Easy to medium	all	X	X	X	X
Adding motion pictures	medium	Samples and examples		X	X	X
Fast motion real time drawing,	medium	all	X	X	X	X
How to video **Live-action movie**	easy	Laboratory, manuals		X	X	X
Screenplay	advanced	overview	(X)	X	X	X
Handdrawing **Stop-motion technique**	advanced	All, detailed scientific information	X	X	X	X
Power-point animation	easy	All, detailed scientific information	(X)	X	X	X
Video scribe using hand drawn sketches	Easy to medium	all	(X)	X	X	X

In general the choice of a lecture film format has to suit 3 boundary conditions:

1. Learning outcome of the lecture (e.g. overview, introduction or precise instruction)
2. Technical support and surrounding (e.g.: professional illustrator or artist for sketches, equipment, guidance by professional director)
3. Motivation of the student group to decide on a technique (if they are genrally happy with one technique the lecture film will be a success no matter of the technique)

Students state that the film format has nearly no influence on the "joy of use" and on their learning progress (Figure 5).

Lecture videos were preferred by a factor of three compared to books or the face-to-face, because they may be used time and place independent and the explanation is given directly. 33% percent of the students state that lecture videos give an extra degree of freedom in their learning methods. In general the combination of interactive online lectures and quizzes with the videos provides a highly appreciated learning environ-ment: Pfennig (2018-2).

Students working on the lecture films found themselves deeply involved gaining substantial knowledge in material science as well as in film making techniques. Both are skills never being part of the official curriculum, but contributing to high learning outcome and self attentiveness. The students found themselves capable of analyzing and applying the suitable parameters to give profound information on mechanical properties.

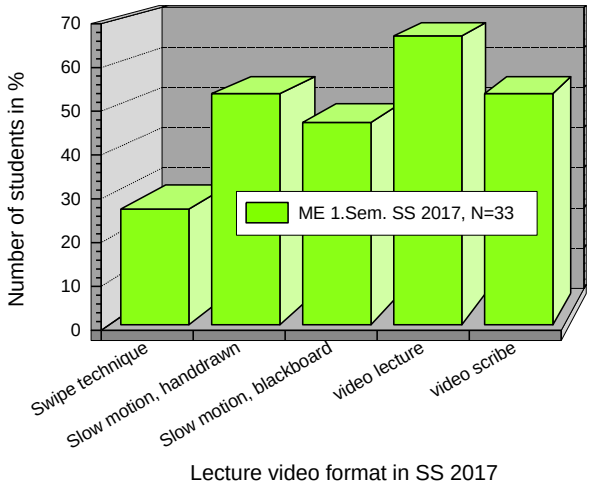

Fig. 5. Preference of video format in first year material science. (multiple choices were possible).

5. Conclusion

Lecture videos can be successfully produced by guided student project groups preparing necessary self studying teaching material for "inverted classroom" lecture scenarios in an interdisciplinary concept of teaching materials science (peer-to-peer approach). Different film formats such as: power point, comic, cutout animation of avaragely 5 minutes of high quality video is produced per student. These videos need to be of a certain standard to gain students` interest and become a fully accepted learning material. Therefore lecture screenplay 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. Filming can be done with any kind of camera of sufficient quality. Suggestions for lighting, pre-/ and postproduction equipment are given with respect to a tight budget, always keeping in mind the teaching outcome, not the perfection of film production. The following suggestions help to produce successful lecture videos:

1. Peer-to-peer approach: involve students in the film making and benefit from their learning experience
2. 5 min length the most
3. KISS: keep it simple: applying to equipment, language and pre/post production
4. Screencast/treatment is perferct before starting to illustrate
5. Always illustrate the meaning of the sentence not the keyword (example: bone has high strength: not the bone, high strength is the meaning).

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