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Peer-to-peer lecture films - a successful study concept for a first year laboratory material science course

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Abstract

Material science is believed to be one of the more complicated subjects in mechanical engineering because the scientific background is generally not taught at school during job training. First year students of mechanical and automotive engineering at HTW Berlin are required to take 2 classes in material science. Laboratory exercises accompany the education, but basic knowledge upon theory is necessary to work practically. Lecture films show the laboratory routine prior to lab hours and show students what they are going to experience and learn. These films were initially inspired by students and conducted during a one term semester project supervised by lecturers and film experts (peer-to-peer approach). It was found that students watching the films were prepared better and gained more knowledge during practical work than those who did not have access to the films. Watching the introductory films lead to more download activity and actual studying of the lectures provided to prepare the experiments and furthermore lead to slightly better testing results. Peer-to-peer lecture films were also successfully implemented teaching general phase diagrams and the iron-carbon-phase diagram.

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Keywords: blended learning; lecture films; peer to peer; material science

1. Introduction

Material Science for mechanical engineering students at HTW Berlin is taught via the “design-led” teaching approach (Ashby, 2013), (Pfennig, 2013). Because the motivation by the challenges of the design is often lost in the conventional “science-led” teaching approach, the “design led approach” faces the engineering product, introduces

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its properties and later relates these to microstructure, atomistic structure and progresses to the physics and chemistry of materials. Therefore the teaching goal is the understanding of material science, but moreover to educate students and prepare them for their role as a maker of things (Ashby, 2013).

Lecture information and a wide range of teaching materials are provided in the moodle-based material science course (ExcelLuS, 2015). This course basically addresses first year students in mechanical engineering, economical engineering, and automotive engineering. The concept follows a blended learning scenario where scientific backgrounds are self-studied via online-lectures. These small units, micro-modules, have precise titles and summarize the most important issues necessary to follow lectures and conduct laboratory experiments.

Students enrol into HTW applied university come from multiple different educational backgrounds, which is a benefit and a great challenge at the same time. It is necessary to study the scientific background of material properties to understand the material test results gained in the lab course. Discussions are encouraged, but each student is responsible for her/his own. Therefore a great variety of teaching material is provided. Mindmaps summarize the content of the micro module lectures. Micro module lectures combined with self-testing questions cover the most important issues. Web Based Trainings (WBTs) offer individual studying and demonstrations enhance memorizing and understanding. Short course mindmaps aim at memorizing technical terms and understanding the correlation of the micro modules. Full content self-tests as well as assignments with worked solutions allow for students to control their learning progress and for the lecturer to assess skills and knowledge.

Still, so far students did not find these appealing to pick and study properly when preparing for the lab course. Hence, most lab courses were very challenging, often chewy and disappointing for lecturers. The joy of hands-on courses could not be felt. Based on students` initiative films were produced to make materials science lectures come to life.

2. Material science lecture films

Up to now there are 36 lecture films ready available on moodle HTW and youtube for students enrolled in material science classes:

- Phase diagrams (10 lecture films) (2:35 hours)
  (https://www.youtube.com/playlist?list=PLUOlZMSZYz5zha5EbwAKrQ8w8W65ST3fN)
- Iron-Carbon phase diagram (11 lecture films, 2:47 hous)
  (https://www.youtube.com/watch?v=_RdbQFk4jWU&list=PLUOlZMSZYz5yHjaqEAaPj77ignXqACXaD)
- Corrosion (4 lecture films) (10:10 min)
  (https://www.youtube.com/playlist?list=PLUOlZMSZYz5ww5xRMQdzIUooNifYEemvZ)
- Materials Testing (5 lecture films) (11:42 min) (Fig. 1)
  (https://www.youtube.com/playlist?list=PLUOlZMSZYz5ww5xRMQdzIUooNifYEemvZ)
- Heat treatment (3:08 min)
- Ultrasonic testing (1:22 min)
- Microstructure (1:44 min)
- Tensile strength testing (1:19 min)
- Hardness (3:09 min)
- Composites – fiber reinforced polymers (6 lecture films) (35:31 min)
  (https://www.youtube.com/playlist?list=PLUOlZMSZYz5xoSdJuRuKCOxIDqnryBRpK)