e-Learning & lab based teaching

experiences from ‘41030 Mechatronics Engineering Design’

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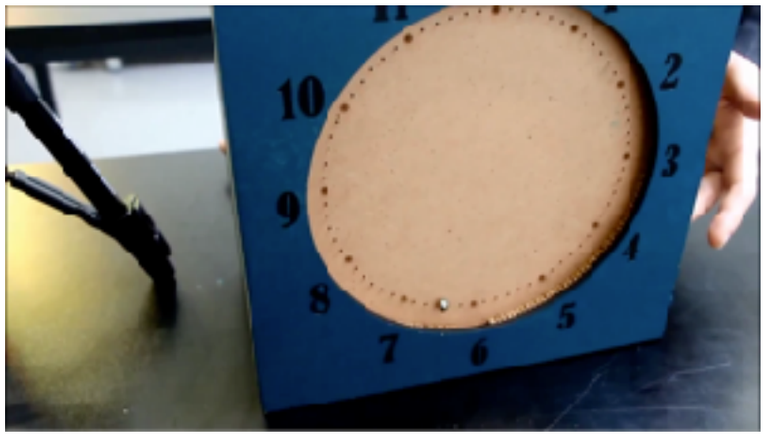
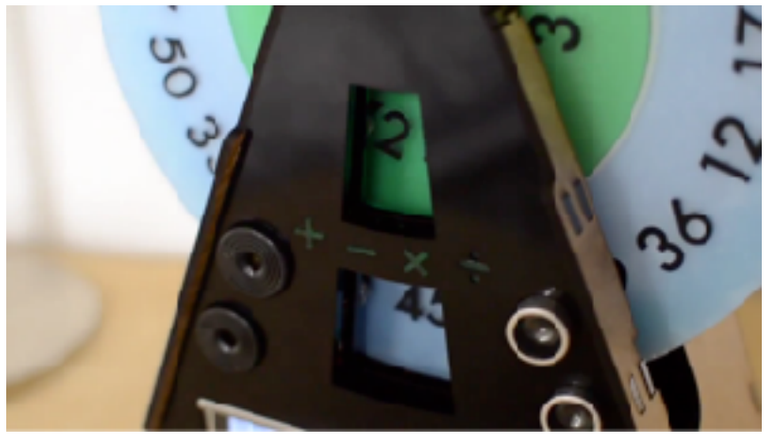
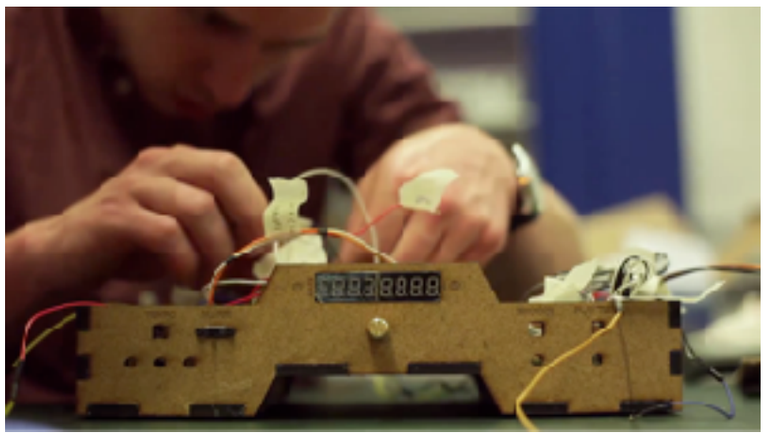
Highlights

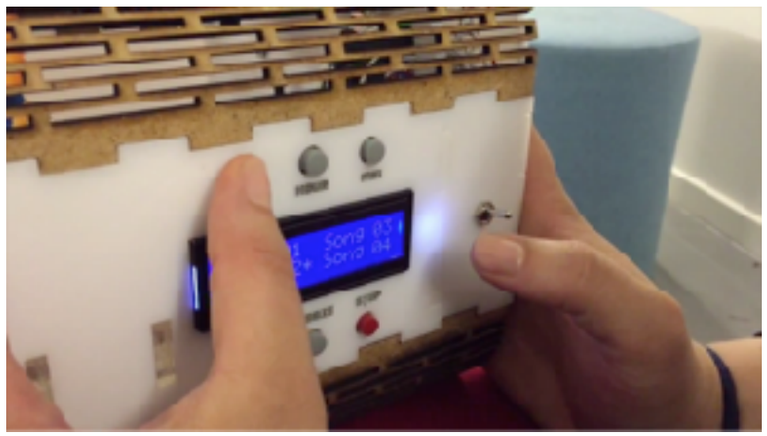
- We have developed an e-learning module on 3D printing.
- Students follow the module as a part of a lab-based course, and get access to 3d printers.
- %85 of the students evaluate to prefer this part of the course as an ‘e-learning module’ (survey evaluation).
- After the implementation; the overall quality of the deliverables (3d printed, functional prototypes) increased significantly.

41030 Design of Mechatronic Systems









41030 Course Structure

- Four projects:
  - Sensors & Data
  - Rapid prototyping w/ 3D printers
  - Digital Logic and Internet of Things
  - Final project

e-learning module

Why 3D printing?

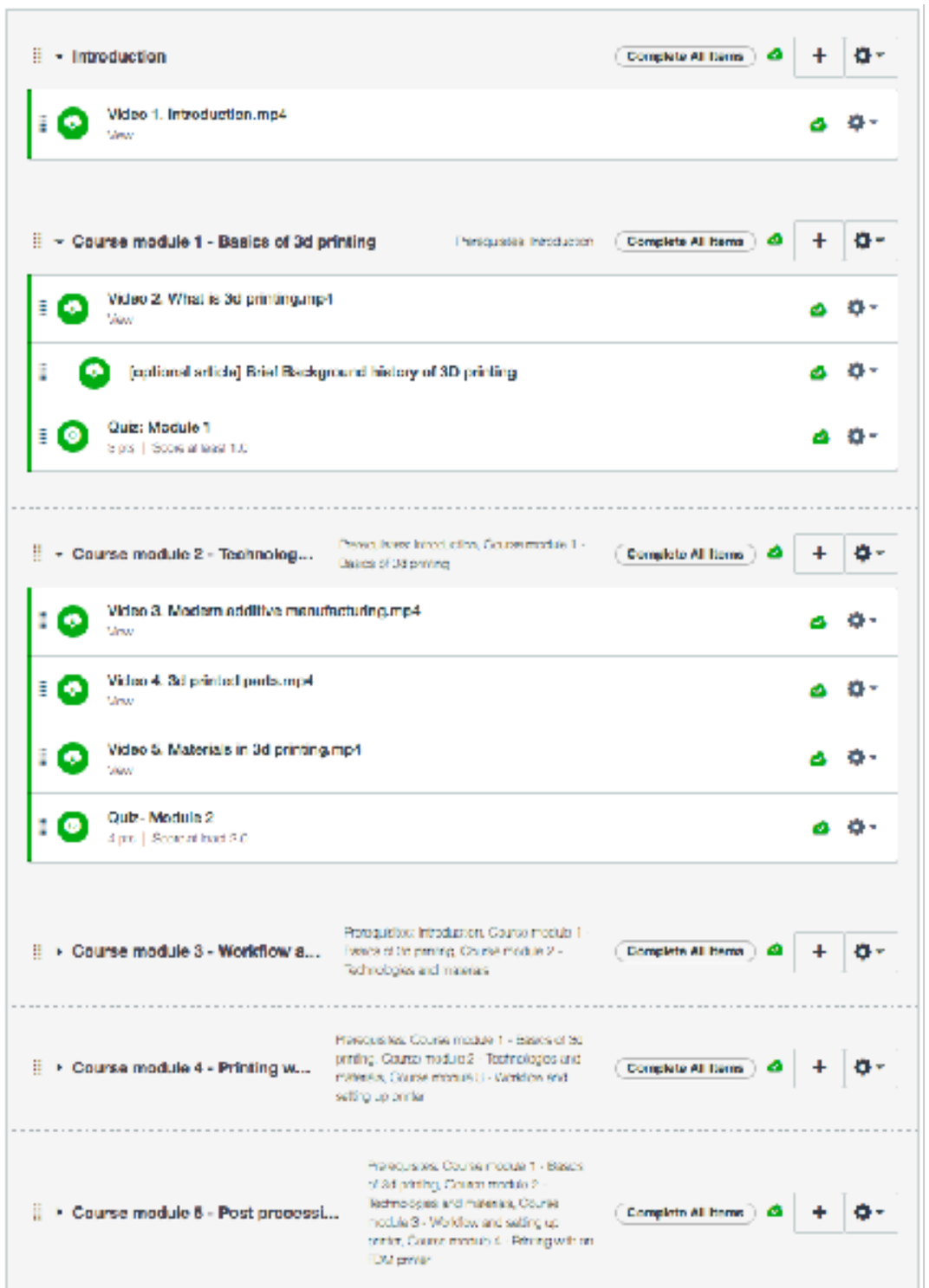
- Became affordable and extremely popular in the past few years… [DTU Skylab, DTU fablab, DTU Library].

- It offers great possibilities, but it is not a magical tool - we need a D*esign for 3d Printing* methodology.

- There is a good amount of procedural knowledge needed, to utilise the design methodology and benefit from access to 3d printers.

- Our e-learning module aims to *minimise* the time spent on in-situ procedural learning, and *maximise* the time used for teaching more advanced topics.

Content on Canvas



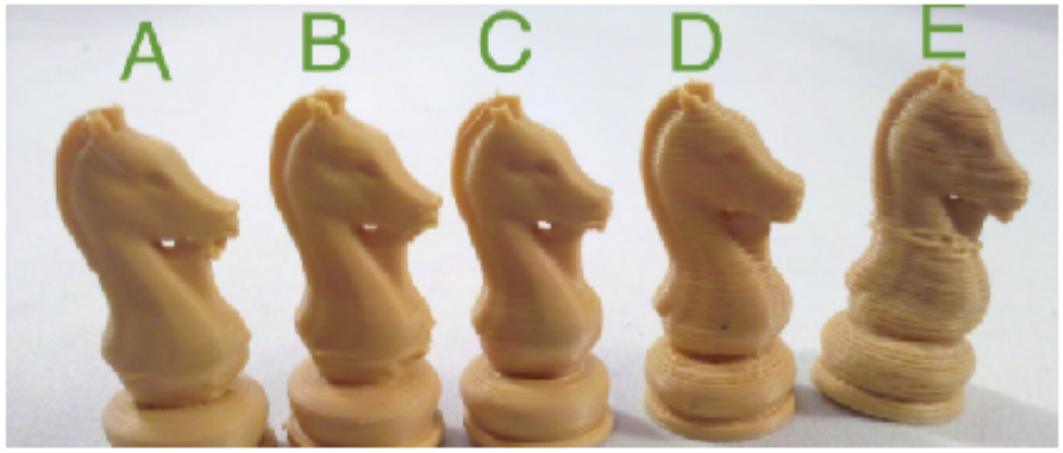
- Short videos, webpages (lecture notes) and quizzes
- Six themed modules, 14 videos, 3 webpages
- Each module is concluded with a quiz (from quiz bank)
- Available 3 weeks before the 3DP project starts
- Students must finish the module to use the 3d printers

Videos

- Videos are designed to be max. 5-7 minutes
- Written as a ‘script’ and recorded at DTU fablab
- Rec: 5 min. video ~ 50 min. rec. (multiple takes, alternative cuts)
- Edit: B-roll - background images, text and animations. ~ 120 min

Quizzes

Which one of the following has the lowest layer height?



A	19 respondents	83 % ✔
B		0 %
E	4 respondents	17 %
C		0 %
D		0 %

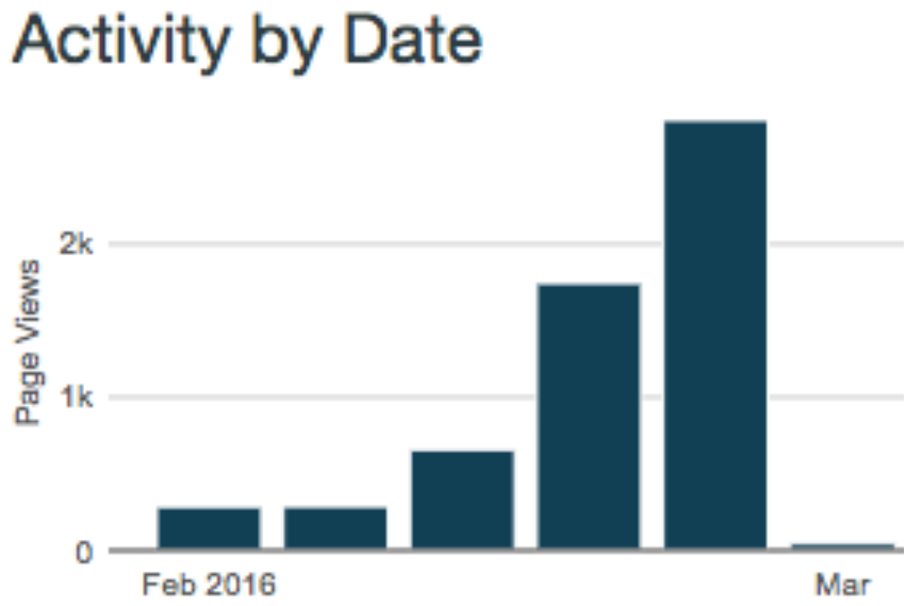
Please select the correct options to make the following sentence correct:

FDM is an [Vælg] manufacturing technology. It is [Vælg], and [Vælg] available. It works by [Vælg] plastic materials. Common types of plastics used in FDM printers are [Vælg] and [Vælg]

mat2 | tech | common | expensive | mat1 | techtype

PLA	9 respondents	100 % ✔
Nylon		0 %
ETA		0 %
PTA		0 %

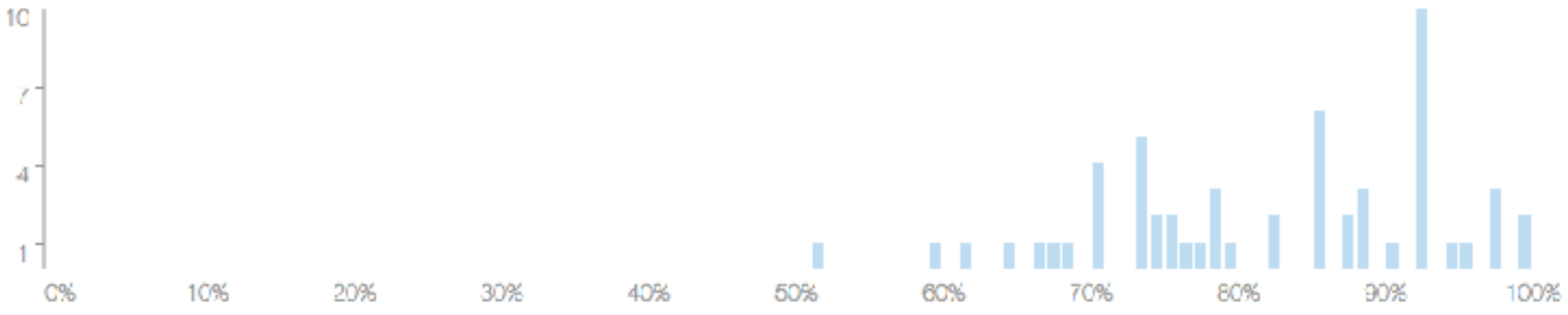
Activity / Results



Quiz Summary

Section Filter | Student Analysis | Item Analysis

Average Score	High Score	Low Score	Standard Deviation	Average Time
82%	100%	52%	1.55	50:42



Evaluation

How effective was the course at helping you learn about 3D printing?

1 - not at all	1 respondents	**2 %**	
2	5 respondents	9 %	
3	11 respondents	20 %	
4	26 respondents	47 %	}69 %
5- very much	12 respondents	22 %	

Evaluation

How easy was the course to follow?

1 - not at all	1 respondents	**2 %**	
2	2 respondents	4 %	
3	10 respondents	18 %	
4	14 respondents	25 %	
5 -very much	28 respondents	51 %	

}76 %

Evaluation

How effective were quizzes?

1 - not at all	4 respondents	**7** %	
2	6 respondents	11 %	
3	21 respondents	38 %	
4	14 respondents	25 %	
5 - very much	10 respondents	18 %	

Evaluation

How would you rate the amount of material covered?

1 - very unsatisfactory		**0 %**
2	2 respondents	4 %
3	12 respondents	22 %
4	26 respondents	47 %
5 - very satisfactory	15 respondents	27 %

}74 %

Evaluation

How confident you feel about your knowledge on the subject, after completing all the modules?

1 - very inconfident		**0 %**	
2	3 respondents	5 %	
3	19 respondents	35 %	
4	27 respondents	49 %	
5 - very confident	6 respondents	11 %	

}60 %

Evaluation

Overall, how would you rate this course?

1 - not good at all		**0 %**
2 - poor	2 respondents	4 %
3 - fairly good	14 respondents	25 %
4 - very good	37 respondents	67 %
4- excellent	2 respondents	4 %

}71 %

Evaluation

Would you prefer to take this course online or in the classroom?

Online	47 respondents	**85** %	
In-class	8 respondents	15 %	

Three Things …

You enjoyed

- **Fleksibelt**, hurtigt, underholdende
- The infograpichs, **the quiz/video ratio**
- **Short and sharp** lectures with a clear purpose
- The examples, pictures and demonstrations **along the talk.**
- Great **visuality** with different angles as well.
- **The texts** in the video while the teacher is speaking is really helpful
- It was quick, and the **play-speed settings** in the videos are great!
- **The mix** between videos, guides and articles
- Videos felt very **professional**
- Fast, **No-nonsense**
- **Punktligheden** - Det var dejligt overskueligt.
- Could do it **when I had the time**

Could be improved

- Kunne være fedt med **fokus** på netop de ting, vi skal arbejde med
- Perhaps **more display time** for some of the **illustrations** in the video.
- Maybe to **reduce** some of the stuff covered, because it can easily get too much information at one time to remember
- the **quiz** was to focused on detail.
- **quiz answers** should be looked through. there were some things that was repeated
- More real **examples**
- Make the videos **shorter**
- Use the voices better and maybe more small break. Think about when somebody nice talks (like **Obama**) he's really good…

Summary

- E-learning can be effectively used for lab-based learning
- Short videos and linear structure works quite fine for this purpose
- Don’t make quizzes / challenges too easy
- Don’t underestimate the effort that goes in planning, production & post processing

Summary

..and perhaps try hiring Obama to maximise student satisfaction

…he might me available from January…