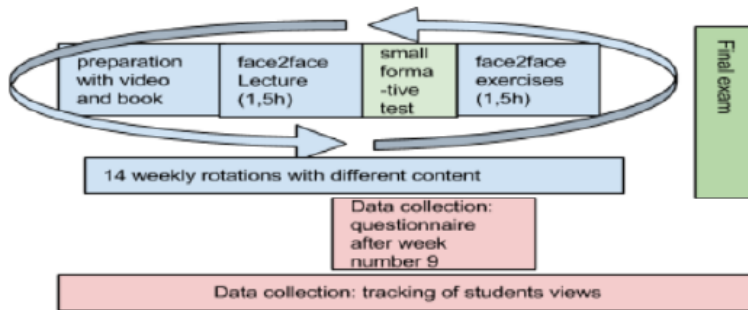


Students' benefit from video with interactive quizzes in a first-year calculus course

Henrik Skov Midtby

2017/03/06

Context for this study



- First year calculus course in an engineering programme
- Videos used for student preparation
- Videos of worked examples
- Some of the videos were augmented with mini quizzes

Noninteractive video (VT1)

$$\begin{pmatrix} 1 & \underline{2} & -1 & 1 \\ 0 & 1 & 1 & 3 \\ 0 & \underline{-3} & 5 & 0 \end{pmatrix}$$

$$R_1 - 2R_2 \rightarrow R_1, \quad R_3 + 3R_2 \rightarrow R_3$$

$$\begin{pmatrix} 1 & 0 & -3 & -5 \\ 0 & 1 & 1 & 3 \\ 0 & 0 & 8 & 9 \end{pmatrix}$$

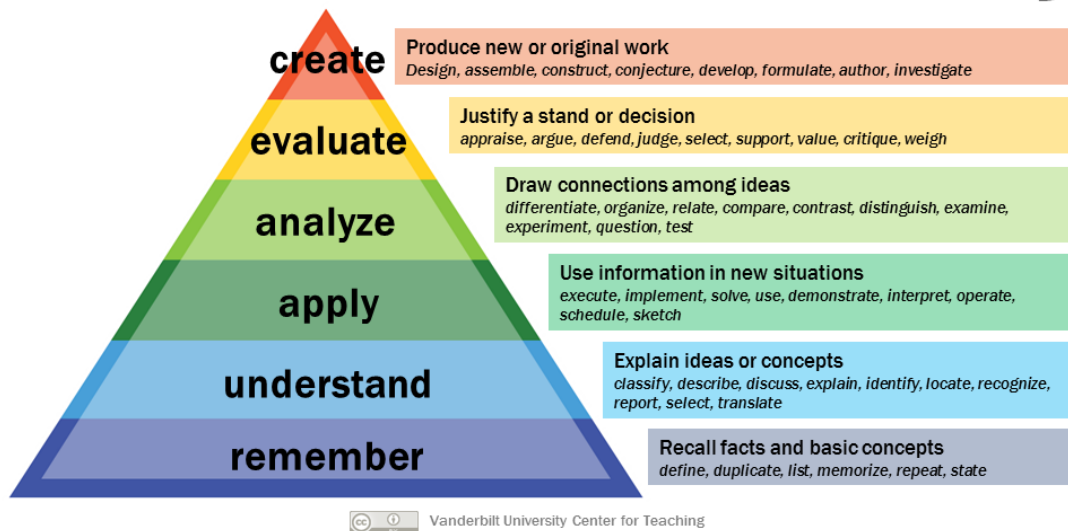
YouTube

8:38 / 14:09



Blooms taxonomy

Bloom's Taxonomy



Picture from <https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/>

Interactive video (VT2a) - complete intermediate results

$$\frac{d}{dx} f(x) = \frac{df}{du} \cdot \frac{du}{dx}$$

→

$$= \frac{d}{du} (u^7) \cdot \frac{d}{dx} (3x^2 + x)$$

↓ ↓

$$= \boxed{} \cdot \boxed{}$$

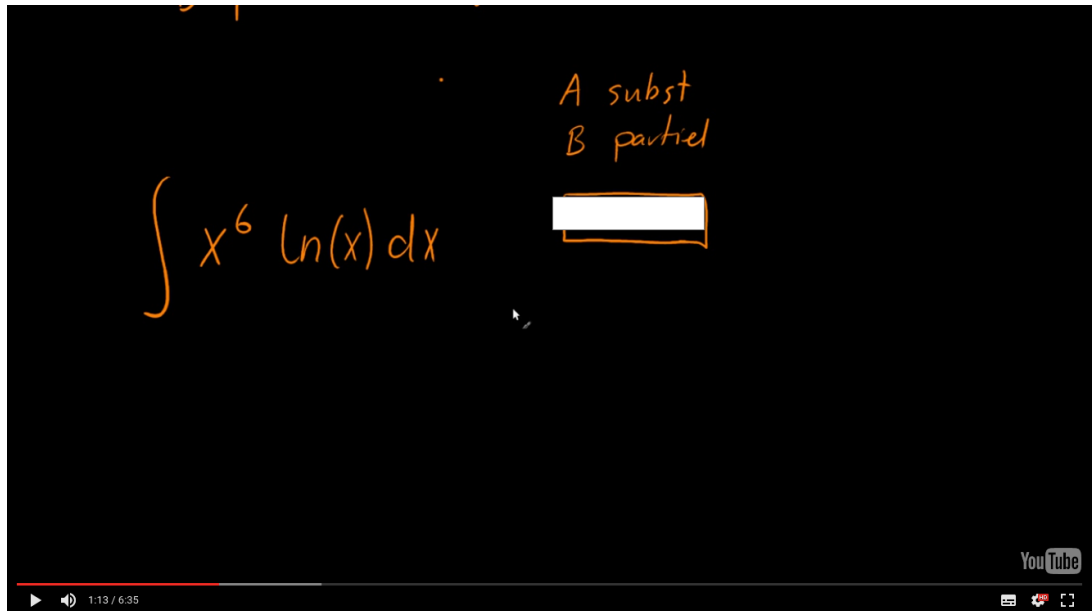
YouTube

3:30 / 6:17

Interactive video (VT2a) - complete intermediate results

$$\begin{aligned}\frac{d}{dx} f(x) &= \frac{df}{du} \cdot \frac{du}{dx} \\&= \underbrace{\frac{d}{du} (u^7)}_{\downarrow} \cdot \frac{d}{dx} (3x^2 + x) \\&= \boxed{14u^6} \cdot \boxed{6x + 1}\end{aligned}$$

Interactive video (VT2b) - choose solution strategies



A screenshot of a video player showing a blackboard with handwritten text and a math problem. The text on the blackboard includes:

- $\int x^6 \ln(x) dx$
- A list with two items:
 - A subst
 - B partiel
- A white rectangular box with an orange border, likely for a user input.

The video player interface at the bottom shows a progress bar at 1:13 / 6:35, a play button, a volume icon, and the YouTube logo.

Videos

Video title	Type	Duration (m:s)	# questions
Integration by substitution, example	VT1	5:44	0
Integration by parts, example	VT2a	7:48	4
Partial fractions	VT1	7:18	0
Choose integration technique	VT2b	6:36	4
Long division of polynomials	VT2a	6:16	1
Separable differential equation	VT1	10:33	0
First order linear differential equation	VT2a	11:39	4
Types of differential equations	VT2b	9:09	3

Quote

“Videos have given me a clearer understanding of content we read in Calculus. Book seems somehow complicated at times and it is nice to have a media which quickly and precisely clarifies how things are connected. if I could choose I would like this kind of videos in all of my courses”.

Goals of this study

1. Are there any differences in how students estimate the learning benefit from three types of videos?
2. Are there differences in how students use the three types of videos? (see paper)
3. Do interactive videos support deeper learning?
4. Do students value the idea of flipped classroom, face2face elements and integration of the different learning resources.

Methods of this study

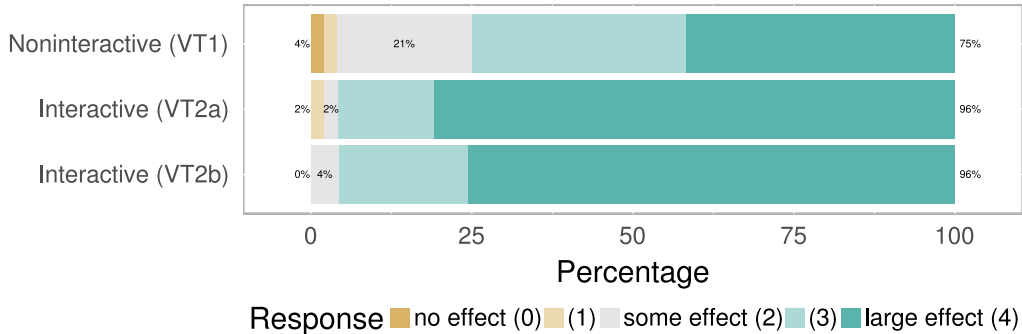
Questionnaire (n = 47 / 79)

- Locked responses, according to a Lickert scale
- Free text responses

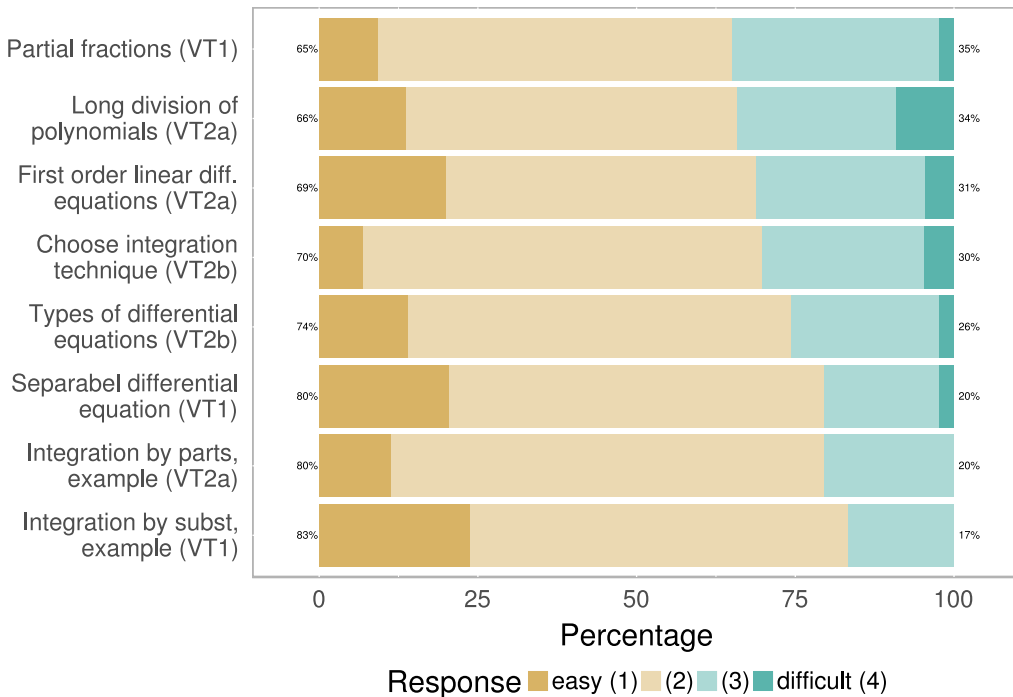
Statistics from the site hosting the videos

- views of individual videos
- interactions with the interactive elements

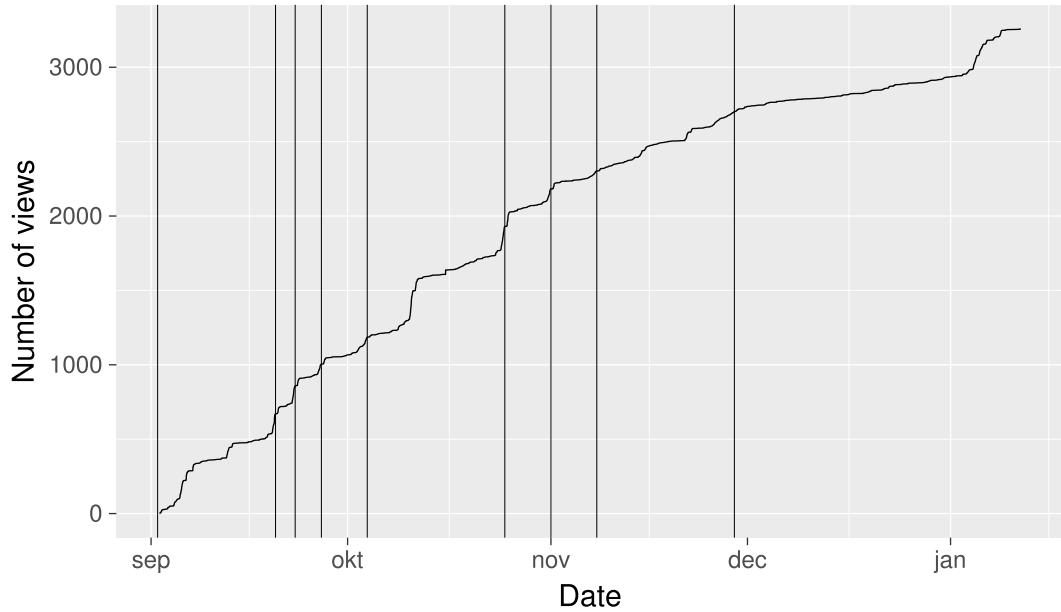
Which video type helps you the most?



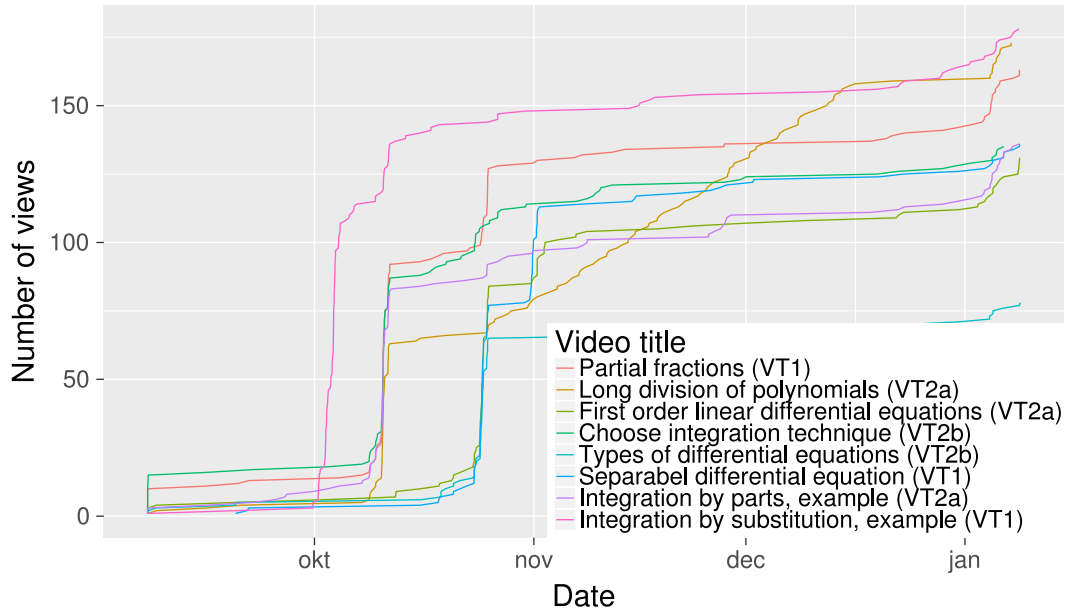
Difficulty of videos



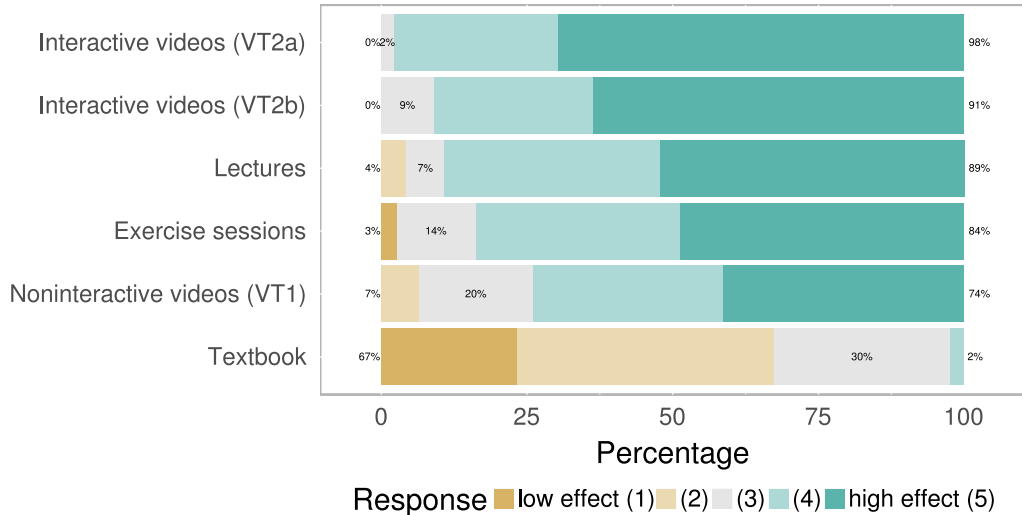
Viewing statistics



Selected videos



Learning effect of different learning resources



Conclusion

- Videos helps students feel more prepared for face2face session
- The interactive videos are estimated significantly better than both non-interactive videos and the book.
- Higher learning levels
 - Indicated but not proved

Next steps

To fully utilize the potential of interactive videos in future courses at the University of Southern Denmark we plan to apply the following adjustments.

1. produce additional videos with interactive elements,
2. clearly state that the videos only give an overview of a topic and that the textbook have additional details and

Long term interests

1. students' perception of feedback both during interactive videos and during face2face sessions.

Questions and discussion