Learning Physics with Interactive Videos – Possibilities, Perception, and Challenges

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Abstract. Videos on YouTube are very popular among students and they are a learning opportunity with unique features like slow motion or multiple representations. Unfortunately, students often just watch learning videos passively; whereas, learning needs an active processing. Moreover, a first study with *n*=3377 users of an online learning environment showed that learners perceive online videos as not particularly helpful when learning with websites. Making these online videos which are already available more interactive with tasks, questions, and quizzes can foster an active processing and students should perceive interactive videos as more helpful when learning online.

1 Introduction – Options for Learning with Online Videos

Online videos on YouTube are very popular among students, cover all conceivable topics, and are available for free. Even learning videos in STEM subjects can reach thousands of students [1]. Such videos can be paused and replayed. Also videos can contain animations, multiple representations [2], and visualizations of invisible things like electrons or concepts like electric or magnetic fields. Moreover, online videos are available 24/7, can be watched on Smartphones, and can be used nearly without copyright concerns. However, students watching such videos on YouTube are mostly passive recipients. They just consume videos. On the other hand, most theories of learning with multimedia, for example Mayer's "Cognitive Theory of Multimedia Learning" [3], are based on an active processing assumption. Such theories are supported by a wide range of studies, which show that active learning increases student performance (a meta-analysis see [4]). Thus, learning needs active processing of the given information.

2 Methods – Survey about Perception of Online Videos

This results in the question, if students perceive learning videos as helpful when learning online with websites. So, we performed a survey on virtual-experiments.com, one of our online learning environments. As shown in Tab. 1 in total *n*=3377 students and teachers (*n*=2330 German-speaking people and *n*=1047 English-speaking people) participated in a period of 5 months in the survey. This corresponds approximately 10% of all visitors of the learning environment.

Tab. 1 Participants in the online survey

User group (German)	Number	%	User group (English)	Number	%
Teacher	245	10,5 %	**Teacher**	75	7,2 %
High school student	1053	45,2 %	**High school student**	219	20,9 %
University student	902	38,7 %	**University student**	641	61,2 %
Other	130	5,6 %	**Other**	112	10,7 %
Total	2330	100 %	**Total**	1047	100 %

3 Results

The results show that users of the learning environment perceive videos least often as especially helpful when learning online. Users rate traditional visualizations like text, static pictures, and

formulas more often as helpful. This result applies for most groups. Moreover, teachers rate videos more often as especially helpful than university students. Still, students like watching online videos and videos provide unique features for learning. So, it is necessary to "redesign" online learning videos to make them more effective and helpful for learning.

4 Conclusion - Creating Interactive Learning Videos

According to multimedia learning theories and the active processing assumption learning videos should be more interactive to foster an active processing of the presented information. Students should perceive such interactive videos as more helpful for learning.

One way to make learning videos more interactive is to include tasks directly in the video. Unfortunately, new videos must be recorded to realize such a scenario. A more promising way is to adapt videos that are already available by adding tasks. Here, various settings to enhance learning with videos can be implemented. For example, a specific question can be placed at the beginning or a quiz can be placed at the end of the video. Moreover, new tools like H5P enable real adjustments on YouTube videos. Additional text can be displayed, the playback rate can be modified, and most important different tasks and questions (single-choice, multiple-choice, fill the blankets, drag-and-drop tasks) can be displayed as overlay over the video. For example, Fig. 1 shows a single choice question in the video frame. Thus, after the presentation of the experimental setup in the video, students have to predict the result of the experiment.

With tools like H5P teachers can create interactive learning videos based on content which is already available and without producing new videos and without any programming skills. This should activate the learners and foster the active processing of information.

The presentation describes the study and the results in more detail and provides examples how interactive videos can foster active processing of content and promote learning with videos.

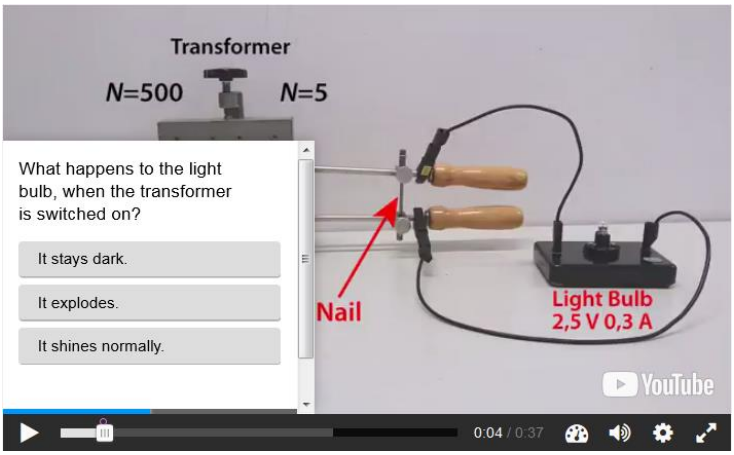

Fig. 1 Interactive question on a YouTube video created with H5P

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