Student Perceptions on the Cost-Benefit of Screencasts

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Abstract

This paper describes the work completed in regards to determining how students perceive different course activities. Specifically, students' views about "flipping" the classroom through the use of screencasts are of particular interest as they relate to the more overt activities enabled by such a course structure. A survey has been created to examine this. Since the survey results are not available presently, this research is being submitted as a work-in-progress. However, some general student feedback is presented as are lessons learned by the authors' in terms of best creating and utilizing screencasts.

1. Introduction

Along with "teaching," university instructors have a number of other activities vying for their time. As a result, they have a limited amount of time to devote towards the development of educational activities. Over the years, research has been done to study the effectiveness of various educational activities [1], [2], [3], [4], [5], [6]. The general consensus is that activities which require overt student actions generally lead to much better student learning achievements as compared to activities where the students are passive. However, little has been done to explore how students perceive the importance of these activities in comparison to how much time an instructor must devote to their development.

This work examines the cost-benefit of these activities in terms of instructor time (cost) and perceived importance to the student (benefit). This work specifically focuses on the use of screencasts, which are recordings (e.g. videos) of the output of a computer screen, often involving instructor audio and annotations. While watching a screencast is a passive activity, instructors often utilize them by having students watch them outside of the class so that the in-class time can be spent on more overt learning activities (while the instructor is present to provide feedback and guidance). Such a scenario is often called "flipping" or "inverting" the classroom and this setup was utilized for at least a portion of the semester in courses this past fall.

The remainder of the paper is organized as follows: Section 2 first provides further background about the classification of classroom activities and then describes how screencasts were specifically utilized within courses. Section 3 then describes a survey that was constructed to determine how students perceive the relative benefit from different types of course activities. The results of this survey, however, are not presently available. As a result, Section 4 describes student feedback from course assessment that is standard at Lake Superior State University

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(LSSU) as well as some lessons learned about screencasts. Section 5 lastly summarizes the paper and concludes with the discussion of potential future work.

2. Classroom activities

2.1. Classification

Past research [3], [4], [5] indicates that engaging students in the learning process results in better student learning and understanding. This method, known as "Active Learning," has been further differentiated into the categories of active, constructive, and interactive [7]. The effectiveness of each of these types of activities has also been studied within the context of engineering education [8], [9], showing a general hierarchy where interactive activities produce better learning results as compared with the other three in a descending fashion (Interactive > Constructive > Active > Passive). This classification (along with a "location" categorization explained later in Section 3) was chosen as a framework to determine how effective students viewed these activities in terms of how much they thought they learned from the different techniques and activities. In this study, a "flipped" classroom setting was used where students watched screencasts outside of the class and worked on overt activities during class time in the presence of instructor to provide feedback and help whenever required.

2.2. Use of screencasts

Instructional videos have been receiving a significant amount of attention in recent years. This attention is in part due to the increase in student learning that has been seen from using such videos. Although watching a video is a passive activity, many instructors require students to watch them before class, thereby allowing in-class time to be devoted to more overt learning activities. This arrangement is often referred to as "flipping" or "inverting" the classroom.

Many of the first instructional videos were created by simply recording a standard in-class lecture. However, this technique does not take full advantage of the video medium. A screencast is a type of video created by recording the visual and audio output of a computer. One distinguishing aspect of a screencast is that the instructor is not visible within the video. However, screencasts are usually narrated by the instructor and often times contain annotations written by the instructor. The length of screencasts varies greatly. However, they are often much shorter than a traditional lecture as they are designed to cover a specific topic and are more optimized for the video format (removing the "dead time" that often occurs during lecture).

A screencast can be created using just about any computer; all that is required is screen-capturing software (software that records the computer screen and any audio input). However, the use of specific hardware and/or software can reduce the time and effort requirements needed to produce a screencast. Namely, a "touch" sensitive input device allows the instructor to easily annotate the video. In addition, a quality video editing program allows the recording to be easily edited to final form (removing errors as well as encoding the video to a suitable format).

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One of the authors of this work used Microsoft PowerPoint to create the basic outline/structure of each video. The slides contained basic information about the topic as well as the description and figures of example problems. A Microsoft Surface Pro (tablet computer), which has a "pen" based input device, was used thereby enabling the instructor to quickly and easily annotate the slides. The pen input also allowed the instructor to work through example problems step-by-step just as would be done on the chalkboard. Camtasia Studio software was used for both screen capturing and video editing. Finally, a Blue Yeti microphone was used to record high quality audio for the video narration.

At LSSU, the electric circuit analysis course during the fall (2013) semester used screencasts to enable a flipped classroom. Students were asked to watch a single screencast before each class period. Each video covered a specific topic and were on average about 15 minutes in length. At the start of each class the instructor asked the students to summarize the video. A brief discussion (1-3 minutes) would follow to ensure students understood the main points. After this the instructor assigned problems for the students to solve. Students were split into groups of 3-4 and asked to work on the problems as a group. The instructor would give the groups a few minutes to think about and get started on the problem. Then the instructor would go around and join each group (for 2-5 minutes) listening to the discussion and examining the process the group used to solve the problem. Depending on the situation, the instructor would answer questions, provide guidance, and/or ask probing questions. The instructor allowed the groups to perform as much of the work as possible (only intervening when necessary). Once a group completed the problem they were assigned another, while the other groups would continue with the previous problem until they completed it.

At the beginning of the semester students were able to choose their own groups, which remained the same for several weeks. However, after each test the groups were rearranged by the instructor. Many aspects of the student (learning style, learning pace, ability, attitude, personality, etc.) were considered when rearranging the groups. The goal was to try and provide the best balance and maximize learning of all students.

Similar setups were used in a first-year general engineering course that covered Linear Algebra and engineering software as well as a senior-level robotics elective course. However, unlike the circuit analysis course, the other courses only used this setup for approximately one quarter of the semester. These courses were taught by a different instructor at LSSU and generally had student populations that were mutually exclusive to each other and to the circuit analysis course.

3. Surveys and student population(s)

In order to determine students' perception about the relative benefit of screencasts, a survey was constructed to give to students that asked them to rank course activities in terms of the perceived benefit gained from the activity. The instructions specifically stated that students should assign a value to each activity on a linear 1 to 10 scale where 10 indicated the most possible benefit. It was clarified that multiple items could be given the same rank. The list of activities is shown below, where it was also stated that all activities were assumed to be related to the class material.

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Outside-of-Class Activities:

- Watching a screencast
- Reading an existing external resource (book, conference paper, web blog, etc.)
- Reading an instructor-made resource (book, web/collection of resources, etc.)
- Reading/listening to personalized instructor feedback from design reviews, presentations, etc. from open-ended group projects
- Reading personalized instructor feedback on lab write-ups

In-Class Activities:

- Traditional lecture: explanation of "big picture"
- Traditional lecture: explanation of more specific concepts
- Traditional lecture: generic instructor-worked problems
- Traditional lecture: real-world application instructor-worked problems
- Individual in-class student-worked problems that apply learned information in new ways
- **Group in-class student-worked problems that apply learned information in new ways**
- **Group discussions of class concepts (debates, pro/con lists, etc.)**

Activities That Could Be In-Class or Out-of-Class:

- Reading automated instructor feedback on individual student-worked problems
- Reading personalized instructor feedback on individual student-worked problems
- *Asking individual questions and having the instructor answer them (in-class or during office hours)*
- *Working on individual student-worked problems similar to problems worked by instructor (in-class or via traditional HW)*
- *Individual projects/labs that are a direct application of the material learned in class*
- Individual projects/labs that apply learned information in new ways
- **Working on open-ended group projects/labs that apply learned information in new says (e.g. final projects, Senior Projects, etc.)**

As can be seen in the list above, each item was categorized as an in-class activity, outside-of-class activity, or an activity that could take place in either "location." These location categories were included in order to provide a basis for discussing the trade-offs of time spent outside of class (which is limited, but variable) with time spent in class (which is limited and fixed). These categories were shown explicitly when the survey was given to the students.

The questions were also marked according to the ICAP classification [7] as either passive (regular font), *active (italicized)*, constructive (underlined), or **interactive (bold)** activities (see Section 2.1 for further discussion). One of the strong potential benefits of using screencasts is that they can enable more in-class time for overt activities. Because of this, it is useful to know if the students' perceive such activities as more beneficial. When the survey was distributed to the

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students, this color-coding/classification was *not* shown. Furthermore, the order of the activities was randomized so that students would not see a pattern of activity classification.

Once finalized, the survey was given to students in 3 different classes: a first-year general engineering course dealing with Linear Algebra and engineering software, a second-year electric circuit analysis course, and a fourth-year robotics elective course. The student populations for these three were almost entirely mutually exclusive. Any students taking multiple courses within this set were asked to complete the survey only once. Each of the classes exposed students to the use of screencasts, but the use was much more extensive (with the requirement of watching a screencast for almost all class periods) in the circuit analysis class as compared to the other two classes (where screencasts were used only for approximately one quarter of the semester).

4. Student feedback and lessons learned

At the current time, no compiled survey results are available. It is planned that some preliminary data will be available for presentation at the conference, but this research is currently being presented as a work-in-progress. However, general student feedback *was* obtained through the standard course assessment process, the results of which are described in the following paragraphs.

Given the small population of the circuit analysis course along with the typical variation in year-to-year scores, the effectiveness of the screencasts (in terms of student learning) cannot be accurately determined. Still, the flipped lecture had other benefits beyond student learning. Overall students indicated that they enjoyed the use of screencasts and the in-class group work they enabled. Student engagement in the classroom seemed to be significantly higher than when the course used a standard lecture technique. These factors made the class more interesting and fun for both the students and the instructor.

A few students commented on some minor issues regarding the group work. Since each person learns each topic at a different pace, some students felt like learning was hindered if the pace of the group members varied by too much. It would be good to make it clear to the students that differences in the pace of learning can actually be used to improve the learning of all members of the group. If the "faster paced" students use the opportunity to explain and teach the topic to the "slower paced" students, then everyone benefits since, as they say, "you don't truly understand a topic until you teach it to someone." Given that everyone learns each topic at a different pace, most students will at times be the "faster paced" while at other times be the "slower paced," thereby alternating roles within the group. In those cases where it is clear that one member of the group is constantly struggling it would be good for the instructor to provide extra attention, such that they do not actually become a hindrance to the rest of the group.

Initially the screencasts were only available via the university's course management system (Blackboard Learn). Students later requested that they be available via other means to make them easier to access from all devices (computers, tablets, smartphones, etc.). Additionally some students wanted the ability to share the videos with other students outside of those registered for the course. In response to these requests, the videos were uploaded to Vimeo, an online video

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hosting website (similar to YouTube). This allowed anyone to easily access the videos from all types of devices. Videos in other courses were posted in MP4 format on Google Drive for similar reasons.

5. Summary and future research

In summary, this work-in-progress paper has presented the background for a survey designed to explore how students perceive the importance/usefulness of screencasts with respect to other educational activities. It has also presented a general framework and lessons learned for utilizing screencasts to "flip" a classroom. The surveys will be given to those students who were exposed to screencasts in at least one of their engineering courses. The results of this survey will then be used in conjunction with an estimate (via the authors' personal experience) of how much instructor time is used for each activity to generate a general cost-benefit model for utilizing a "flipped" classroom approach via screencasts as compared to other class activities. Another area of potential future research is to give the students a pre and post survey from the class to see how their attitude changes about the different types and classifications of activities as well as about the use of screencasts.

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