Work-in-Progress: Introduction for Flipping the Classroom Techniques to Improve Instruction of Software-Specific Techniques and Methods

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Abstract

One specific objective of engineering graphics courses is to teach how to communicate engineering design. An observation is that a significant amount of class time is spent teaching students how to use CATIA in order for them to develop the necessary skills before they can begin to learn design and modeling techniques. This work is an effort to use videos as short, specific reference for particularly challenging techniques to students. The goal is to shift the software-learning time away from the classroom in order to be able to focus the class on design and design expression.

Introduction

The concern that initiated the modification of the course is the considerable amount of class time used to teach CAD software utilization, in this particular case CATIA. The focus of the graphical communication course is to teach standard forms of design graphics and view layout to express engineering designs. While the use of computer aided drafting is part of curriculum, time spent teaching repetitive tasks or tools could be better spent on design communication.

The traditional source of guidance is the use of written tutorials, usually from a textbook. While these are effective and provide high detail, they are difficult to use as reference given the use of very specific parts that can limit the creativity of the student (Yip-Hoi, 2015). They may also be used as step-by-step process to obtain a single result without giving the tutorial any in-depth thought; thus not actually learning how to use the tools effectively.

Another common source used by students are online videos provided by other users. Videos length and content play a key role and their accessibility by the students. There is plenty of material available on the Internet on how to use CATIA's workbenches. However, this material can be very challenging to understand by the students due to their complexity and length. In addition, these videos do not always include the most correct method for modeling.

The user provided videos online usually cover complex models in high detail and as such they cover a multitude of tools at once. This leads to a few problems. First, given the complexity, it is

difficult to dissect the video to understand what section may be relevant to them. Second, given the length of the videos, they are not always an easy reference when doing homework or preparing for a test. Being able to manage the source materials also permits the instructor to release them in a particular order to coincide with the class curriculum.

This work is an attempt to provide the students with quick references that can be used to prepare or refer back for specific information. This will allow the instructor to spend more time on design and design expression.

Methodology

In order to make the videos accessible as quick but effective guides, they need to be just long enough to cover specific tools given that the intention is to present specific pieces of knowledge (Johnson, 2011). The recordings have two main characteristics:

1. They are short. About 2-5 minutes long (Bristow, 2008). The instructor in the Graphical Communication course tested this concept in Summer 2015. Feedback from the students in this term reflected approval for that format. In a short, informal, survey 86% of the class approved of the approach.
2. They have no sound track. All information is conveyed using appropriate demonstrations and captions. While multi-modal videos would be beneficial as a stand-alone guide (Pohl, 2015), this initial approach is the result of a practical limitation. The students will use the material as reference during class time to start work on homework problems. It would be impractical to have them use audio listening devices during the class time.

The approach to these changes occurs in three main stages, in three separate semesters. If a significant issue is noticed on a particular term, it can be addressed prior to the next term. The three semesters are:

1. Summer 2015. A small set of 5 videos, one per week, was created and made available to students. The purpose was to get preliminary feedback on the material to see if the format was acceptable or usable to them. The class had a total of 15 students enrolled.
2. Fall 2015. Additional videos are created (currently in progress) and the already existing videos were made available on CANVAS for reference. However, a concern was brought up; if the material were used during the semester, it would alter the baseline. In turn, the material was not used during class.
3. Spring 2015. The chosen video material will be used to replace the procedurally intense sections of lectures by hands-on work during class time. Additional to material may be developed if need to cover a specific topic but it will adhere to the semester format for delivery.

The videos are made available through the CANVAS learning system. It allows the instructor to track the number of views per video.

Results

Tracking the number of views using the learning system was used collect initial feedback during the summer ’15 term. In addition, a small, simple survey at the end of the semester was used to measure student opinion of the quality, length, and availability of the videos.

At the time of this writing, only the preliminary results from the summer term are available. This feedback was meant to provide information about whether the students would find the videos useful or even practical. The purpose of the survey during this semester was solely to help the instructor decide if the format change was desirable at all. There was no assignment that required watching the material and no points or academic incentive was offered to view them. The material was made available purely as a reference on CANVAS. The results to the summer survey were as follows:

Table 1. Preliminary results from the summer ’15 semester

Questions	Responses
When did you watch the videos provided in class (if you did watch the videos)?	21% - As soon as posted 43% - When doing homework 21% - When studying for a test
Regarding the length of the videos (About Right?)	86% - Approve
Would more videos covering other topics be useful?	64% - Agree

During the fall semester, the average grade per assignment for the whole class will be recorded. It will be used as a baseline for comparison with the upcoming spring semester results. It is worth noting that, as a continuation from the summer, the portions of the material were already posted on CANVAS. A concern was brought up early on that this material having been available would affect the baseline; this allowed the instructor to introduce changes to diminish the possible effects. While some of the videos were made available, the students were not encouraged to use them and they were not required in any way for classwork. According to the tracking data from CANVAS, 10 students accessed the media files, however, three of them watched only two videos and seven watched only one recording. Since the spring 2015 section has 26 students and a total of nine CATIA-based assignments, the instructor does not believe that this is enough to have significant impact on the overall performance evaluation of the class.

In the spring semester, the methodology would change from having media as reference to having media as an integral part of the course. Specific media will be made available to correspond to specific topics during class. As such data collection will change. At this stage, the average grade per assignment will be collected and compared to the fall semester results.

Conclusions

While no conclusions have been drawn so far, a few things can be expected to happen. First, student performance in the assignments used for comparison should objectively improve. In addition, there will be more class time available to the instructor in order to focus on the design and design communication aspects of the course.

These modest gains might be of interest to other instructors since the restructuring of the class content and delivery is minimal at this stage. The addition of support material might take some work outside of the classroom but it is generally reusable and could provide the timesaving advantage, for instructors and students, of providing with an easily accessible reference for the most often used tools or procedures.

References

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